PERSPECTIVA PRODUTIVA DE SUÍNOS EM XINGUARA-PA EM RELAÇÃO AO LEVANTAMENTO CLIMÁTICO DE 2016 A 2023.

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RESUMO: Nos últimos dez anos o crescimento do consumo da carne suína no mundo foi de 12%, isso é equivalente a 16 kg consumido por pessoa ao ano (ABPA, 2024). O estado do Pará ocupa a 14ª colocação em relação ao abate de suínos por unidade federativa, tendo grande potencial produtivo. Nesse contexto, o trabalho foi realizado visando associar a temperatura e umidade de conforto nas fases da suinocultura, em relação as temperaturas e umidades médias durante os anos de 2016 a 2023 no município de Xinguara, localizado no sul do estado do Pará, e verificar o potencial produtivo da região em relação as condições climáticas. Para a realização deste estudo foram utilizados dados das temperaturas e umidades relativas de conforto dos animais encontradas na literatura e as médias dessas variáveis coletadas pelo INMET (Instituto Nacional de Meteorologia, 2024). Observou-se que a região possui condições de ser um grande produtor da carne suína, porém com a necessidade da utilização constante de equipamentos de acondicionamento térmico do ambiente, em alguns momentos aquecimento e outros momentos resfriamento, em vista que a região possui condições climáticas que podem interferir na produtividade, tendo meses com temperaturas muito elevadas.

Palavras-chaves: ambiência, suinocultura, conforto térmico.

PRODUCTION PERSPECTIVE OF PIGS IN XINGUARA-PA IN RELATION TO THE CLIMATE SURVEY FROM 2016 TO 2023.

ABSTRACT: In the last ten years, pork consumption has increased worldwide by 12%, which is equivalent to 16 kg consumed per person per year (ABPA, 2024). The state of Pará ranks 14th in relation to pig slaughter by federative unit, having great production potential. In this context, the work was carried out with the aim of determining the comfort temperature and humidity during the pig farming phase in relation to the average temperature and humidity from 2016 to 2023 in the municipality of Xinguara, which is located in the southern part of the state of Pará, and to verify the productive potential of the region in relation to climatic conditions. To carry out this study, data on the temperatures and relative humidities of the comfortable animals reported in the literature and the averages of these variables collected by INMET (National Institute of Meteorology, 2024) were used. The region is capable of being a major producer of pork, but with the need for constant use of environmental thermal conditioning equipment, at times heating and other times cooling, given that

the region has climatic conditions that can interfere with productivity, with months with very high temperatures.

Keywords: ambience, pig farming, thermal confort.

1 INTRODUCTION

Pig farming is a predominantly intensive activity that seeks greater productivity, reduced production costs, and animal welfare in all phases of production. In Brazil, pig farming already has cutting-edge technology, which is available for all areas of pig production, including genetics, nutrition, health, management, facilities, and equipment (Dias *et al*., 2011). According to the Brazilian Animal Protein Association (2024), in 2023, approximately 5.156 million tons of pork were produced in Brazil, placing the country as the fourth largest producer of pork in the world.

According to Galvão *et al.* (2019), even with Brazil's excellent position in the world ranking, competition with other countries has become very high because of the lack of factors that support production, such as biosafety, health, and investment in labor, especially in the promotion of animal welfare. Additionally, after the globalization process, the consumer market has become more demanding in terms of seeking products with higher quality and known origin; thus, investments in ambiance, nutrition and management have become essential to maintain products within the expected standards.

When we look at the northern region, together with the northeast region, according to a publication by the Brazilian Animal Protein Association (ABCS, 2024), in 2023, they held 2.1% of the country's breeding stock. If we consider its territorial extension and production capacity, we can say that Pará's potential for pig farming is still well below what it can achieve. This is due to obstacles such as the supply of inputs and the flow of productivity.

According to Rodrigues, Zangeronimo and Fialho (2010), heat stress is very common on most pig farms in Brazil. Additionally, according to the author, in Brazil, heat stress is the main limiting factor for production; therefore, understanding the environmental needs of the animals and studying the climatic conditions of the region where the system will be implemented are essential to define which construction techniques and devices maximize the comfort of the animals.

Thus, the present study aimed to survey the climate variables, temperature and relative humidity in the city of Xinguara/PA from 2016--2023 and correlate them with the comfort temperatures of pigs in each phase of breeding, thus revealing the productive potential in relation to the climatic conditions in the region.

2 MATERIALS AND METHODS

This study was carried out in the municipality of Xinguara in the state of Pará. The city is located at coordinates 07°05'42" South, longitude 49°56'45" West and an altitude of 278 meters. It is in the super humid equatorial category, type Am, on the edge of the transition to Aw, according to the Köppen classification, with an average annual temperature of 26.5°C.

Data on average temperature and relative humidity were collected from the automatic meteorological station installed in the municipality of Xinguara-PA, which can be found on the INMET (National Institute of Meteorology, 2024) website with code A247. The information collected was from 2016, starting in September until 2023. INMET provides data collected every hour that are used to calculate the average for each month of each year analyzed. In 2020, the months of October and November had no data collected by the meteorological station. In 2022, the data were analyzed only until April, and in 2023, they were analyzed from May onward due to an operational failure of the meteorological station. The reason for this lack of operation was not clarified by INMET. Data on the thermal comfort temperatures and humidities used for the study in each breeding phase are presented in Table 1 (Charneca, 2010; Sousa,

2004; Rodrigues, 2010; Whittemore, 1980; Bortolozzo, 2011).

Graphs were created via Excel 2010 software to visualize the average temperatures in relation to the comfortable temperatures of the animals in each phase of breeding. The graphs created a line that shows the averages of the years for each month in relation to the variables studied.

Table 1. Average temperature and average relative humidity of the ideal air for each stage of pigs.

Category	Ideal temperature (°C)		Relative Humidity (RH) %
Minimum Maximum Ideal			
Calf matrices	16	22	70%
Milkshake	30	32	70%
Nursery	24	27	70%
Growth and Termination	16	22	70%
Reproduction	18	25	70%

Source: Charneca (2010), Sousa (2004), Silva (2006), Whittemore (1980) and ABCS (2016).

With these graphs, it was possible to obtain a more assertive idea about the productive capacity of pigs in the municipality of Xinguara in Pará, which could be disseminated to the cities in the region since the environmental characteristics are similar.

3 RESULTS AND DISCUSSION

According to Furtado *et al.* (2019), pigs are sensitive to variations in air temperature; piglets are more sensitive to cold and adult animals are more sensitive to heat and need to perform heat exchanges, adjusting the heat produced in their metabolism with the heat gained from the environment. In uncomfortable environments, an animal may not reach its maximum genetic potential and may have an inadequate diet, both in terms of nutrient utilization and consumption, due to the diversion of energy needed to maintain body temperature (Soares *et al.*, 2017).

The farrowing stage is the stage of pig farming where we face the greatest environmental challenge, as we have two categories of pigs with very different needs housed in the same place: piglets and lactating females. In this stage, the ideal temperature to satisfy the sow's comfort needs is between 16 and 22°C (Table 1), and for the litter, the ideal temperature in the first days of life is approximately 30 to 32°C (Table 1), which decreases as the piglet grows (Charneca, 2010).

For females in the maternity phase, it was observed that in all years evaluated (Graph 1), the average ambient temperatures were above the recommended values for this category. In general, the highest average temperatures are in the months of August and September in all years, which is a dry period in southwestern Pará and leads us to suggest the use of nebulization associated with ventilation during these periods.

Graph 1. Maximum and minimum comfort temperatures (°C) for female pigs in the maternity ward compared with the air temperature from 2016 to 2023 in Xinguara, Pará.
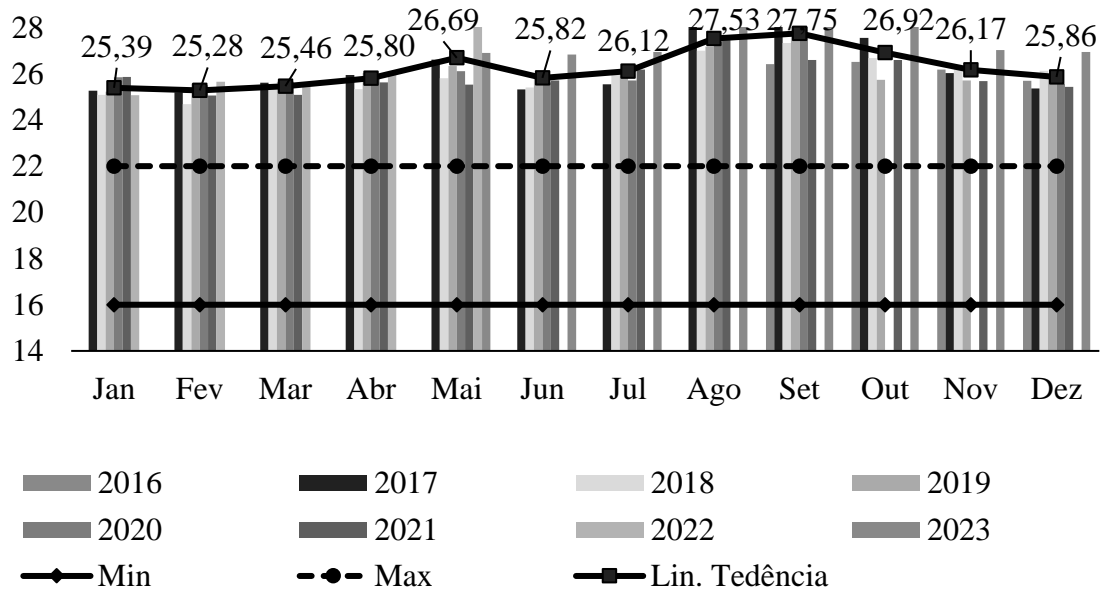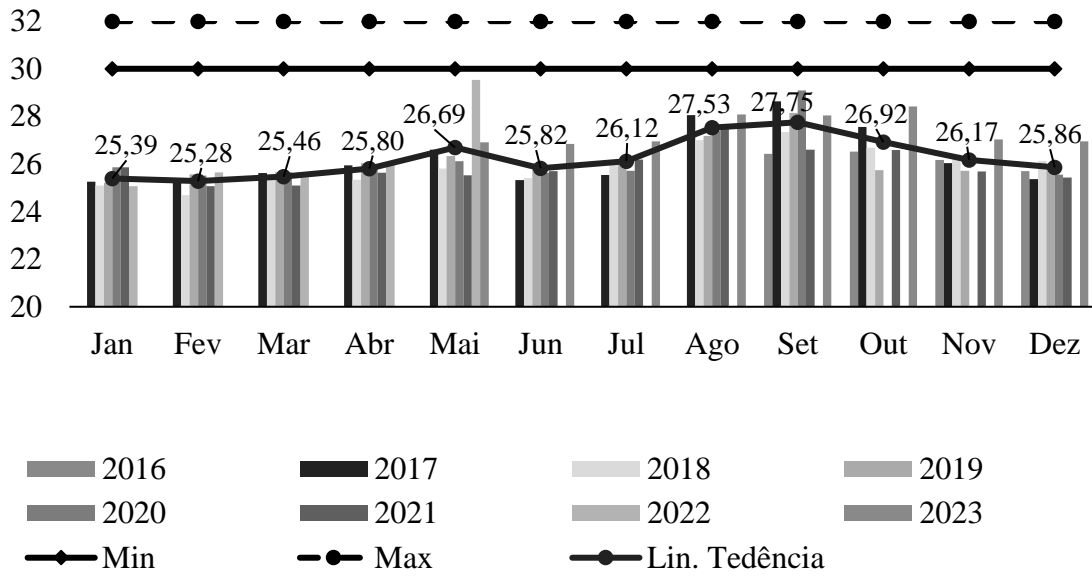

Source: Prepared by the authors.

The temperature conditions for lactating female pigs in the Xinguara-PA region are critical, as at this stage of life, the females produce much metabolic heat with the synthesis of milk, greatly increasing the discomfort caused by high temperatures, and may even affect their production, as presented in the work of Silva (2018), where heat stress has an impact of 20–25% on milk production, subsequently affecting the performance of the piglets and reflecting on the quality of the carcass.

For the litter, graph 2 shows that in all years, the average air temperature was below the ideal temperature for this phase of breeding, indicating a potential reduction in the growth of the animals due to the energy expenditure needed to produce heat and keep warm.

Graph 2. Maximum and minimum comfort temperatures (°C) for litter in the maternity ward compared with the air temperature from 2016 to 2023 in Xinguara, Pará.
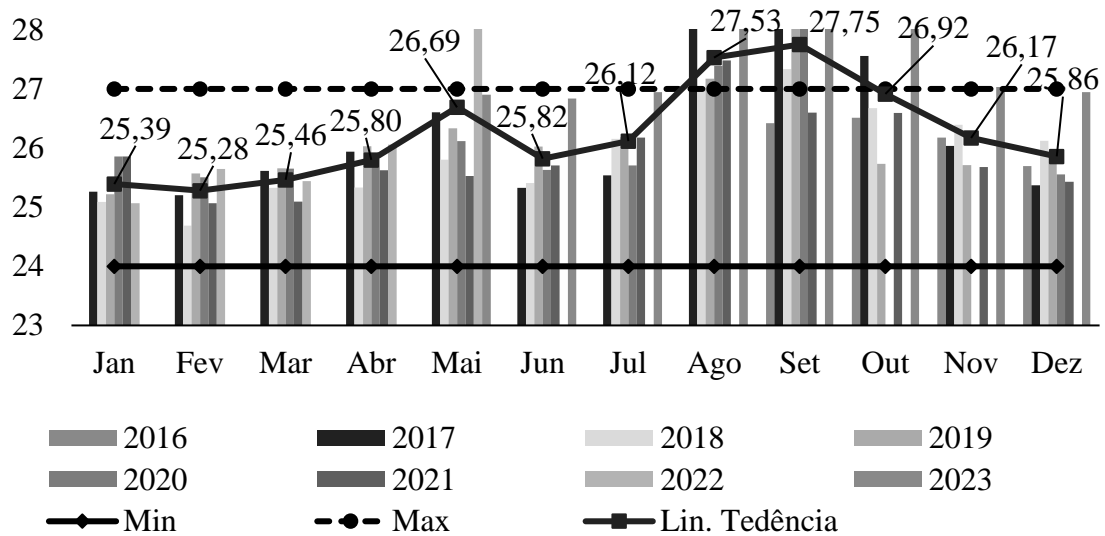

Source: Prepared by the authors

It is known that temperatures are lower at night, making the averages below ideal for this stage of the pigs' lives, which highlights the need for heating for this category, and it is possible to use heat exchangers associated with a heating system, with lamps or heated floors.

In the nursery phase, piglets separate from their mothers and join other litters, which can have a series of effects on pig performance, as shown in the work of Kummer *et al. (*2009). The author stated that high temperatures at this stage directly affect the subsequent growth and termination stages.

Graph 3 shows that the months of August and September are the months with the highest temperatures, which can directly affect the weight gain of animals, resulting in a decline in performance and a delay in the recommended weight for slaughter (Silva *et al.*, 2019).

Graph 3. Maximum and minimum comfort temperatures (°C) for litter in the nursery compared with the air temperature from 2016 to 2023 in Xinguara, Pará.
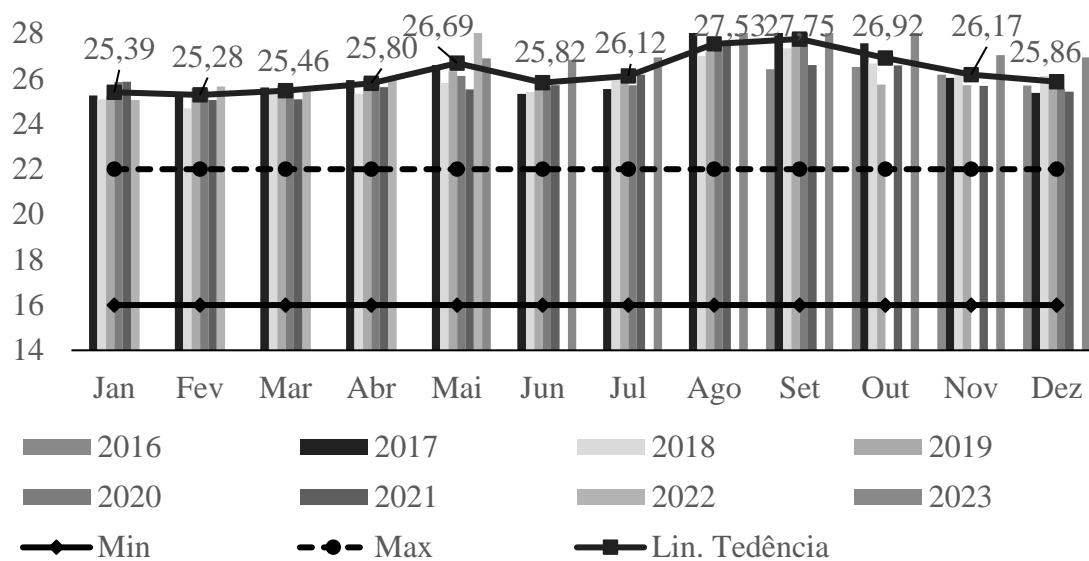

Source: Preparation by the authors

In months in which average variations above the comfort range are observed, interventions, such as the use of fans, are necessary to reduce the room temperature. The month of September is the period that requires the most attention in terms of high ambient temperatures.

According to the comfort temperatures reported by Whittemore (1980), the average air temperature was above the maximum comfort temperature for pigs in the growth and finishing phases in the months of August and September, which coincides with the driest time of the year in the region.

Graph 4. Maximum and minimum comfort temperatures (°C) for pigs in the growing and finishing phases compared with the air temperature from 2016 to 2023 in

Xinguara, Pará.
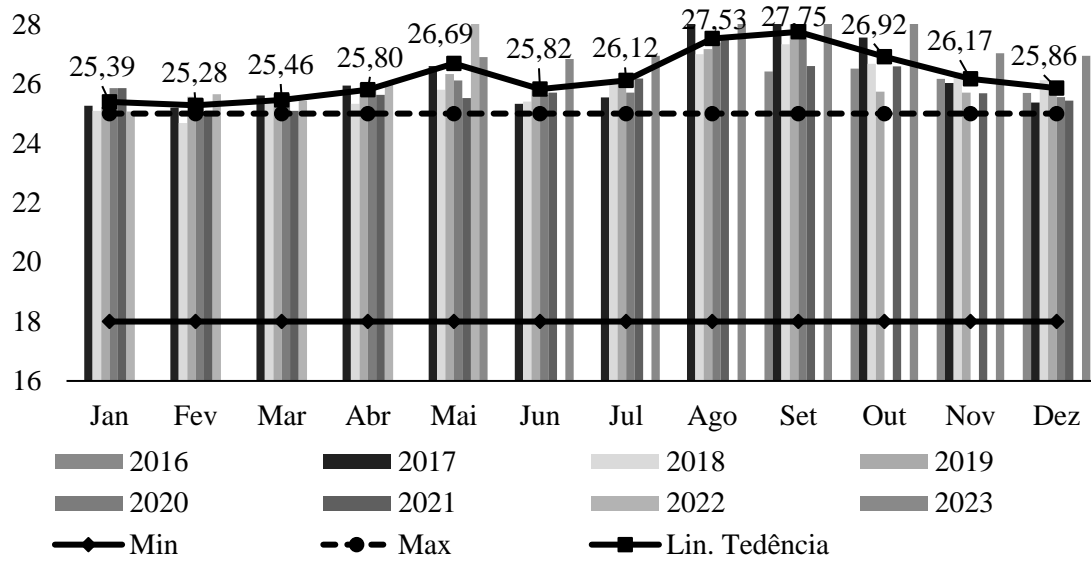**Source:** Prepared by the authors

The results show that in the phase where the carcass is finished, with the need for high energy consumption, the air temperature can affect performance, with a reduction in consumption, according to the work presented by (Tavares *et al*., 2000). The authors state that at high temperatures, pigs tend to activate a physiological and metabolic response, thus presenting a lower growth rate, in addition to reducing the efficiency of the use of food, resulting in changes in the composition of the carcass. Therefore, it is necessary to control the temperature of the environment with the use of artificial ventilation, fans and, depending on the air humidity, nebulizers during critical months.

According to the work of Myer and Bucklin (2018), for pigs in the finishing phase, in addition to heat stress, the species reduces feed intake, resulting in reduced daily gain. According to the author, the main reason for this occurrence is that when pigs ingest food, absorb nutrients and digest it, there is greater heat generation, which increases their body temperature; for this reason, pigs voluntarily reduce their consumption, reducing the amount of heat that needs to be dissipated to the environment.

For breeding animals, the comfort temperature is between 18°C and 25°C (ABCS, 2016), and as shown in Figure 5, the average air temperature was above the maximum comfort temperature for all months of the year. Therefore, in this phase, it is essential to use a cooling system, as it is an extremely heat-sensitive phase, where high ambient temperatures can considerably affect reproductive rates, as shown in the work of (Bertoldo *et al*., 2012), which presents the negative effect of high temperatures on pig breeders.

Graph 5. Maximum and minimum comfort temperatures (°C) for breeding pigs compared with the air temperature from 2016 to 2023 in Xinguara, Pará.
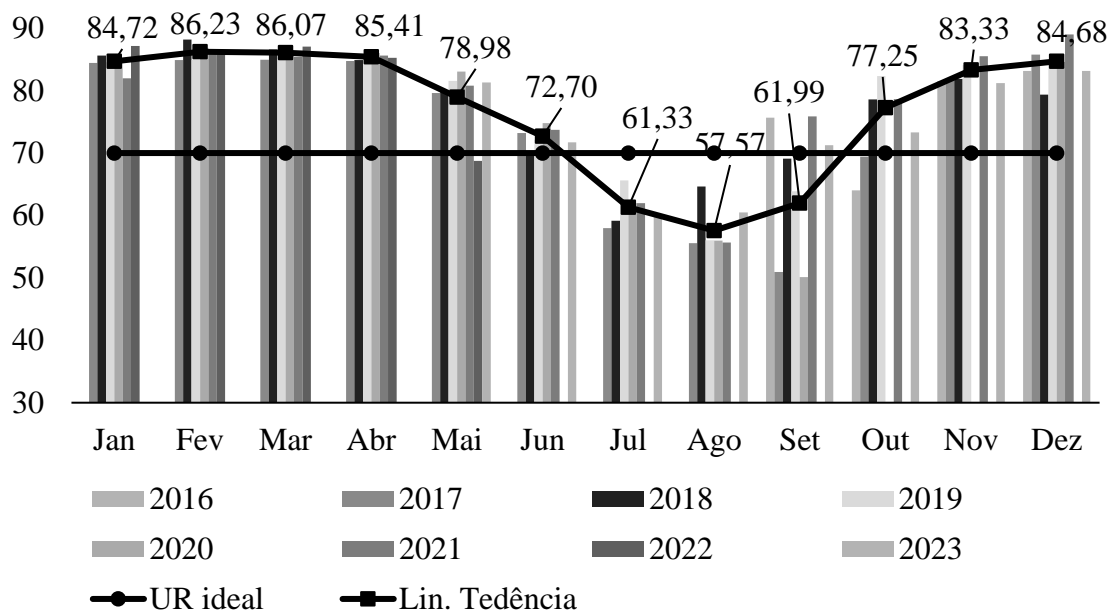

Source: Preparation by the authors

When analyzing the average air humidity in Figure 6, it is necessary to understand that the municipality of Xinguara, in Pará, has two well-defined seasons: the rainy season, which runs from October to May, and the dry season, which runs from June to September. Graph 6 shows that in the rainy season months, the averages recorded were above the recommended values, whereas in the dry season, the relative air humidity was below the recommended value, requiring the use of devices, such as nebulizers or evaporative pads, to obtain satisfactory humidity.

Graph 6. Average relative air humidity (%) from 2016--2023 (Xinguara-PA) in relation to comfort humidity for pigs in all phases.

Thus, producers must exercise greater control over the climate variables of temperature and relative humidity, thus avoiding thermal stress and increasing pig productivity in all stages of breeding.

4 CONCLUSIONS

The Xinguara region in Pará has characteristics that allow for large-scale commercial pig farming if producers invest in upgrading the farm to control the thermal environment, given that average temperatures are above ideal for almost all categories for most of the year, which can cause thermal stress in the animals, reducing their production potential. Despite other problems in the region, such as the difficulty in finding food for the animals, we can say that the production potential for pork in the region is high and has good growth prospects in the coming years.

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