

<https://doi.org/10.48047/AFJBS.6.15.2024.9347-9356>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Evaluation of the Qualitative and Quantitative Traits of Sinirangan Native Pigs (*Sus scrofa* L. 1758)

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Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

doi: [10.48047/AFJBS.6.15.2024.9347-9356](https://doi.org/10.48047/AFJBS.6.15.2024.9347-9356)

Abstract

This study evaluates the phenotypic and morphometric characteristics of the Sinirangan native pigs (SNPs), a unique genetic resource in Eastern Samar, Philippines. The research involved 51 sexually mature SNPs from Borongan City, Maydolong, and Balangkayan, focusing on qualitative and quantitative characteristic evaluation of this valuable native pig breed. Results shows that SNPs predominantly exhibit black hair (98.04%) and erect ears (98.04%), with complete straight tail trait (100%). Morphometric analysis revealed differences in traits based on sex and geographical location, highlighting females' longer tail lengths and greater body weights compared to males. Furthermore, the study identified a borderline significant difference between the estimated body actual weights that emphasizes the importance of accurate weight assessments for marketing. These results provide essential insights for the conservation efforts and sustainable utilization of SNPs, contributing to the economic viability of rural farmers in the region.

Keywords: morphometric traits, native pigs, phenotypic traits, Sinirangan native pigs

Introduction

In the Philippines, the genetically identified native pigs are the Markaduke (Marinduque), Benguet (Benguet), Q-Black (Quezon), ISUbela (Isabela), Biskaya (Nueva Vizcaya) Yookah (Kalinga) and Sinirangan (Eastern Samar) (DOST- PCAARRD, n.d). However, among these native pigs, the Sinirangan native pig (SNP) maintained in Eastern Samar is the only phenotypically developed native pig identified in the Visayas region.

SNP is known for its hardiness, adaptability to local conditions, and resistance to common pig diseases, valued for its meat quality and flavor, and are highly prized by consumers. This native pig's small to medium-sized body and long snout are adaptations to its foraging behavior in the forest and grasslands. This local breed also provides additional income, socio-cultural, and economic activities, especially during cultural festivities and ceremonies in the region (DOST-PCAARRD, 2017). Furthermore, the low production cost of the native pig, combined with the high prices of its processed products, provides financial and sustainable livelihood opportunities for economically disadvantaged rural farmers in Region 8 (Cayubid, 2015). In Borongan City, Philippines, where SNP was first established, a huge demand for SNP lechon was reported (Dacules & Afable, 2020). However, despite the huge demand, limited supply of SNP was seen as the limiting factor in satisfying the demand.

According to the Food and Fertilizer Technology Center for the Asian and Pacific Region (2017), gaining initial understanding of the phenotypic traits of SNPs is crucial for their classification, which aids in the proper conservation and utilization of this breed. Therefore, this study aims to evaluate the qualitative characteristics of SNP, determine the morphological characteristics across different sampling areas, assess the differences between male and female SNP considering sex as a categorical independent variable, and investigate whether there is a significant difference between the actual body weight and the estimated body weight of SNPs. Understanding these aspects will provide valuable insights into their genetic makeup and adaptability to local conditions, establishing baseline information for future conservation efforts and the sustainable use of the breed.

Methodology

Ethical Consideration

The study obtained an approval from Institutional Animal Care and Use Committee (IACUC) under protocol number 2024-034-016, ensuring that the research adhered to ethical standards and complied with all relevant regulations and guidelines.

Experimental animals and study sites

The study involved 51 sexually matured Sinirangan native pigs (6 months and older) from Borongan City, Maydolong, and Balangkayan in Eastern Samar, Philippines (Figure 1). These pigs were sourced from identified farmer cooperators at the Eastern Samar State University, Sinirangan Native Pig Center, and non-cooperators raising SNPs. Pigs were selected based on the phenotypic traits that qualified them as Sinirangan native pigs as described by DOST-PCAARRD.

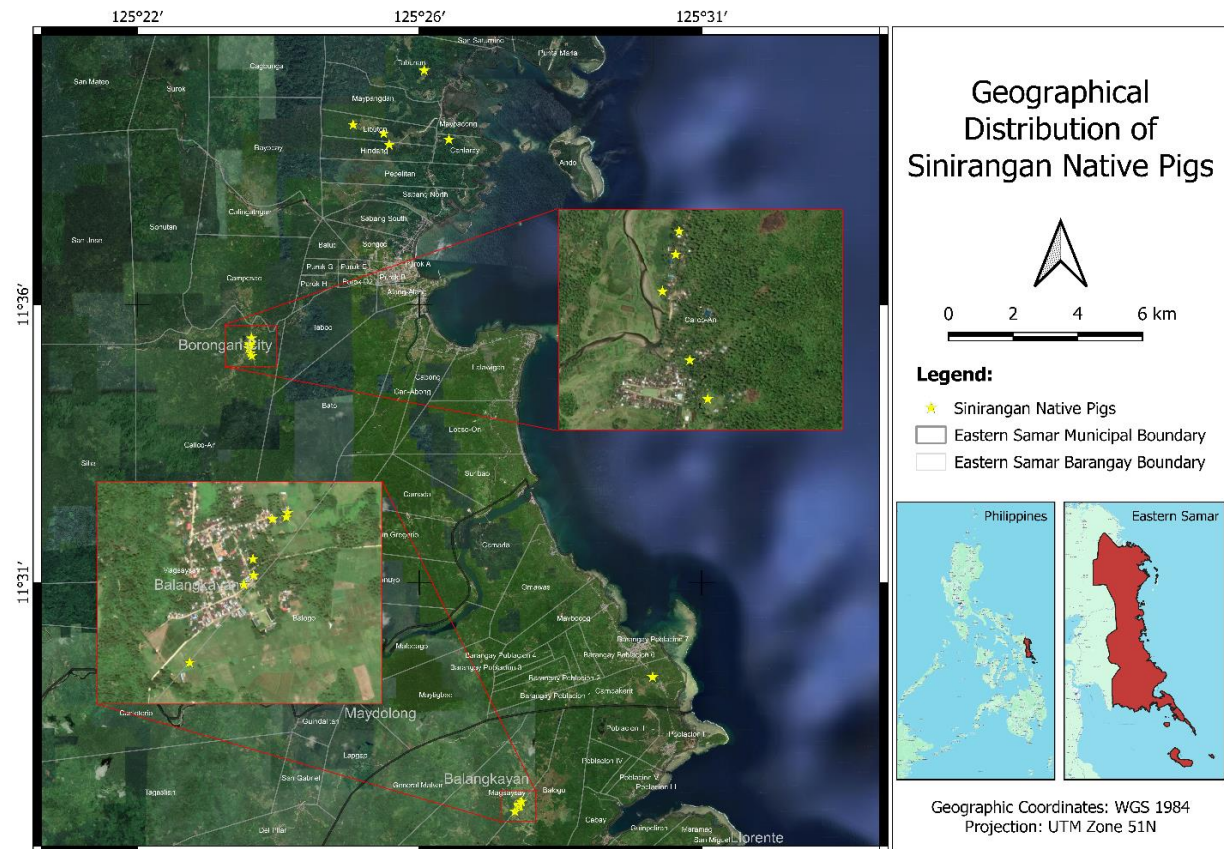


Figure 1. Geographic distribution of Sinirangan native pigs in Eastern Samar, Philippines

Data collection

The study gathered the phenotypic characteristics of the SNP according to the guidelines established by DOST-PCAARRD. Qualitative traits, such as hair color, color pattern, tail type and ear orientation, were assessed through visual observation. Morphometric traits, including tail length, teat number, body length, head length, heart girth, and body weight, were measured using standard measuring tools. Additionally, body weight was estimated for comparison using the formula developed by Javier in 2001:

$$\frac{\text{Heart girth}^2 (\text{inch}) \times \text{body length (inch)}}{400} = \frac{\text{Body Weight (pounds)}}{2.2} = \text{BW (kg)}$$

Statistical tools and analysis

Data on the qualitative and quantitative traits were analyzed using descriptive statistics. The Wilcoxon Rank-sum test was used to compare the morphological traits between male and female Sinirangan native pigs (SNPs). The Kruskal-Wallis test was employed to determine the significant differences in the morphological characteristics of SNP across different sampling areas. Furthermore, Dunn's test was conducted to identify which specific sampling areas differed statistically from one another. Additionally, a paired t-test was utilized to assess the difference between the actual and the estimated body weights of SNPs.

Results and Discussions

Qualitative traits

Hair and Coat Color

Table 1 shows notable similarity in the hair and coat color of Sinirangan native pigs (6 months and older) in Eastern Samar, Philippines. Majority of Sinirangan native pigs (SNPs) display black hair (98.04%), with only one individual showing black color with white patch on the forehead and face (1.96%) (Figure 2). This lack of variation suggests a strong genetic trait for black color within the population, aligning with the characteristics described by the DOST-PCAARRD (2019) for this local breed. Three coat colors were observed among Philippine native pigs, with black being the most common (Dischoso et. al., 2022). Black coat color is particular in most native pigs in Quezon, Marinduque and Bohol Province, Philippines (Logronio et. al., 2021; Geromo et. al., 2020).

Color Pattern

The dominant plain color pattern was observed in 50 individuals, representing 98.04% of the population, with no spotted pigs being observed. However, only one individual displayed a patchy pattern, which constitute an insignificant portion of 1.96% of the total population (Table 1). These results are consistent with various studies (Logronio et. at., 2020; Dichoso et. al., 2022; Falculan, 2021; Geromo et. al., 2020), showing that while some native pigs in the Philippines have patchy color patterns, most of them have plain color patterns. Native pigs with plain color may have an advantage in terms of genetics, which could improve their ability to adapt to their surroundings. Furthermore, selective and indiscriminate breeding might contribute to this dominating feature.

Ear Orientation

Data on ear orientation of Sinirangan native pigs (Table 1) revealed a distinct trait of erect ear orientation. Majority (98.04%) of the surveyed SNPs possessed this trait, which is consistent with the characteristic provided by DOST-PCAARRD (2019) for this breed. However, only 1 showed slight droopiness, contributing 1.96% of the total surveyed SNPs. Furthermore, no pig with a fully droopy ear was observed. The dominance of erect ear orientation is influenced by complex genetic factors that encompasses the interaction of multiple genes and environmental influence (Wei et. al., 2007). Moreover, the absence of droopy ear traits further emphasizes the stability of this characteristic within the population.

Tail Trait

The tail trait among SNPs consistently shows a complete straight tail (100%). This uniformity in tail type indicates a strong genetic predisposition favoring straight tails, which may provide advantages in locomotion (Iglesias & Camerlink, 2022) and social signaling (Valros et al., 2020) among individuals. The absence of coiled tails further emphasizes the stability of this trait within the population, suggesting that environmental factors or selective pressures significantly influence its prevalence. Further, this shows similar tail characteristic with native pigs found in Romblon (Falculan, 2021), Q-black, ISUbel, Yookah and Benguet native pig breeds (PAB-IS, n.d). However, the result is contrary in the native pigs found in Batanes, Quezon and Marinduque with curly tails (Dischoso et al., 2022).

Table 1: Number of Sinirangan native pigs in Eastern Samar, Philippines in terms hair color, color pattern, ear orientation and tail shape (N=51).

MORPHOLOGICAL TRAITS	SAMPLING SITES			TOTAL (%)
	Borongon City	Maydolong	Balangkayan	

	<i>Freq</i>	<i>freq</i>	<i>freq</i>	
HAIR COLOR				
Black	31	8	11	98.04
Black w/ white belt and white forelegs	0	0	0	0
Black w/ white patch on forehead	0	0	0	0
Black w/ white patch on forehead and face	0	0	1	1.96
Black w/ white patch on forehead and forelegs	0	0	0	0
Black w/ white patch on forehead, abdomen and feet	0	0	0	0
Black w/ white patch on forelegs	0	0	0	0
Black w/ white patch on hindlegs	0	0	0	0
Black w/ white patch on both forelegs & hindlegs	0	0	0	0
Black, white and light red	0	0	0	0
TOTAL	31	8	12	100
COLOR PATTERN				
Plain	31	8	11	98.04
Spotted	0	0	0	0
Patchy	0	0	1	1.96
TOTAL	31	8	12	100
EAR ORIENTATION				
Droopy	0	0	0	0
Slightly Droopy	1	0	0	1.96
Erect	30	8	12	98.04
TOTAL	31	8	12	100
TAIL TYPE				
Straight	31	8	12	100
Coiled	0	0	0	0
TOTAL	31	8	12	100



A

B

Figure 2. A Sinirangan sow having black with white patches in the forehead and face (A), and a group of Sinirangan native pigs, with boar in the center displaying slightly droopy ears (B).

Morphometric measurements of Sinirangan native pigs by site

The results in Table 2 presents the morphometric characteristics of Sinirangan native pigs (SNPs) across three distinct geographical sites: Balangkayan, Borongan, and Maydolong in Eastern Samar, Philippines. Tail length measurements revealed that the SNPs in Balangkayan had the longest average tail length of 8.53 cm with a low standard deviation of 0.80, showing uniformity within this population. In contrast, SNPs in Borongan demonstrate a significantly shorter average tail length of 7.81 cm accompanied by a higher standard deviation of 2.02, revealing greater variability in this trait. Head length analysis revealed that SNPs in Maydolong had the largest average head length of 10.05 cm, while SNPs in Balangkayan have the shortest with 9.65 cm. The low standard deviations across all sites provides consistent measurements within each group. Body length data further validate these findings, with SNPs in Borongan exhibiting the greatest average body length of 29.45 cm compared to Balangkayan and Maydolong with 25.02 cm and 29.19 cm respectively, though the higher standard deviation in Balangkayan suggests a broader range of sizes. Heart girth measurements align with the body length trends, as SNPs in Borongan have a heart girth of 27.23 cm, which is significantly larger than that of SNPs in Balangkayan (22.20 cm) and comparable to Maydolong (28.18 cm). The number of teats remains relatively stable across sites, with SNPs in Maydolong exhibiting a slightly higher average (12.00) compared to Balangkayan (11.42) and Borongan (11.84), and low standard deviations indicating reliability in this trait. Notably, actual body weight and estimated weight are markedly higher in SNPs in Borongan (28.35 kg and 27.60 kg, respectively) than in Balangkayan (17.42 kg and 15.72 kg) and Maydolong (31.56 kg and 31.27 kg), with substantial standard deviations in Balangkayan and Maydolong highlighting considerable variability. These findings highlight the morphological differences among SNPs across locations. Different populations exhibited unique phenotypic traits due to adaptations to their specific environments (Layos, et. al., 2021). However, further investigation is necessary to explain the genetic and ecological determinants contributing to these observed variations.

Table 2. Mean and standard deviations of morphometric measurements of Sinirangan native pigs by site

Characteristics	Site	Mean (inch)	Std. Deviation
Tail Length (inch)	Balangkayan (n=12)	8.53	0.80
	Borongan (n=31)	7.81	2.02
	Maydolong (n=8)	8.16	0.79
Head Length (inch)	Balangkayan (n=12)	9.65	0.98
	Borongan (n=31)	9.90	1.01

	Maydolong (n=8)	10.05	0.87
Body Length (inch)	Balangkayan (n=12)	25.02	5.39
	Borongon (n=31)	29.45	6.52
	Maydolong (n=8)	29.19	6.03
Heart Girth (inch)	Balangkayan (n=12)	22.20	4.49
	Borongon (n=31)	27.23	5.23
	Maydolong (n=8)	28.18	8.22
Number of Teats	Balangkayan (n=12)	11.42	1.24
	Borongon (n=31)	11.84	0.90
	Maydolong (n=8)	12.00	1.07
Actual Body Weight (kg)	Balangkayan (n=12)	17.42	10.33
	Borongon (n=31)	28.35	15.10
	Maydolong (n=8)	31.56	25.28
Estimated Weight (kg)	Balangkayan (n=12)	15.72	10.68
	Borongon (n=31)	27.60	15.71
	Maydolong (n=8)	31.27	25.51

Morphometric measurements of Sinirangan native pigs by sex

Data in Table 3 revealed morphometric measurements difference in SNPs based on sex. Female pigs exhibit a greater average tail length (8.61 inches) compared to males (7.33 inches), with the standard deviations indicating higher variability in the male population (1.87) than in females (1.23). In terms of head length, males possess a larger average (10.04 inches) than females (9.72 inches), although the standard deviation for males (0.78) suggests a more consistent measurement within this group. Body length measurements further illustrate these sex-based differences, as females average 28.96 inches, surpassing the male average of 27.64 inches, with females displaying a higher standard deviation (6.84) that indicates greater variability. Heart girth measurements show minimal difference between sexes, with females averaging 26.05 inches and males at 26.37 inches, and the lower standard deviation for males (5.09) suggests more uniformity in this trait. The number of teats is slightly higher in males (12.00) compared to females (11.57), with both sexes exhibiting low standard deviations (1.00). This finding aligns with the data presented by DOST-PCAARRD (n.d) indicating stability in this characteristic. When examining actual body weight, females significantly outweigh males, averaging 27.84 kg compared to 24.38 kg, with the higher standard deviation in females (17.68) reflecting greater variability. Estimated weights follow a similar trend, with females averaging 26.23 kg and males at 24.35 kg, again showing higher variability in females (18.50). Differences in various morphometric traits between male and female SNPs reinforce the idea that these differences are influenced by sexual dimorphism (Falculan, 2021). However, there is a need for further investigation into the biological and environmental factors that contribute to these observed differences.

Table 3. Mean and standard deviations of morphometric measurements of Sinirangan native pigs by sex

Characteristics	Sex	Mean	Std. Deviation
Tail Length (inch)	Female (n=28)	8.61	1.23
	Male (n=23)	7.33	1.87
Head Length (inch)	Female (n=28)	9.72	1.10
	Male (n=23)	10.04	0.78
Body Length (inch)	Female (n=28)	28.96	6.84

	Male (n=23)	27.64	5.80
Heart Girth (inch)	Female (n=28)	26.05	6.66
	Male (n=23)	26.37	5.09
Number of Teats	Female (n=28)	11.57	1.00
	Male (n=23)	12.00	1.00
Actual Body Weight (kg)	Female (n=28)	27.84	17.68
	Male (n=23)	24.38	15.37
Estimated Weight (kg)	Female (n=28)	26.23	18.50
	Male (n=23)	24.35	15.77

Actual body weight and the estimated body weight of Sinirangan native pigs

A borderline significant difference ($p=0.04$) between actual body weight (26.28 kg) and estimated body weight (25.38 kg) of SNPs (Table 4). An effect size is considered moderate when it falls between 0.3-0.5 according to the rule of thumb of Cohen (1992). This means that actual and estimated body weight slightly differs with estimated body weight relatively lower than the actual body weight. Furthermore, the effect size of 0.33 reflects a moderate practical significance, indicating that the difference between actual and estimated body weights is not only statistically significant but also meaningful. Accurate weight is essential for the selling and marketing of Sinirangan native pigs. The differences between the estimated and actual bodyweights can impact directly on pricing strategies, as buyers often base their purchasing decisions on weight estimates on farms. Underestimating body weight may lead to lower selling prices and reduced profit margins, while overestimating could result in potential buyer dissatisfaction if the actual weight is less than expected (Rodrigues da Costa, et. al., 2021). Furthermore, the accurate weight assessment is important in ensuring compliance with market standards and regulations, that influence marketability and consumer trust (Marshall, et. al., 2023). Hence, these findings highlight the need for reliable weighing methods to optimize selling practices and enhance the economic viability of raising SNPs.

Table 4. Difference between actual body weight and the estimated body weight of Sinirangan native pigs

	Mean	SE	Test statistic*	p-value	Effect size
Actual Body Weight (kg)	26.28	2.33	2.05	0.04	0.33
Estimated Weight (kg)	25.38	2.41			

*Large-sample approximation of the Wilcoxon signed rank test

Conclusion

It is concluded that there is a strong genetic predisposition for specific traits among SNPs, notably the predominance of black hair color (98.04%) and a uniformity in coat patterns, ear orientation, and tail trait, with all observed SNPs exhibiting straight tails. Morphometric analysis provides significant differences among SNPs in various locations, with SNPs in Borongan exhibiting larger body measurements and weights compared to those in Balangkayan and Maydolong. Moreover, female SNPs has greater tail lengths and body lengths, while males possessed larger head lengths. Furthermore, a borderline significant difference was noted between the actual and estimated body weights of SNPs. The moderate effect size indicates that while the difference is statistically significant, it also holds practical implications for the economic viability of raising Sinirangan native pigs.

Acknowledgment

The authors would like to extend heartfelt appreciation to the Sinirangan native pig raisers for their invaluable support and cooperation throughout this research. Sincere appreciation is also extended to Eastern Samar State University (ESSU) for providing resources and guidance that enabled the conduct of this research effectively.

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