Relatório Final de Estágio

Mestrado Integrado em Medicina Veterinária

Assessment of animal welfare of pigs in the central region of Portugal

Avaliação do bem-estar animal de suínos na região centro de Portugal

Marta Cristina de Fernandes e Rouquinho

Orientador(a): Eduarda Maria Freitas Gomes da Silva Neves

Co-orientadores: Emma Fàbrega e António Manuel Gama Duarte

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ABSTRACT

Animal welfare is closely linked to various aspects of this concept, including the health of the animals, their productivity, the safety and quality of the meat, and the efficiency of production costs. These interconnections are evident throughout the entire production process, starting from the animals' early life on the farm and continuing until they are slaughtered. When it comes to farming, specific welfare concerns deserve attention, such as the survival rate of new-borns, guarantee of appropriate housing conditions and insufficient sensory stimulation for the animals.

The aim of this study was to analyse animal welfare in Portuguese pig farms. Therefore, visits were made to 8 pig farms, where animal welfare was quantified through the application of animal-based and non-animal-based welfare measures. Animal-based measures were recorded for 65 sows in maternity pens and their respective litters, 58 in individual housing, 97 in group housing, and 56 in weaners pigs. Non-animal-based measures were recorded in the 8 visited farms. Despite the need for caution in interpreting the results due to the limited sample of farms, it was possible to identify welfare issues in all observations.

It is important to introduce strategies to reduce the occurrence of animal welfare problems and, if possible, implement suitable strategies in the daily operations of the farms that allow producers to detect these problems early.

KEYWORDS: Animal welfare; Pigs; Measures.

RESUMO

O bem-estar animal está intimamente ligada a vários aspetos, incluindo a saúde dos animais, a sua produtividade, a segurança e qualidade da carne e a eficiência dos custos de produção. Essas interconexões são evidentes em todo o processo de produção, desde o início da vida dos animais até o abate. Quando se trata de produção animal, existem preocupações específicas de bem-estar que merecem atenção, como a taxa de sobrevivência de recém-nascidos, a garantia de condições de alojamento apropriadas e a insuficiência de estimulação para os animais.

O objetivo deste estudo foi analisar o bem-estar animal em explorações de suínos portuguesas. Para tal, foram realizadas visitas a 8 explorações de suínos, onde o bem-estar animal foi quantificado através da aplicação de indicadores de bem-estar baseados nos animais e não baseados nos animais. Os indicadores baseados em animais foram registados para 65 porcas em maternidades e suas respetivas ninhadas, 58 porcas em alojamento individual, 97 porcas em alojamento em grupo e 56 porcos na recria. Os indicadores não baseados em animais foram registados nas 8 explorações visitadas. Apesar da necessidade de precaução na interpretação dos resultados devido à amostra ser limitada, foi possível identificar problemas de bem-estar em todas as observações.

É importante introduzir medidas que ajudem a reduzir a ocorrência de problemas de bem-estar animal e, se possível, implementar estratégias adequadas nas operações diárias das explorações que permitam aos produtores detetar esses problemas precocemente.

PALAVRAS-CHAVE: Bem-estar animal; Suínos; Indicadores.

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ABBREVIATIONS

ABM Animal-based Measures
AW Animal Welfare
CFP Confederation of Farmers of Portugal
DGAV Direção Geral de Alimentação e Veterinária
DL Decree-Law
EC European Commission
EFSA European Food Safety Authority
EU European Union
MS Member State
NABM Non-animal-based Measures
OV Official Veterinarian
IRTA Institute of Agrifood Research and Technology
WQ Welfare Quality®

DESCRIPTION OF CURRICULAR INTERNSHIP ACTIVITIES

The internship, which comprised a total of 16 weeks of practical work, was divided into two periods: the first took place at the "Institute of Agrifood Research and Technology" (IRTA), located in Monells, Spain; the second consisted in visiting pig farms and following the activities of Dr. António Manuel Gama Duarte, Official Veterinarian (OV) of the "Direção de Serviços de Alimentação e Veterinária da Região Centro".

In IRTA, for 14 weeks (568h), I followed the duties of researchers and technicians in the animal welfare (AW) area. During this period, I made visits to intensive, weaning and finishing pig productions and organic pig productions, in which I performed the following tasks: a collection of saliva samples for cortisol analysis; behavioural assessment; evaluation of respiratory, digestive and thermal comfort parameters; evaluation of body, tail and ear lesions, following the "Welfare Quality® " (WQ) protocol, and assembly of cameras that allow recording and observation of animal behaviour or, more specifically of pig maternities. I processed and analysed the data collected within AW projects in pigs and analysed the behaviour of pigs using the Boris software (Friard, O., & Gamba, 2016). I made visits to slaughterhouses, where I performed the following tasks: collection of saliva for cortisol quantification; collection of blood samples, for lactate quantification; and evaluation of skin and tail lesions, at the slaughter line. I had the opportunity to attend trainings on chicken and turkey consciousness indicators held by Dr. Antonio Velarde, Dr. Alexandra Contreras and Mrs. Arancha Varvaro. During this period, I also attended a course on scientific research and references, a course on AW assessment in horses, according to the AWIN protocol - The Animal Welfare Indicator (AWIN, 2015) taught by Professors Michela Minero and Emanuela Dalla Costa, and the training course for WQ auditors for fattening pigs.

In the second period of the internship with Dr. António Gama, for 2 weeks (80h), I followed the duties of an OV in planning and performing official audits in pig farms and in assessing and verifying the AW conditions within the scope of the official controls of the "Animal Protection Plans". In total, I visited ten farms, where I was able to recognize the legal requirements of AW in the various stages of pig production, as well as their assessment and implementation from an OV point of view. During the visits, I applied a questionnaire to the producers and evaluated the behaviour of the animals in order to assess the AW of the farm. I also had the opportunity to follow other functions of the OV, performing the *ante* and *post-mortem* inspection and the analysis of the accompanying documentation of the animals presented for slaughter in a piglet slaughterhouse.

1. INTRODUCTION

AW has been discussed in Europe since the 1960s. It is a multifaceted and complex concept, with scientific, ethical, economic, religious, and cultural dimensions (Lund et al., 2006).

In the 2000s, Hewson has emphasized the importance of psychological well-being in characterizing AW, i.e., an animal's physical health does not, by itself, guarantee that it is not in psychological distress and anxiety (Hewson, 2003). Three interconnected points were made by Fraser on the definition of AW: the first emphasizes the importance of good growth and production rates to raise healthy animals; the second the importance of promoting a good emotional state and minimizing animal suffering; and the third underlines the importance of allowing animals to express their natural behaviour, so it is important that housing systems are as natural as possible (Fraser, 2003). Thus, it can be observed that the most recent AW study protocols are no longer based solely on measures of the housing in which the animals are raised, but also take into consideration "animal-based" measures (e.g., presence of hernias, number of body lesions, tail biting) (Welfare Quality®, 2009).

The AW must oversee the five freedoms principles:

1. Free from hunger and thirst;
2. Discomfort-free;
3. Free of pain and disease:
4. Free to express natural behaviour;
5. Free from fear, stress, and anxiety.

In addition, proper management and housing, as well as health and prophylaxis programs, are essential to ensure proper AW (Farm Animal Welfare Council, 2009). However, nowadays the five freedoms have been reformulated in order to include a new dimension linked to emotional state and positive welfare. Practically speaking, the Model centres on assessing the existence or nonexistence of diverse internal physiological/functional conditions and external situations that give rise to mentally significant negative and/or positive experiences related to welfare (Mellor, 2017).

The World Organization for Animal Health recognizes that there is a critical interdependence between AW and animal health, and consequently with the safety of the food chain (WOAH, 2021). Thus, it is of paramount importance that it covers the entire production process, from breeding to slaughter (WOAH, 2022). Raising animals with low levels of welfare will compromise their immune system and provide conditions for the entry of pathogens, which will consequently compromise the quality of the products (EFSA, 2006). Moreover, consumers' awareness of how food is produced has been increasing in

recent years (Thorslund et al., 2017). The debate and the importance of consumers on the topic have driven the increase of policy initiatives in the area.

Pigs are one of the largest areas of animal production in Europe and much of the concern discussed about AW has focused on the production of these animals (Thorslund et al., 2017).

1.1. PORK CONSUMPTION IN PORTUGAL

The European Union (EU) is the second largest producer of pork in the world, and the largest exporter of pork and pork products, with an annual production of approximately four million tons (European Commission, 2023).

In Portugal, pork represents, following poultry meat (chicken, turkeys, ducks, among other species), the second most produced type of meat, representing 41.4% of total production (377309 ton of a total of 911360 ton). From 2020 to 2021, pork consumption increased from 41.1 kg/inhabitant to 42.1 kg/inhabitant, representing the second most consumed type of meat by the Portuguese (INE, 2023).

2. AW IN PIGS

Industrialization and the increase in pig production forced an adaptation of the production conditions. We went from an extensive housing system, with low degree of confinement, to housing units with high degree of confinement and little environmental enrichment (Albernaz-Gonçalves et al., 2021). These changes were accompanied by an awareness of AW issues and development of legislation, as Council Directive 2008/120/EC of December 18, which sets minimum acceptable standards (European Commission, 2008). However, despite the legislation in force, pig farms continue to face major AW challenges. The problems are related to high animal density and lack of environmental enrichment (EFSA, 2022). The difficulty and costs of changing often leads to resistance from producers. However, the data collected shows that improvements in AW become profitable in the long term, because of improvements in animal health, which result in lower rates of mortality, disease and rejection at the slaughterhouse (WOAH, 2022).

2.1 AW MEASURES

Several measures of AW have been identified and studied, each with its own characteristics. Current scientific research in the area provides a reliable basis for the development of assessment systems and standardized measures (Blokhuis, H. & Ribó, O; 2012).

Currently, it is possible to find AW measures based on management and facilities, non-animal-based measures (NABM), generally more objective and practical, such as the size of pens and the number of feeders; and AW measures based on the animal (ABM), which cover physiological, behavioural and pathological measures, these being more complex and more difficult to interpret (Praks et al., 2010).

In order to ensure a good assessment of AW, the European Food Safety Authority (EFSA) advocates the importance of creating AW assessment tool that contains as many measures as possible, and the choice of these should meet the following criteria: feasibility, repeatability and reliability (EFSA, 2012).

2.2 AW LEGISLATION

The EU recognizes that animals are sentient beings and emphasizes the need to take their AW requirements into account when formulating and implementing market policies. The Animal Health and Welfare Panel, an independent European expert body of the European Commission, is used as a scientific source whenever changes or new laws on AW are needed (EFSA, 2022). Currently, legislation sets standards for AW from breeding, through transport, to slaughter.

The Council Directive 2008/120/EC, dated December 18, determines the minimum standards for the protection of pigs, providing indications on management, housing, and facilities, and also on mutilations (tail docking, teeth clipping/grinding and castration). The same directive requires that a statistically significant number of holdings in each member state (MS) are annually inspected by the national competent authority (European Commission, 2008).

All MS are obliged to transpose the provisions present in the European legislation into national legislation, and may, if they wish, apply stricter standards, if this intention is communicated to the European Commission beforehand.

In 2003, with Decree-Law (DL) no. 135/2003, of June 28, Portugal compiled the various norms that aim to establish the minimum requirements for AW of pigs. After its

application, and with the emergence of some doubts about the text, the same DL was amended by DL no. 48/2006, March 1st, to clarify and add some norms, such as rectifying minimum required measures for boar pens.

2.3 FACTORS INFLUENCING THE AW OF PIGS

During the pig production cycle, and despite EU guidelines that aim to establish minimum requirements for AW in pig farms, several challenges can still be identified during the different production stages.

The adoption of proper management practices, specifically with regard to stocking density, housing, hygiene, and air quality, can improve the pigs' resistance to disease and enhance growth, which consequently becomes a gain for the producer and consumer due to improved profitability and carcass quality (Blokhuis & Ribó, 2012). Management systems should allow animals to be inspected easily and routinely by the handler. Pigs must be allowed to express their biological conditions and, when handled, must be handled quietly and at their own pace, avoiding the use of force, excessive noise, and agitation (Pickett, 2009).

2.3.1 Housing

The facilities must allow the animals to be housed in adequate, safe conditions in which movement of the animals, as well as access to drinking, feeding, and resting areas, is possible and easy.

It is important to ensure that:

- animals have sufficient space, appropriate to the density of the group, in order to prevent disease transmission, negative interactions between individuals and, consequently, high levels of stress (Fàbrega, 2019);
- each animal has access to comfortable and clean areas to allow for good rest (Jones & Manteca, 2018);
- the floor is flat, without slippery areas and suitable for the weight of the animals, so that they can move around without risk of falling or injury (CAP, 2018);
- the floor, a continuous area, without openings, is sufficient to allow all animals to lie down completely without being in contact with others (Guy et al., 2002);

- the environment is enriched with materials that allow pigs to meet their exploratory and social needs, without clashing within the group and developing aberrant behaviours, such as tail or ear biting (Fàbrega, 2019).

Regarding enrichment materials, there are several options to be used, considering that they should be chewable and/or edible, manipulable, accessible to all animals, made available in sufficient quantities, cleaned and restocked whenever necessary (Decree-Law nº135/2003, 2003; European Food Safety Authority, 2022).

2.3.2 Environmental Parameters

The behaviour of pigs is strongly influenced by environmental parameters. Being animals with a limited transpiration capacity, pigs are very susceptible to heat. Thus it is important to

- maintain temperature and humidity of the facilities appropriate for the age and size of the animals (Jones & Manteca, 2018);
- avoid sudden swings in temperature, as they cause cortisol levels to rise, potentially triggering bouts of tail-biting and increased respiratory illnesses (Jones & Manteca, 2018);
- ensure air quality, without harmful gases (e.g. carbon dioxide and ammonia) and dust, which causes respiratory problems and conjunctivitis (Nielsen et al., 2022);
- ensure a photoperiod of at least 8 hours daily, with an intensity of at least 40 lux (CAP, 2018).

2.3.3 Feeding and Watering

A balanced and age-appropriate diet should be guaranteed for all animals. Pigs that are older than two weeks should have fresh, clean water available at all times. This is the only way to guarantee and optimize the animals' productivity and growth. Feeders and drinkers must exist in adequate numbers for the group, to avoid competition for resources, must be in good working conditions, hygienic, and must present an adequate size for the animals housed (DGAV, 2018).

2.4 MAIN AW PROBLEMS IN PIG FARMS

2.4.1 Housing, birth management and neonatal mortality

From the moment the breeding sows are transferred to the farrowing pen, usually one to two weeks before the expected farrowing date, different AW problems arise. To avoid

them, it is necessary to consider the biological characteristics of the animals. Pigs live in groups, but a few days before farrowing, the sows look for isolated places where they can build a nest. This nest proves to be of great importance for the survival of piglets since they are born with low thermoregulation capacity and low energy reserves (Pickett, 2009). Piglet survival depends on the rapid ingestion of colostrum, which will help thermoregulation and strengthen the immune system. Sows, before lying down for suckling, tend to exhibit a behaviour intended to push the piglets away to avoid crushing. Under natural conditions, piglets elect a specific teat or pair of teats, which allows for less competition in the litter, since the descent of the mother's milk lasts only 20 seconds and occurs once an hour (Chaloupková, H. et al; 2011).

Given these biological characteristics, it is possible to identify some of the AW problems that arise on intensive pig farms:

- excessive litter size;
- limited space;
- the restricted possibility of piglet and sow movement;
- the impossibility of construction or non-existence of a nest.

The emergence of the listed problems is translated into the neonatal mortality rate of piglets which, despite different developments in knowledge in the area, remains high. In Europe, around 15-25% of piglets born die before weaning (Thorup et al., 2021). Strategies such as genetic selection of hyperprolific breeds increase the duration of farrowing and gives rise to competition between piglets for access to teats, as these are insufficient in number for the litter size. EFSA's Health and AW Panel scientific opinion is that litter size should not exceed an average of 12-14 live-born piglets for sustainable reproduction (WOAH , 2022).

The lack of space and restrictions on movement of the sow, which is mostly kept in crates during farrowing and lactation to avoid crushing the piglets, makes it unable to perform its normal nesting behaviour. As a consequence there is an inhibition on oxytocin release due to increased plasma levels of β-endorphin and cortisol (Gimsa et al., 2022). The result is an increased duration of parturition and delayed colostrum secretion, which leads to lower survival and growth delays in new-born piglets (Velarde et al., 2015). Another problem is that *standard* pen sizes are sometimes inadequate for the size of the sows. Forced reduced activity and increased time in the prone position reduces cardiovascular fitness, reduces bone and muscle strength, and increase the number of body injuries. This lack of space can also make it difficult for piglets to access the teats, leading to increased lactation difficulty and litter competition (Lene J Pedersen et al., 2020).

Looking at the average levels of preweaning mortality in piglets on UK farms, it was found that these are at the same level for farms where the sow is kept free (12.20%) and when the sow is kept in confinement (12.19%). However, farms, where the sow is kept free, have lower neonatal mortality (piglets that die before weaning) compared to confinement (3.3% vs. 5.8%), suggesting that increased AW of the sow works for the piglets, leading to more successful suckling and consequent higher weaning weights and less aggression directed towards the piglets (Jarvis et al., 2006).

Nest building, a behaviour exhibited by sows in the 16 to 24 hours before parturition, is stimulated by extrinsic factors and endogenous hormones, with its final phase (3-7h before parturition) coinciding with increased oxytocin levels. In cases where sows are kept in confinement, the inability to nest will lead to increased stress, negatively affecting farrowing and maternal behaviour. However, when it is impossible to satisfy the necessity for a nest building by the sow, providing an external nest can be useful for piglets' welfare (Pedersen et al., 2020).

2.4.2 Housing of sows and gilts

Since 2013, the group housing system should represent the main housing system for gestating sows and gilts (females before first farrowing) in the EU. According to the European Council Directive 2008/120/EC, MS must "ensure that sows and gilts are kept in groups during a period starting from four weeks after the service to one week before the expected time of farrowing", except for the farms with fewer than ten sows (European Commission, 2008).

Biologically, sows live in social groups of two to four, where hierarchies are established. Most of the daytime actions are related to foraging, that is, searching for food and territorial exploration. When the time comes for rest, the group seeks to lodge in dry areas, avoiding elevated temperatures (Schubbert et al., 2020).

Currently, in the EU, sows are allowed to be housed individually for up to 28 days post-farrowing, to protect them from the stress associated with group housing and competition and promote embryo survival (European Commission, 2008). However, individual crate housing causes restricted movement, inability to socialize, and inability to manifest the exploratory behaviour intrinsic to the species. Crates prevent proper rest, give rise to repetitive behaviour induced by frustration, called stereotyped behaviours, such as tongue rolling and simulated chewing, among others. (Pickett, 2009).

At the end of the fourth week of gestation, the sows move into a group housing system. This can be characterized in terms of the grouping system - static or dynamic groups - and in terms of the feeding system. In static groups, the sows are mixed only once

per gestation, which means that no new animals enter the group until the entire group is transferred to the farrowing pen. In dynamic groups, there may be the introduction of new elements several times per gestation: every time a sow goes to the farrowing pen, a new post-mating sow may be introduced, and this type of group management exposes the animals to higher levels of stress because every time a change occurs in the group, a new social hierarchy must be established (Bench et al., 2013). In this type of housing, feed is typically restricted to about 60-70% of the amount that sows and gilts are able to eat *ad libitum*, in order to prevent health problems (obesity and joint problems). This dietary restriction increases group activity, to explore and search for food, and competition for resources. If resources and available space are not adequate for the sows' exploratory and foraging behaviour, they begin to direct their behaviour toward the pen (sniffing, licking, biting in the pen or trough areas) (WOAH , 2022; Schubbert et al., 2020).

Group housing should also provide a good resting area for all animals. Sows and gilts spend approximately 80% of their time lying and, due to their limited ability to lose heat through their skin, they need good ventilation conditions to avoid heat stress. This is directly linked to increased embryonic mortality in early pregnancy and piglet deaths in late pregnancy (Pedersen, 2007).

For proper group behaviour, it is important to ensure that three spaces are provided: static space, where sows can stand or lie down; behavioural space, for feeding and meeting physiological needs, and space for interaction (WOAH, 2022).

2.4.3 Mutilations

Most piglets are routinely subjected to a series of mutilations, such as teeth clipping or filing, tail docking, and castration. These mutilations are intended to try to reduce behaviours that may be the source of injury to the animals, such as sow teat lesions and tail biting (Sørensen & Schrader, 2019).

According to the legislation in force (Directive 2008/120/EC and DL 135/2003), "all procedures not due to therapeutic or diagnostic reasons or for the identification of pigs [...] leading to the lesion or loss of a sensitive part of the body or to the alteration of bone structure, with the exception of the procedures: - uniform shedding of piglets' teeth by filing or partial cutting [...];- partial cutting of tails; - castration [...]." are prohibited and "neither tail amputation nor teeth shedding should be routinely performed, but only when there is objective data proving the existence of lesions of sows' teats or other pigs' ears and tails."

Tail docking and Trimming

Pigs are curious animals, with a natural exploratory behaviour. This behaviour is manifested at a very young age and is innate, occurring even if they are well fed and have adequate resting areas (Nielsen et al., 2022). However, tail biting, is an abnormal behaviour manifested by pigs, presenting a multifactorial ethology, often associated with stress, frustration, or competition. This behaviour can lead to the destruction of the epithelium of the tail skin and/or the complete destruction of portions of the tail, in more severe cases. The onset of a tail biting outbreak must be tail-biting identified as early as possible (Velarde et al., 2015).

According to the literature, a tail-biting outbreak can be divided into two phases. The first phase consists of a pre-injury phase, where there is gentle, non-harmful chewing of the tail, of an exploratory character. This phase usually happens when both pigs - the one biting and the one being bitten - are lying down and the tail shows no macroscopic lesion, and only hair loss from the tip of the tail may be present. The second stage is where the injury of the tail. The tail biting becomes constant and more severe, resulting in injury and bleeding. The injured pig becomes more active, due to the discomfort and pain, causing more agitation in the group. This increased activity, coupled with the taste for blood, leads to increased tail biting in the group (Schrøder-Petersen & Simonsen, 2001; Taylor et al., 2010).

In addition to the pain and altered AW of the affected animals and the frustration of the biting animal, this behaviour poses other problems. Tail lesions carry an elevated risk of infection since there is an entry point for infectious agents. Injured pigs become more apathetic and lack appetite, leading to retarded development and decreased body condition. Consequently, the risk of carcass failure due to abscesses increases (Temple, D. et al, 2014)

Increased stocking density, which results in a decrease in the area available for each animal, lack of enrichment materials that allow for exploratory behaviour, and competition for access to drinking and/or feeding troughs are factors that increase the likelihood of outbreaks of tail biting (EFSA, 2012).

To address these outbreaks, which increase with the intensification of pig production, caudectomy (the process of partial amputation of the tail), allowed to be practiced without anaesthesia and analgesia up to the 7th day of life of the piglet, has become common, despite its prohibition as a systematic practice (European Commission, 2016).

Since the tail of piglets is an area with innervation, the scientific community has been dedicated to try to understand the degree of pain and sensitization to which the animal is

subjected during caudectomy. Although this process does not seem to be sufficient to induce a physiological stress response, have be demonstrated the manifestation of behaviours representative of pain, not only during and after the cut (Prunier et al., 2005). Other factors to consider are the formation of neuromas (non-neoplastic proliferations, of regenerative and Schwann cells, of neuronal connective tissue) that occurs in the healing process, which lead to changes in nerve activity, causing chronic discomfort, as well as the usual development of infection subsequent to tail docking, due to the failure of asepsis of the procedure (Sandercock et al., 2016).

The practice of cutting or filing the teeth aims to reduce injuries in piglets and on the sow's teats during lactation (Hay et al., 2004). The procedure consists in removing the pointed portion of the incisors and canines, without accessing the dental pulp. However, the discrepancy between the teeth and sometimes the lack of training of the operator results in the procedure not being done well and often the entire tooth is removed, causing lesions in various tissues of the teeth (Prunier et al., 2005). This procedure negatively affects the AW of the litter by increasing the stress level, not only in the performance of the procedure itself, but also due to the moment of capture and opening of the mouth. It involves intensive handling of the piglets, in addition to causing pain acute, at the moment of tooth reduction, and long-lasting, in the subsequent inflammatory processes (WOAH, 2022).

Castration

Castration in piglets aims to reduce sexual behaviour and aggression in adult males, as well as to prevent the unpleasant odour (boar taint) for consumers in pork products, which results from circulating, mainly, androsterone and skatole compounds in the animal's body (Borell et al., 2020).

Castration, similarly, to other mutilations, besides increasing cortisol levels due to excessive handling, also causes soft tissue lesions and, since in most cases it is performed without any analgesia and/or anaesthesia, it is responsible for causing pain to the animals, negatively affecting their AW (Hay et al., 2004).

Although weaning entire males represents AW benefits, it also presents a challenge for pig production, as pigs tend to develop aggressive and mating behaviours upon reaching sexual maturity (Borell et al., 2020). Thus, a viable alternative to surgical castration is immunocastration (Pickett, 2009).

The objective of this study was to evaluate the AW of pigs in intensive farms (i.e., indoor farming systems that do not use grazing in any of the production phases) (DL n. º339/99, 1999). For this purpose, with the Co-supervisor of the second internship period,

intensive pig farms were visited, where a questionnaire was applied to the person in charge of the farm regarding AW issues and, subsequently, the behaviour of the animals was evaluated, by observing the parameters presented in the AW observation sheets on the animals.

The data collected were analysed and compared with the AW recommendations of the "Manual of AW Recommendations of the Confederation of Farmers of Portugal (CFP) for pigs" (CAP, 2018) made available by DGAV, and respective legislation in force.

3. MATERIALS AND METHODS

3.1 Characterization of the studied sample

The present study took place during 10 non-consecutive days from March 6 to March 20, 2023. We evaluated 8 pig farms, all classified as intensive production systems in the central region of Portugal. Of the 8 farms visited, 5 were engaged only in piglet production and 3 were of the "Full cycle"- piglet production for weaning and finishing on the farm (DL n. º339/99, 1999). For the study, animals in gestation, maternity and weaning were considered.

The AW assessment questionnaire and observation sheets applied were adapted from the WQ® protocol (Welfare Quality®, 2009) and the "Questionnaire for the evaluation of risk factors for tail bites" of the “Direção Geral de Alimentação e Veterinária” (DGAV, 2020).

3.2 Evaluation planning

Data collection was done through two moments of assessment. First, an interview was conducted with the person in charge of the farm and an AW assessment questionnaire was applied during the general visit. In this phase, the objective was to collect information regarding the type and system of production, as well as management procedures and mortality rates. In the second phase, through the application of observation sheets, housing conditions and animal behaviour of a representative group of the farm were evaluated, thus whenever possible, in the maternity, 10 breeding sows and their respective litters were observed; in gestation, 30 breeding sows were observed (10 in individual housing in crates and 20 in group housing); and, in weaning, 10 pens were observed. In the case of litter and weaning pens the animals were evaluated as a group. The observation planning was done

after the farm visit, to allow the identification of the rooms to be evaluated, not including nursery/refuge pens. Initially, a qualitative evaluation of the behaviour and clinical evaluation of the animals was made on site, and then the housing conditions were evaluated.

3.3 Evaluating AW

The evaluation was done from the outside of the pen and lasted 10 minutes. It was performed in silence, in order to ensure the normal behaviour of the animals.

For the assessment of AW on the farm, the ABM were used, adapted from the protocol for welfare assessment for pigs of the WQ project, which were given a rating of 0, 1 or 2, according to what is described in Table 1 (Welfare Quality®, 2009).

Table 1. List of animal-based measures and their description that were used to assess AW on farms.

Animal-based measures	**Description**
Evaluation of the respiratory clinic signs	0 - Absence of coughing, sneezing, or laboured breathing (panting) animals; 1 - Presence of coughing, sneezing, or laboured breathing (panting) animals.
Hygiene (absence of faeces on the body)	In breeding sows: 0 - Up to 10% of the surface of one side of the body soiled; 1 - 10-30% of the surface of one side of the body soiled; 2 - More than 30% of the surface of one side of the body soiled. In litter and weaning pigs: 0 - Up to 20% of the group has 10% of the surface of one side of the body soiled; 1 - 20-50% of the group has 10-30% of the surface of one side of the body soiled; 2 - More than 50% of the group has more than 30% of the surface of one side of the body soiled.
Digestive clinic signs (diarrhoea)	0 - No evidence of diarrhoea in the pen; 1 - Evidence of diarrhoea (liquid stools) in the pen.
Presence of hernias	0 - No hernia; 1 - Evidence of hernia, but not affecting locomotion, not touching the ground, or bleeding; 2 - Evidence of hernia affecting locomotion and/or touching the ground and/or bleeding.
Interaction with the enrichment materials	0 - Animals interact; 1 - Animals do not interact.
Animal-based measures of breeding sows only	
Pressure sores on crated animals	0 - No evidence of injury; 1 - Evidence of injury with formed scar tissue or recent injury that is healing; 2 - Open injury.
Presence of stereotypes	Counting the number of animals exhibiting stereotyping (sham chewing, tongue rolling, teeth grinding, bar biting, trough/drinker biting, floor licking).
Animal-based measures of weaning pigs only	
Tail biting	0 - No evidence of tail bite; 1 - Superficial bite along the length of the tail, but no evidence of fresh blood; 2 - Tail bite with fresh blood and/or infection and/or inflammation and/or missing part of tail tissue when caudectomy is not practiced.
Ear biting	0 - No evidence of ear biting; 1 - Indication of ear biting.

The NABM analysed are presented in Table 2, and the factors with the greatest relevance to AW were considered, according to the recommendations proposed by the WOAH for AW in pig production systems (WOAH, 2022b).

Table 2. List of non-animal-based measures and their description that have been used to assess AW on farms.

Non-animal-based measures	Description
Workers	Number and training
AW guides on the farm	Absence or presence.
Tail docking	Absence or presence.
	Who is performing the procedure (producer or veterinarian).
	Age of the animal.
	Use of anaesthesia/analgesia protocols.
Castration	Absence or presence.
	Who is performing the procedure (producer or veterinarian).
	Age of the animal.
	Use of anaesthesia/analgesia protocols.
Teeth clipping	Absence or presence.
	Who is performing the procedure (producer or veterinarian).
Housing type	Cell (individual) or group.
Floor Type	Plastic or cement.
Infirmary Pens	Absence or presence.
Control of temperature, humidity, gas and dust content in the rooms	Realized or not realized.
Ventilation system	Manual or automatic.
Lighting at least 8h/day	Absence or presence.
Maintenance and hygiene of the feeders	Compliant or non-compliant.
Maintenance and hygiene of the drinking fountains	Compliant or non-compliant.
Enrichment Material	Absence or presence and type: metal chains, plastic material, wood, other.
Bed	Absence or presence and type: straw, hay, sawdust, paper, other.
Nesting material	Absence or presence.
Isolated nest and/or heated lying area for the litter	Absence or presence.

4. RESULTS

In total, 8 intensive pig farms in the Aveiro municipality in Portugal were visited, where 65 sows and litters, 58 sows in crate housing, 97 sows in group housing, and 56 weaning pens were observed and recorded.

4.1 Animal-based measures of AW

The percentage of occurrence of the different ABM recorded in the groups of animals observed on the farms visited are grouped in Table 3.

Table 3. Percentage of occurrence of the different animal-based AW measures recorded in the animal observation.

Animal-based measures		Group	n/N	%
Respiratory clinic signs	Cough	Litter	9/65	13,8
		Sows in group housing	4/97	4,1
		Weaning pigs	9/56	16,1
	Sneezes	Litter	16/65	24,6
		Sows in group housing	2/97	2,1
		Weaning pigs	21/56	37,5
Hygiene	1	Sows in maternity	18/65	27,7
		Sows in individual housing	25/58	43,1
		Sows in group housing	42/97	43,3
		Weaning pigs	18/56	32,1
	2	Sows in maternity	12/65	18,5
		Sows in individual housing	9/58	15,5
		Sows in group housing	35/97	36,1
		Weaning pigs	7/56	12,5
Pressure Injuries	1	Sows in maternity	26/65	40,0
		Sows in individual housing	19/58	32,7
	2	Sows in maternity	9/65	13,8
		Sows in individual housing	7/58	12,1
Diarrhoea	1	Litter	10/65	15,4
		Sows in individual housing	2/58	3,4
		Weaning pigs	5/56	8,9
Hernias	1	Sows in maternity	6/65	9,2
		Sows in individual housing	6/58	10,3
		Sows in group housing	13/97	13,4
		Weaning pigs	4/56	7,1
Stereotypes		Sows in individual housing	36/65	55,4
		Sows in group housing	43/58	74,1
Tail biting	1	Weaning pigs	15/56	26,8
	2		8/56	14,3
Ear biting	1	Weaning pigs	18/56	32,1
	2		3/56	5,3
Enrichment material	Not present	Sows in individual housing	16/58	27,6
		Sows in group housing	60/97	61,8
		Weaning pigs	10/56	17,8
	Animal interact	Sows in individual housing	14/58	24,1
		Sows in group housing	11/97	11,3
		Weaning pigs	30/56	53,7
	Animals don't interact	Sows in individual housing	28/58	48,3
		Sows in group housing	26/97	26,8
		Weaning pigs	16/56	28,6

N →Total number of observations. n → Number where the occurrence of the ABM under study was observed.

Panting animals weren't observed in any of the groups. In the sows in the maternity and group housing no respiratory clinic ABMs were present. Diarrhoea was not observed in any of the sows in the maternity and group housing. The litters observed all had a hygiene score of 0.

The percentage of the different stereotypical behaviours displayed by the breeding sows in individual housing and group housing is shown in Figure 1.

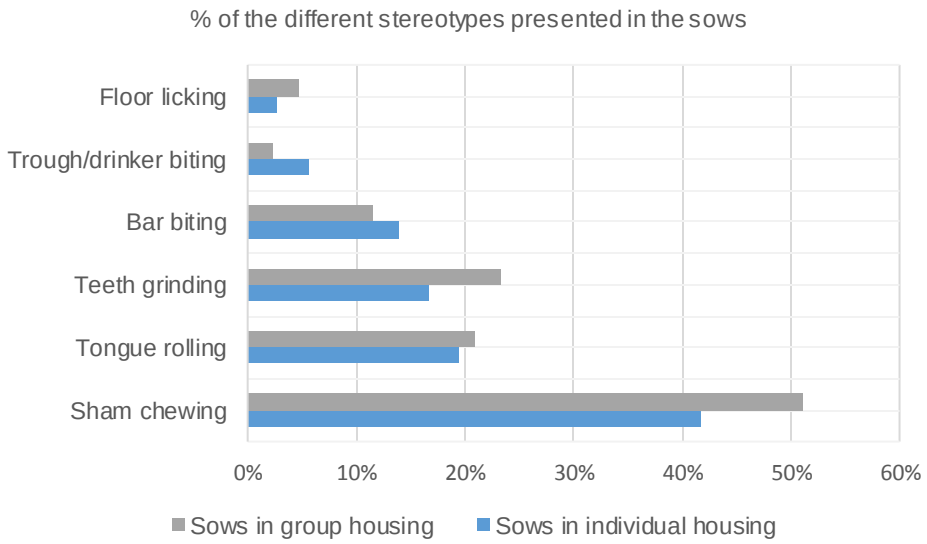

Figure 1. Different stereotypical behaviours exhibited by 36 sows in individual housing and 43 sows in group housing.

4.2 Non-animal-based measures of AW

Table 4 shows the NABM results obtained from the questionnaire to the people in charge of the farm and their observation.

Table 4. Results of the non-animal-based AW measures recorded during the farm visit.

Non-animal-based measures			n/N
Workers Training and Competence			
Training in animal production			10/22
Training in AW			5/22
AW guidelines on the farm			0/8
Training to slaughter/kill the suffering animals			2/8
Environmental Conditions			
Ventilation System		Natural	5/8
		Automatic	3/8
Brightness of at least 8 hours a day		Yes	5/8
Room temperature measurement		Yes	3/8
Room humidity measurement		Yes	1/8
Measurement of gases and dust in the room		Yes	0/8
Management			
Number of times animals are inspected per day		1 time a day	2/8
		2 times a day	6/8
Average mortality of pre-weaned piglets			22%
Average sow mortality			19%
Average litter size			13
Average age at weaning (days)			32
Permanent Identification Method		Auricular tattoo	7/8
		Another	1/8
Mutilations			
Performs tail cutting		Yes	1/8
Performs castration		Yes	2/8
Performs a partial cut of the teeth		Yes	2/8
Performs teeth filing		Yes	2/8

Housing		**Maternity**	**Individual housing**	**Group housing**	**Weaning pigs**
Existence of an infirmary in the room	Yes	0/8	3/8	3/8	2/8
Feeders in good maintenance and hygiene conditions	Yes	7/8	6/8	8/8	8/8
Drinking fountains in good maintenance and hygienic conditions	Yes	8/8	8/8	8/8	8/8
Access to enrichment materials	Yes	1/8	3/8	3/8	6/8
Existence of bed	Present	0/8	0/8	0/8	0/8
Access to nesting materials one week before delivery	Yes	4/8	-	-	-
Isolated resting area for piglets	Present	2/8	-	-	-
Heating system for piglets	Present	8/8	-	-	-
Piglet drinkers	Present	7/8	-	-	-

N →Total number of observations. n → Number where the occurrence of the NABM under study was observed.

- → Not applicable

As for mutilations, all of them were performed by the person in charge of the farm and without the use of anaesthesia and/or analgesia protocols.

In the maternity farms visited, all sows observed were housed in crates, 2 of the farms visited had partially concrete slatted floors and the remaining 6 had plastic floors (3 of which had fully slatted floors).

The breeding sows in individual and group housing were all housed on cement floors partially slatted. The farms that had enrichment material available to the animals, either in individual or group housing, were all metal chains, except for one of the group housing farms that had plastic bottles.

In the case of weaning, 5 farms had plastic floor pens (3 with fully slatted floor and 2 with partially slatted floor), the remaining 2 had partially slatted cement floor. Only 1 of the farms did not have enrichment materials in the pens, and of the 6, 4 had a metal chain as enrichment, 1 had wooden logs and the remaining had balls, metal chains and plastic bottles.

5. DISCUSSION

Analysing the results obtained based on the questionnaire applied to with the person in charge of the farms, it was concluded that the AW indications present in the "CFP AW Recommendations Manual for pigs" (CAP, 2018) as well as what is provided for in the legislation, more specifically in DL no. 35/2003, of June 28, are not always complied with. None of the farms fully complies with the provisions of section I, relating to "Housing, Infrastructure and Equipment" of DL no. 35/2003, of June 28.

The results showed that 77% of the workers were not trained in AW, and none of the farms provided AW guides or guidelines. However, in order to ensure AW, it is important that all workers are adequately trained according to their responsibilities. This training should cover areas such as animal management, nutrition, behaviour, biosecurity, detection of signs of disease, and identification of measures of compromised AW, such as stress, pain, and discomfort, and knowledge to alleviate them (WOAH, 2022).

As mentioned above, failure to ensure adequate environmental conditions (air quality, air conditioning and number of daily light hours) can compromise the health of the animals and consequently affect the AW. Therefore, although none of the farms performs routine monitoring of environmental conditions, only occurrences related to respiratory clinics were observed in litters, group breeding and weaning. However, it is difficult to ensure, due to the lack of more accurate measurements (measuring values) and lack of control records, that the animals continuously experience housing conditions with adequate thermal comfort and air quality. The existence of automatic or manual climate regulation/air quality and lighting monitoring mechanisms optimize production systems and prevents possible disturbances in physiological processes, resulting in better animal production rates (Godyń et al, 2020).

The practice of recurrent mutilations was not observed in most farms. The most common were cutting and/or filing of teeth (practiced in 4 of the 8 farms visited), and the farms that practiced it justified it with routine not with data proving the need. Studies show that the manipulation and restraint of piglets can result in behavioural and physiological

changes, and may induce long-lasting physical negative consequences, such as abscess formation, lesions, neuromas and possible sources of acute or chronic pain. It is essential to adopt effective strategies, such as the adoption of anaesthetic protocols and training of those responsible for performing the procedures, which significantly minimize the pain caused by these procedures and, whenever possible, to adopt alternative management practices that eliminate the need for these procedures (Prunier et al., 2020; Schmid & Steinhoff-Wagner, 2022; Sutherland, 2015).

5.1 Animal-based measures of AW

The measures that were shown that are more relevant in the results obtained from on-farm observations are mainly associated with the "Good Housing" criterion indicated in the WQ protocol for pigs (Welfare Quality®, 2009).

The percentage of pressure lesions presented in breeding females in the maternity and in individual housing, respectively 53.8% and 44.8%, shows that the crates in which the animals are housed are, in most cases, insufficient for the size of the animals. The lack of space and prolonged immobility cause constant pressure, most often in the joints, which, with the reduction of blood flow, leads to lesions that, in addition to being painful, serve as an entry point for infections (Herskin et al., 2011).

The presence of stereotypical behaviours, 55.4% in individual-housed and 74.1% in group-housed sows, and aberrant behaviours, such as tail and ear biting in weaning, respectively 41.1% and 37.4%, are measures of the animal stress. Behaviours of this kind are associated with housing problems, such as high densities, competition for resources, lack of environmental enrichment (Ludwiczak et al., 2021). However, it is important to emphasize that the fact that producers are trying to avoid tail docking is positive and according to the law. Usually takes some time for producers who raise pigs with an intact tail to learn to control the incidence of tail biting, as this problem is often a combination of many risk factors (housing, health, nutrition, genetics) (EFSA, 2022).

5.2 Non-animal-based AW measures

The results showed that regarding the housing in the farrowing crates there are some measures that should be improved, such as the size of maternity, specifically the size of the cage, the possibility for nest building and a heated isolated area for piglets. It is important to ensure that all sows have access to sufficient and well-placed nesting material, i.e., in the front area of the crate to allow the sow to perform her nesting behaviour. Damm et al.

(2003) demonstrated that sows in crates without the possibility to perform nesting behaviour exhibited more stereotypic behaviours, as well as higher heart rates and cortisol levels (Damm et al., 2003).

European countries today still experience high preweaning mortality rates of live-born piglets, around 15-25%, which is still one of the major challenges in pig production (Thorup et al., 2021). The result obtained from the sample in this study is within this range. The fact that these mortality rates remain so high may be due to several factors, the main ones related to AW being poor maternal behaviour of sows, which occurs mainly when they experience prominent levels of stress, and due to poor housing conditions for piglets. Ideally, piglets should have access to an isolated and heated resting area ("nest", which was only found in two of the farms visited) (EFSA, 2022).

As far as enrichment material was concerned, it was available only in some farms and it was mostly metal chains, material classified with a low degree of interest, not properly promoting the requirements of manipulation, chewing, ingestion and investigation. Enrichment material has been shown to stimulate exploratory and social behaviour in pigs and may reduce the onset of aggression and aberrant behaviour among group-housed individuals and stereotyping in individually housed animals (Godyń et al., 2019).

6. CONCLUSION

Although intensive pig production results in greater efficiency in the use of available resources, productivity, and food security, it can sometimes undermine AW, which is a key element to ensure the sustainability of production. Studies are needed to assess the benefits of production systems that allow pigs to express their biological behaviour in a natural way. Proper management, that is, the interaction between humans and animals, is key to reducing stress and ensuring good conditions for the animals, which benefits production, animal health, and food safety, so it is crucial to properly train the producers and the workers involved.

Implementing standardized procedures for monitoring management and environmental conditions, reducing animal density and providing a stimulating environment are important strategies for improving AW. Although the national competent authorities conduct annual AW audits in a significant number of farms, as required in Council Directive 2008/120/EC of December 18, the study shows significant gaps in compliance, as observed in the results obtained with this study, despite the limited sample.

The articulation between official and clinical veterinarians is fundamental to achieve animal production that considers not only productivity and profitability, but also health and

AW. Clinical veterinarians have an important role in reducing these gaps. It is important that they make producers aware of the importance of AW, and help identify factors that may trigger problems, advising production managers on the creation of customized action plans to prevent AW problems and consequent decrease in production and quality of the meat obtained.

The market responsible for producing and encouraging pork consumption should be an agent that promotes health and AW, prioritizing good production practices. It is essential to make all parties involved, from production to consumer choice, aware of these issues for a more sustainable agricultural production. The interest of meat consumers about farm animal production should be applied in the moment of the choice of pig products and they are willing to pay higher prices for products raised in good welfare conditions. So,it is , therefore, important to create a labelling system that allows the distinguishing of foods that are created under good welfare conditions, as with products that have welfare certification by the WQ and that the meaning of this labelling is known by consumers, and it is paramount to invest in publicizing how animal production works, not only through the usual marketing channels, but also through educating the younger population.

The limitation of this current study derives from the results obtained by visiting a reduced number of farms, and therefore may not be representative of the reality of Portuguese intensive pig farming. The data obtained are mainly from sows, since the region of the country where the study was carried out has a pig production focused on the production of piglets, and not on fattening. In order to obtain a more thorough and real view of the situation of pig production in Portugal, it would be pertinent to conduct studies with a larger number of samples in order to build a more detailed analysis.

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