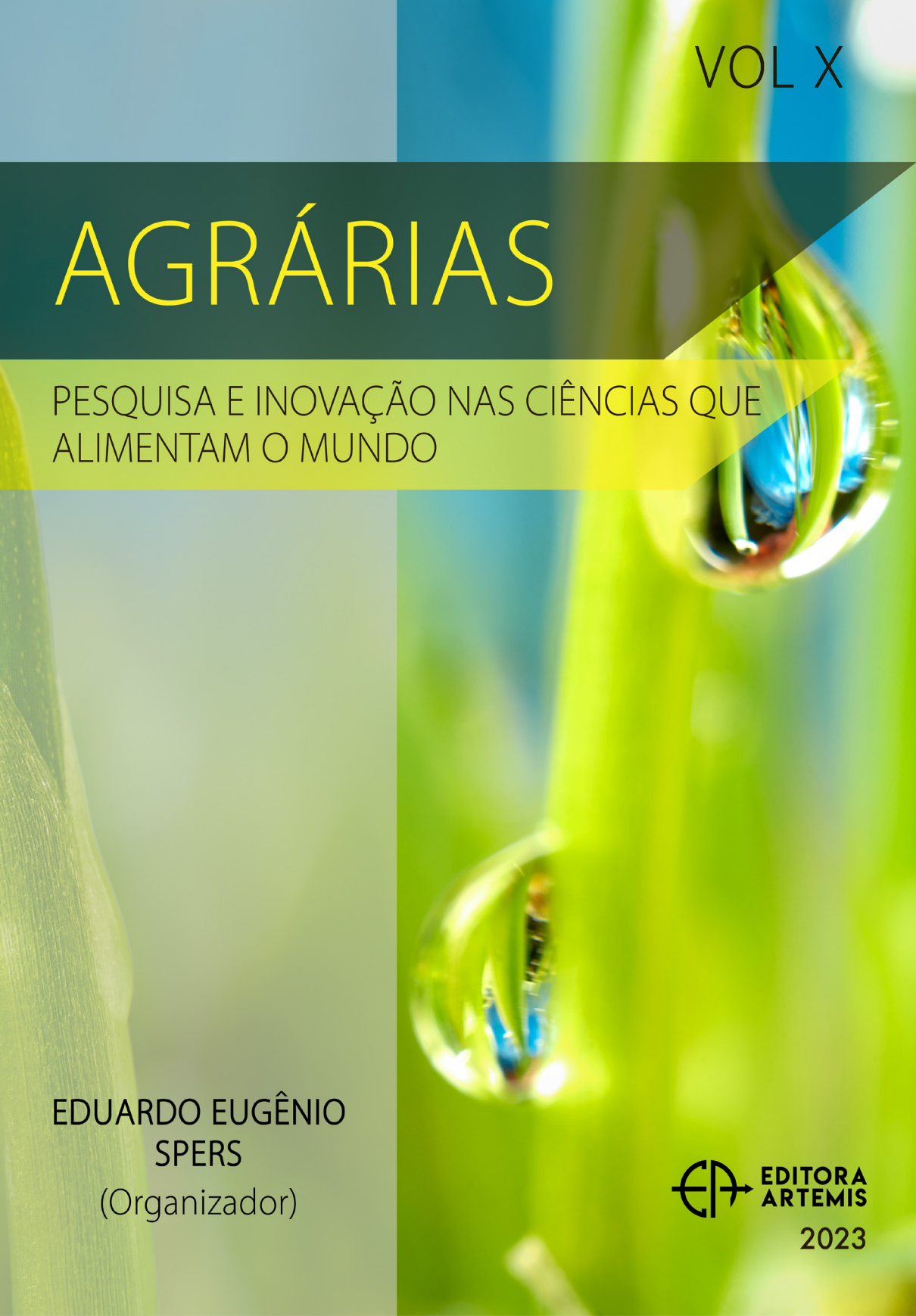
VOL X

AGRÁRIAS

PESQUISA E INOVAÇÃO NAS CIÊNCIAS QUE ALIMENTAM O MUNDO



EDUARDO EUGÊNIO SPERS
(Organizador)

EDITORA ARTEMIS
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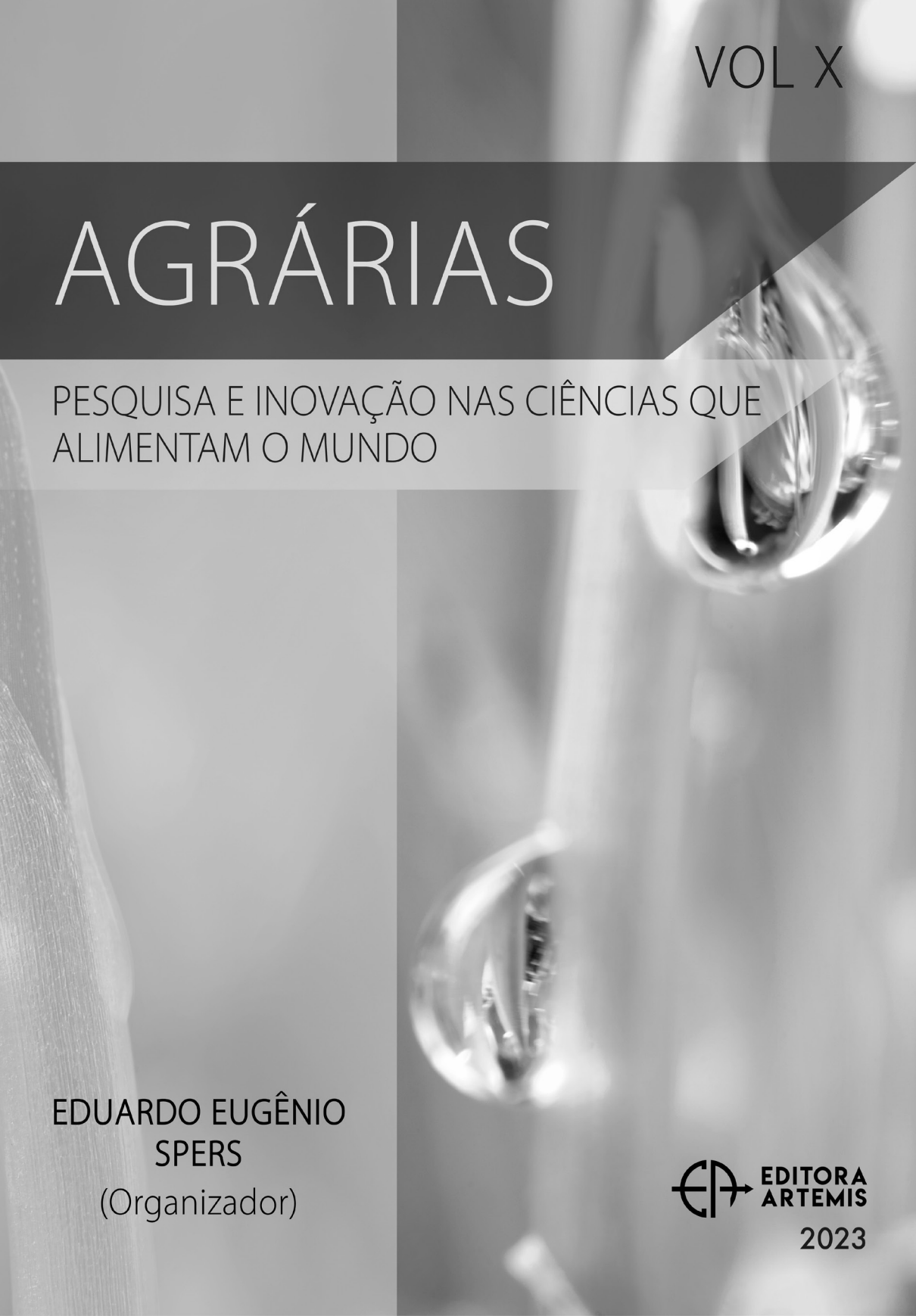

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APRESENTAÇÃO

As Ciências Agrárias são um campo de estudo multidisciplinar por excelência, e um dos mais profícuos em termos de pesquisas e aprimoramento técnico. A demanda mundial por alimentos e a crescente degradação ambiental impulsionam a busca constante por soluções sustentáveis de produção e por medidas visando à preservação e recuperação dos recursos naturais.

A obra **Agrárias: Pesquisa e Inovação nas Ciências que Alimentam o Mundo** compila pesquisas atuais e extremamente relevantes, apresentadas em linguagem científica de fácil entendimento. Na coletânea, o leitor encontrará textos que tratam dos sistemas produtivos em seus diversos aspectos, além de estudos que exploram diferentes perspectivas ou abordagens sobre a planta, o meio ambiente, o animal, o homem e a sociedade no ambiente rural.

É uma obra que fornece dados, informações e resultados de pesquisas tanto para pesquisadores e atuantes nas diversas áreas das Ciências Agrárias, como para o leitor que tenha a curiosidade de entender e expandir seus conhecimentos.

Este Volume X traz 14 trabalhos de estudiosos de diversos países, divididos em dois eixos temáticos: *Produtividade e eficiência na produção vegetal* e *Sustentabilidade e reaproveitamento produtivo.*

Desejo a todos uma ótima leitura!

Eduardo Eugênio Spers

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PRODUTIVIDADE E EFICIÊNCIA NA PRODUÇÃO VEGETAL

CAPÍTULO 13

MORPHOLOGICAL CHARACTERIZATION OF MIXED PIGS FOR SUSTAINABILITY IN THE LEGAL AMAZON, BRAZIL

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ABSTRACT: The world scenario presents a constant and growing concern with the genetic improvement of breeds to meet the demand for pork. The morphological characterization of crossbred swine breeds is of great importance within programs for the conservation of animal genetic resources, as it makes it possible to differentiate genetic groups within species, based on quantitative and qualitative variables. Given the above, the objective of the study was to evaluate the morphological characterization and zoometric indices of crossbred pigs from the municipality of São Luís, Maranhão, Brazil. The information collected related to the biometric variables, the zoometric indices, and the characteristics of the exterior, through the application of the form and measurement of measurements with the aid of a hip. The crossbred swine population studied is well adapted, about the presence of bristles, these were present in 100% of the animals. The animals presented well-developed and uniform nipples. The ultraconcavillin profile was not observed in the animals. São Luís crossbred pigs showed adequate morphometric and zootechnical characteristics for production.
KEYWORDS: Animal production. Morphometry. Adaptability. Animal protein.

CARACTERIZAÇÃO MORFOLÓGICA DO SUÍNO MESTICO PARA A SUSTENTABILIDADE NA AMAZÔNIA LEGAL, BRASIL

RESUMO: O cenário mundial apresenta uma preocupação constante e crescente

com o melhoramento genético de raças para satisfazer a demanda por carne suína e proteína animal. A caracterização morfológica de raças cruzadas de suínos é de grande importância dentro dos programas de conservação dos recursos genéticos animais, pois permite a diferenciação de grupos genéticos dentro das espécies, com base em variáveis quantitativas e qualitativas. O objetivo deste estudo foi avaliar a caracterização morfológica e os índices zoométricos de suínos mestiços do município de São Luís, Maranhão, Brasil. As informações coletadas foram relacionadas a variáveis biométricas, índices zoométricos e características exteriores, através da aplicação da forma e aferição de medidas com auxílio de um quadril. A população suína mista estudada está bem adaptada em relação à presença de porcas, que estiveram presentes em 100% dos animais. Os animais apresentavam mamilos bem desenvolvidos e uniformes. A característica do perfil ultraconcavilíneo não foi observada nos animais. Os suínos mestiços de São Luís apresentaram características morfométricas e zootécnicas adequadas para produção.
PALAVRAS-CHAVE: Produção animal. Morfometria. Adaptabilidade. Proteína animal.

1 INTRODUCTION

The world scenario of pork has a constant and growing concern with the genetic improvement of breeds to meet the demand from the consumer market, where Brazil presents itself as the fourth largest producer and aims to conquer new markets through technological advances [1]. However, the Brazilian pig breeds that stood out the most are formed from animals descended from wild boars that were introduced in Brazil during the colonial period. These animals in turn have characteristics such as rusticity, adaptability to poor conditions of administration and feeding, in addition to great resistance to diseases [2].

Currently, Brazilian pig farming is practiced mainly by small family farmers in the Northeast region, where there are still basic obstacles to the production chain, such as the low level of education of workers and the discredit of new forms of production [18]. Considering this context, morphological characterization has great importance within genetic resource conservation programs, based on quantitative and qualitative variables. Which it is necessary to analyze the morphological, productive, functional, reproductive, and behavioral aspects, in addition to the genetic aspects to obtain a complete racial characterization [3, 4].

The similarities and differences between commercial and native breeds are important to identify and evaluate their origins and possible sources of genes for the genetic improvement of herds. The size of the animal is also needed to determine diet and housing requirements [5]. The knowledge of the genetic, morphological, and productive characteristics of the breed, as well as its products, is essential for the constitution of a rational production system [6].

Few studies have yet been carried out on the diversity of naturalized pig breeds in South American countries. The lack of information makes in-depth analysis more difficult, especially due to the high expressiveness of Brazilian industrial production covering the importance of subsistence pig farming. Increasing the diversity of production on small farms through the introduction of other agricultural and livestock species can improve the small production of food and nutrition through subsistence. It is well known that small producers families generally consume a considerable part of what they produce at home, and this increases agrobiodiversity, according to research carried out in Ethiopia, on average, subsistence production is responsible for 58% of the calorie consumption of rural area families [7]. Given the above, the objective of this study was to evaluate the morphological characterization and zoometric indices of crossbred pigs in the municipality of São Luís, Maranhão, as a way to standardize the biometry of the animals studied.

2 MATERIALS AND METHODS

2.1 STUDY REGION

This work was carried out in the municipality of São Luís, capital of the state of Maranhão, Brazil. The municipality has 1,014,837 inhabitants spread over an area of 835 km². It is 2º 31 '47' 'latitude, 44º 18'10' 'longitude, and at an altitude of 24,391 m. It is limited to the Atlantic Ocean, to the North; with the Estreito dos Mosquitos, to the South; with São Marcos Bay, to the West [8]. The climate is hot and humid (tropical), with two seasons: the rainy (January to June), with an average rainfall of 1,954mm, and the drought (July to December). The temperature varies between 28ºC and 30ºC [9].

To standardize data in the Northeast region and for possible comparison with existing data. This work was based on the methodology applied by Silva Filha [10]. The study was developed through visits to breeders, information related to biometric variables was collected, zoometric indices and outdoor features, through the application of the form and measuring the measurements with the help of a hip in which the information found was used for the racial evaluation of the pigs. 55 animals from a total of 5 crossbreed breeders were evaluated.

The selection of animals to be measured in this study was defined based on criteria such as age (preferably over six months); individuals being of different mothers; coat pattern with predominance in the municipality. To obtain the biometric variables (Table 1), the zoometric indices, the racial and functional evaluation of the animals studied, as well as for the characterization of the animals' exterior [10,11].

Table 1. Measurements made to animals in studies and their correspondence in letters.

Biometric variable	Measurement zone	Measuring instrument
Height to Withers HW	Distance measured from the ground to the highest point of the withers	Hypometer
Height to dorsum HD	Distance measured from the ground to the highest point on the dorsum	Hypometer
Height to rump HR	Vertical distance from the ground to the point where the lumbar region joins the rump	Hypometer
Height to tail insertion HTI	Vertical distance between the ground and the base of the tail implant	Hypometer
Hight to Leg HL	Vertical distance between the ground and the end of the rump	Hypometer
Head length HL	Distance from the base of the occipital to the coccygeal vertebrae	Measuring tape
Body length BL	Distance measured from the outer occipital protuberance to the tip of the snout	Measuring tape
Snout lenght SL	Distance measured from the fronto-nasal suture to the tip of the snout	Hypometer
Rump lenght RL	Distance measured from the external iliac tuberosity (hip tip) to the buttock tip	Hypometer
Ear lenght EL	Distance measured between the central point of the ear base and the ear apex	Measuring tape
Leg lenght LL	Distance measured from the termination of the buttock region to the tip of conversion	Measuring tape
Neck length NL	Distance measured from the end of the ear base to the beginning of the palette	Measuring tape
Inter-orbital distance ID	Measured distance between both frontal apophyses	Hypometer
Head width HW	Distance measured between both temporal apophyses	Hypometer
Snout width SW	Distance measured between the base of both canines	Hypometer
Rump width RW	Measured distance between both external iliac tuberosity	Hypometer
Ear width EW	Distance measured between both edges of the ear	Measuring tape
Abdominal Perimeter AP	Surrounding the body in the lumbar region	Measuring tape
Cannon Perimeter CP	Surrounding the middle third of the metacarpal	Measuring tape
Thoracic perimeter TP	Surrounding the body in the thoracic region	Measuring tape

For the calculation of the zoometric indices, where three indices (cephalic, facial, and pelvic) were used, based on biometric measurements. Such calculations are often used as indicators of racial diagnosis [10, 11], using the following formulas:

1) Cephalic Index (CI): (Head Width) / (Head Length) x 100
2) Pelvic Index (PI): (Rump width) / (Rump Length) x 100
3) Cannon Load Index (CLI): (Cannon Perimeter) / (Estimated weight)

Weight was estimated using biometric measurements (transformed into meters) PT e CC [12], using the equation:

$$\text{Weight} = [(PT \times PT) \times CC] \times 69{,}3$$

For the exterior characterization, eight variables were used, these being: ear type; cephalic profile; fur; mucous; legs; foot; number of teats, and gender. The statistical design was descriptive using the means obtained between the variables.

3 RESULTS

We obtained the descriptive statistics through the biometrics performed (Table 2). Based on the biometric measurements obtained, we calculated (in %) the main zoometric indices to classify the study population (Table 3).

Table 2. Averages of the biometric measurements of the pigs analyzed in the city of São Luís- MA.

Biometric variable	Averages
HW	67,57
HD	71,80
HR	73,54
HTI	63,00
HL	123,54
HL	28,89
BL	15,32
SL	23,18
RL	19,21
EL	26,16
LL	16,55
NL	11,3
ID	12,91
HW	9,21
SW	24,00
RW	15,29
EW	118,62
AP	18,23
CP	115,11

Table 3. Main zoometric indexes (em %).

WEIGHT	CI	PI	CLI
112,72	44,68	103,53	16,17

The animal's general and qualitative data, the crossbreed swine population studied is well adapted, and the fur color was white (61.53%) for the majority of the pigs observed, which demonstrates the strong influence of the Landrace and Large White breeds in the racial composition of swine from São Luís - MA. Regarding the presence of bristles, they were present in 100% of the animals.

The type of Asian ear was predominant with 55%, followed by the Iberian type with 27% and the Celtic type with 18%. It was also observed superiority to the animals that have the ear with a rectilinear cephalic profile (50%), Superiority was also observed, followed by animals with a concavilinous cephalic profile (42%), and subconcaviline (8%). For the ultraconcavillin characteristic, no animals with this profile were found. The animals presented well-developed and uniform nipples, where most had 14 teats (Table 4).

Table 4. Number of teats per animal and percentage found.

Number of teats per animal	Percentage **(%)**
10	5,45
11	1,81
12	25,45
13	9,09
14	52,72
16	5,45

4 DISCUSSION

Native pigs are a valuable genetic reserve that can be used to recover the organoleptic properties of pork meat [13]. However, studies have shown that the Mexican Pelon Pig is evolving from traditional breeding systems to other (intensive and extensive) business systems where rusticity and adaptability are used, leaving behind the concept of animal genetic resources at risk and ensuring their presence in the immediate future [14].

The averages obtained in the present study were higher than the municipalities of Curimataú Paraibano, with the exception only of body length (BL) which demonstrated inferiority for the municipalities of Tacima (28,92), Cuité (29,16), Santa Rosa (29,77) and Remígio (32,06) [10], showing superiority on the part of São Luís-Ma crossbred pigs.

Regarding the Alcobaça spotted pigs crossbred pigs showed inferiority in all studied variables [11]. However, São Luís cross-bred pigs showed superiority over New Guinea Creole pigs [15].

Attention should be given to the cephalic index (CI) as the best indicator of the expression of racial diagnosis [10, 11]. Considering the CI of the pigs measured in São Luís, they presented a higher value (44,68%) to the native pigs of Curimataú Paraibano (37,38%), to New Guinea (42,51%), and a lower value than Alcobaça spotted (59,61%). The animals from São Luís presented CI close to the animals from New Guinea, both being classified together as dolichocephalics, that is, with an enlarged skull [15]. Skull-related characteristics are strongly influenced by race and gender, however, the environment infers low performance on these attributes.

The PI was lower than that of the pigs from Curimataú Paraibano (127,79%), superior to Alcobaça spotted (101,91%) and New Guinea (86,87%). The ICC of crossbred pigs in São Luís was higher than that of native pigs measured [10, 11, 15], demonstrating that the animals of São Luís have a greater aptitude for meat production. The weight was lower for crossbred pigs from São Luís, only, compared to Alcobaça spotted with an average of 112,72kg and 230,06kg respectively [11].

Therefore, for the external characterization, a superiority was observed in the animals that have the ear with a rectilinear cephalic profile (50%), followed by animals with a concavilinous cephalic profile (42%), and subconcaviline (8%). For the ultraconcavillin characteristic, no animals with this profile were found. The type of Asian ear was predominant with 55%, followed by the Iberian type with 27% and the Celtic type with 18%. Regarding the presence of bristles, they were present in 100% of the animals, and the fur color was white (61,53%) for most of the pigs observed, which demonstrates the strong influence of the Landrace and Large White breeds on the racial composition of the pigs of São Luís-MA [10, 11, 15].

For the variable, several teats pairs, authors [10] found in their study with native pigs that 5%, 33%, 50%, and 11.5% of the animals studied had 4, 5, 6, and 7 pairs of teats, respectively, that is, only 11.5% of the animals, animals had 14 teats. None of the animals had a number less than 12 [11]. In this study, most of them had 14 teats (52.72%), which shows that crossbred pigs have a better maternal ability compared to native breeds (Landrace e Large White). Was observed that the morphometric variability detected in pigs in Mexico's rural areas can be attributed to the differences in the management and environment systems in which they developed to the genetic diversity existing between them [16]. Swine external morphometry studies may contribute to the advancement of advanced medical research details [17].

Although studies of genetic variability such as pedigree analysis or genetic markers have not been carried out in this study, the results presented are supported. However, when investigating hairless pigs raised in Mexico, used genetic resources and observed that the morphological variables present phenotypic variation, their relations, and dimensions constitute the racial pattern and that these criteria can be considered as selection objectives [18]. The importance of technical training and support for small-scale pig producers, especially in sensitive regions like the Tocantina Region of Maranhão [19], particularly through technical visits, property assessments, and discussions, illustrates how education and extension services can contribute to enhancing animal welfare, production efficiency, and sustainability in the pig production chain [20].

5 CONCLUSION

The pigs studied in São Luís showed morphological and external characteristics with a slight similarity to foreign breeds (Landrace e Large White). It is believed that due to the genetic influence of the strains created in the intensive pig production systems and the demand of the consumer market on the São Luís - MA Island. The zoometric indices of the animals studied were similar to other studied breeds. Being able to characterize them as a productive and technically economical group.

6 INTEREST CONFLICT

The authors declare that there is no interest conflict.

7 ETHICS COMMITTEE

The research did not use animals, and it is not necessary to issue a favorable opinion by the Ethics Committee on the Use of Animals. All interviewed breeders signed the Free and Informed Consent Form –TCLE.

8 ACKNOWLEDGMENT

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