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Phenotypic Characterization of Philippine Native Pigs (*Sus scrofa domesticus* L.) in Selected Municipalities of Isabela Province

Jojo D. Caulan [1,] and Karina Marie G. Nicolas[2]*

[1]College of Veterinary Medicine, Cagayan State University, Carig Sur, Tuguegarao City
[2]School of Veterinary Medicine, Isabela State University, San Fabian, Echague, Isabela

*Corresponding Author: cauilanjojod@gmail.com (Jojo Cauilan)

ORCID Numbers: [a] 0000-0002-1234-5678

†These authors contributed equally.

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Abstract

Background: Philippine native pigs (Sus scrofa domesticus L.) are valuable animal genetic resources because of their adaptability to low input farming systems, yet localized phenotypic data in Isabela Province remain limited. **Methods**: A survey of 209 native pigs (boars, sows, and gilts) was carried out in six municipalities in Isabela Province. Pigs were randomly selected from farms. Researchers recorded physical traits like coat color, ear type, and tail type, as well as body measurements such as body length and heart girth, following FAO guidelines. **Results**: Most native pigs showed uniform phenotypic traits, including absence of prominent tusks, straight snout and head profiles, erect forward-facing ears, black coat color, straight hair, smooth skin, and straight backlines. Curly tails were more frequent in males, while females more commonly had straight tails. Morphometric measurements were relatively consistent, with females generally exhibiting larger body dimensions than males. **Conclusion**: The phenotypic characteristics observed are consistent with other Philippine native pig populations and recognized strains reported by DOST-PCAARRD such as ISUbela®, Bohol and Romblon. These findings provide baseline data for conservation, breeding improvement, and sustainable utilization of native pig genetic resources in Isabela Province.

Keywords

Native Philippine native pigs, Phenotype, Morphometry, Province of Isabela

1. Introduction

The Philippine native pig (*Sus scrofa domesticus L.*) is an endemic animal genetic resource commonly grown under the small-hold farming system. The continued existence of native pig populations is anchored on their economic, social, religious, and/or cultural significance in specific segments of the Philippine society. Relative attributes favorable in the keeping of native pigs are commonly based on their adaptation to the local environment (which includes climate, feed resources, disease challenges, and management) that keeps the cost of maintaining them very low [1,2]. Similar observations were also documented in Mexico [3] and in Papua New Guinea [4].

The contributions and roles of the Philippine native pig are immensely valuable under the low-input production system. The international

community, through the Food and Agriculture Organization (FAO) of the United Nations, recognized the utility of the native, indigenous, or endemic animal genetic resources for food and other functions related to agriculture [5]. The Philippine native pig meat is viewed as a healthier alternative to commercial pig meat in the market and as a valuable source of income for producers, especially with the growing demand for organic products today. The decreasing ratio of indigenous breeds to exotic breeds in the country due to commercialization, its anticipated economic worth, and potential have led researchers to improve their production performance and product quality without reducing genetic diversity. Also, the production and marketing components of the local pig business are being improved to ensure its availability in the market. Recent advancements in native pig farming resulted in genetically modified native pigs that have higher levels of morphological homogeneity, larger litter sizes, and faster growth rates [1].

To date, there are currently seven genetic subgroups of native pigs being produced, each of which is called after the province in which it originated, such as Kalinga, Benguet, Isabela, Nueva Vizcaya, the *Bundok* Peninsula of Quezon province, Marinduque, and Eastern Samar. Certain distinctions seen in these native pig groups include the hues and patterns of the coat, the conformation of the body, the size of the adult body, behavior, and genetic distances. Moreover, the research and development efforts made on organized breeding and selection of native pigs have led to increased litter size, sped up growth, and pigs with highly uniform physical traits [6].

The African Swine Fever (ASF) outbreak reported in the Philippines in 2019 caused significant impact in both commercial and native pig populations. Thereby emphasizing the need to document and conserve indigenous pig resources.

Native animals depend on their unique phenotypic and genetic characteristics to adapt to their environment and the conditions of farming. Hence, documentation and establishment of accurate information on indigenous pig genetic resources, particularly on their phenotypic characteristics will help in the improvement, conservation, and sustainable use of the native pig population. In Isabela Province, provincial data on native pig populations remain limited.

This study aimed to characterize the qualitative phenotypic traits of native pigs in selected municipalities of Isabela, determine their quantitative morphometric measurements, and compare these traits with those of other native pig populations in the Philippines.

2. Materials and Methods

2.1 Study Area

The study was conducted from six municipalities from different districts of Isabela Province: Angadanan, Benito Soliven, City of Ilagan, Jones, Roxas, and San Guillermo.

2.2 Sampling Design and Animal Selection

Municipalities from six legislative districts were purposively selected based on the presence of native pig populations. Within each municipality, individual pigs (n=209) were randomly selected from participating farms. This sample size has a 5% margin of error at a 95% confidence level. The native status of pigs was determined based on farmer identification, observable phenotypic traits consistent with Philippine native pigs, and the absence of visible signs of crossbreeding with commercial breeds.

2.3 Data Collection

Qualitative traits such as sex, dominant color (black, dark red, light red, Qualitative traits such as sex, presence or absence of tusk in boars, shape of snout (curve or straight), shaped of the head (concave, convex or straight), ear type (droopy, semi-lop or erect), ear orientation (forward, backward or upward), dominant color (black, dark red, light red, spotted), color pattern (plain, patchy or spotted), hair type (curly or straight), hair distribution (dense or sparse), skin type (smooth or wrinkled), backline conformation (straight or swayed back), tail type (straight or curly), and temperament (docile: no avoidance or aggression), aggressive: charging, biting attempts or afraid: retreat, persistent avoidance) were visually observed and noted.

Quantitative traits were measured in cm using a tape measure following the guidelines of FAO [7] on phenotypic characterization of animal genetic resources including age at characterization. These traits include hair length

(measured by plucking three strands from different areas of the withers and computing the average value), snout length was measured at the level of the base of the medial canthus of the eye to the tip of the nose or rostrum, head length was measured from the base of the ear to the tip of the nose , width of the forehead was measured at the level between the base of the left and right ear, ear length was measured from the base to the tip, body length was measured on the mid lateral side of the animal from the cranial border of the scapula to the caudal tip of the rump, the heart girth was measured by taking the circumference of the thorax at the level immediately caudal to the elbow joint, the midbody girth was measured by taking the circumference of the abdomen at the level of the umbilicus, the rump girth was measured by taking the circumference of the abdomen at the area cranial to the stifle joint, height at wither was measured from the tip of the shoulder to distal end of the hoof, height at rump was measured from the tip of the hip joint to distal end of the hoof, circumference of the hock was measured, the tail length was measured from the base to the tip of the fully stretched tail, and teat number both from left and right was obtained.

2.4 Ethical Clearance

Before the conduct of the study, the data collection protocol was submitted for review to the Institutional Animal Care and Use Committee of Isabela State University for Approval. This was approved through the ISU-IACUC permit with protocol number: 07-2023.

2.5 Data Analysis

Data on the questionnaire were compiled in a spreadsheet program (Microsoft Excel©). Descriptive analysis was conducted for the phenotypic characteristics of native pigs using mean, frequency distributions and percentage. Standard Error of Means (SEM) was used to calculate and analyze the quantitative characteristics of the native pig.

3. Results

3.1 Profile of Native Pigs at Characterization

A total of 209 native pigs were surveyed across six municipalities of Isabela Province. Table 1 presents the general profile of native pigs at characterization in this study. Out of the 209 native pigs surveyed, 79.90% (167/209) were females (gilts and sows), while 20.10% (42/209) were males, including 13.88% intact boars and 6.22% castrated males. The computed boar-to-gilt/sow ratio in the population was 1:5.76.

In terms of age distribution, most of the native pigs surveyed were 6 to 8 months old (42.58%), followed by those aged 1 to 2 years (38.76%), 2.1–

Table 1. Profiles of native pigs of Isabela Province at characterization.

PROFILE AT CHARACTERIZATION	NATIVE PIGS FROM SIX MUNICIPALITIES OF ISABELA (n = 209)	
	f	%
Sex		
Male	**42**	**20.10**
Castrate	13	6.22
Intact	29	13.88
Female	**167**	**79.90**
Sow	85	40.67
Gilt	82	39.23
Age		
6-8 months	89	42.58
9-11 months	13	6.22
1 - 2 years	81	38.76
2.1-3.0 years	17	8.13
3.1 - 5.0 years	9	4.31
Weight		
10-20 kgs	40	19.14
21-30 kgs	43	20.57
31-40 kgs	40	19.14
41-50 kgs	23	11.00
51-60 kgs	63	30.14
Behavior		
Docile	145	69.38
Aggressive	23	11.00
Afraid	41	19.62

3.0 years (8.13%), 9–11 months (6.22%), and 3.1–5.0 years (4.31%) groups.

Regarding live weight, most pigs were within the 51–60 kg range (30.14%), followed by 21–30 kg (20.57%), while 19.14% were recorded in the 10–20 kg and 31–40 kg ranges, and 11.00% within 41–50 kg range.

Behavioral assessment showed that the majority of pigs were docile (69.38%), while 19.62% were classified as afraid and 11.00% as aggressive.

3.2 Qualitative Phenotypic Characteristics

The qualitative traits of native pigs in Isabela Province showed generally uniform characteristics across sex groups as shown in Table 2.

Table 2. Distribution of Isabela native pigs according to their qualitative phenotypic characteristics.

QUALITATIVE TRAITS	NATIVE PIGS FROM SIX MUNICIPALITIES OF ISABELA					
	Male n = 42		Sow n = 85		Gilts n = 82	
	f	%	f	%	f	%
Tusk						
Present	17	40.48	3	3.53	0	0
Absent	25	59.52	82	96.47	82	100.00
Snout						
Curve	7	16.67	20	23.53	6	7.32
Straight	35	83.33	65	76.47	76	92.68
Long and Thin	21	50.00	57	67.06	42	51.22
Short and Cylindrical	21	50.00	28	32.94	40	48.78
Head Profile						
Concave	9	21.43	17	20.00	8	9.76
Convex	1	2.38	1	1.18	2	2.44
Straight	32	76.19	67	78.82	72	87.80
Ear Type						
Droopy	7	16.67	24	28.24	9	10.98
Semi-loop	17	40.48	27	31.76	35	42.68
Erect	18	42.86	34	40.00	38	46.34
Ear Orientation						
Forward	26	61.90	59	69.41	46	56.10
Upward	10	23.81	14	16.47	25	30.49
Backward	6	14.29	12	14.12	11	13.41
Color (Dominant)						
Black	38	90.48	73	85.88	73	89.02
Dark red	0	0	1	1.18	3	3.66
Light red	2	4.76	1	1.18	1	1.22
White	2	4.76	10	11.76	5	6.10
Coat Color Pattern						
Plain	35	83.33	70	82.35	70	85.37
Patchy	4	9.52	11	12.94	8	9.76
Spotted	3	7.14	4	4.71	4	4.88
Hair Type						
Curly	6	14.29	7	8.24	6	7.32
Straight	36	85.71	76	89.41	76	92.68
Hair Distribution						
Dense	21	50.00	39	45.88	35	42.68
Sparse	21	50.00	45	52.94	47	57.32
Skin						
Smooth	39	92.86	78	91.76	82	100.00
Wrinkled	3	7.14	7	8.24		
Backline Conformation						
Straight	28	66.67	58	68.24	56	68.29
Swaybacked	14	33.33	27	31.76	26	31.71
Tail						
Straight	15	35.71	50	58.82	34	41.46
Curly	27	64.29	35	41.18	48	58.54

Tusks were absent in all gilts (100%) and were present only in a small proportion of boars (40.48%) and sows (3.53%), indicating that most pigs lacked tusks.

Snout profile was predominantly straight, observed in 83.33% of males, 76.47% of sows, and 92.68% of gilts, with fewer animals showing curved snouts. Snout shapes varied between long and thin and short and cylindrical, with males equally distributed (50% each), while sows more commonly exhibited long and thin snouts (67.06%).

Head profile was mainly straight across all groups (76.19% in males, 78.82% in sows, and 87.80% in gilts), with concave and convex types occurring less frequently. Snout and head profile is shown in Figure 1.

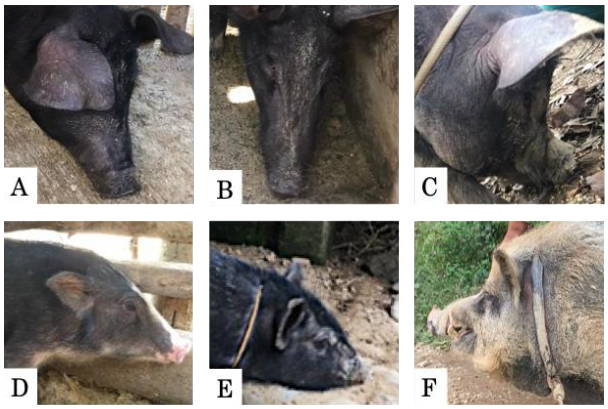

Figure 1. Snout and head profiles of Philippine native pigs from six municipalities of Isabela. A.) Straight, short and cylindrical snout; B.) Straight, long and thin snout; C.) Curve, short and cylindrical snout; D) Straight head profile; E) Concave head profile; and F) Convex head profile with tusks.

Erect ears were the most common ear type in males (42.86%) and gilts (46.34%), while sows showed a more varied distribution of erect (40.00%), semi-loop (31.76%), and droopy ears (28.24%). Semi-loop ears were also common in males (40.48%) and gilts (42.68%).

Ear orientation was primarily forward-facing across all groups (61.90% of males, 69.41% of sows, and 56.10% of gilts). Backward and upward orientations occurred in lower frequencies. Figure 2 shows the different types and orientation of the Isabela native pig ears.

Black was the dominant coat color (90.48% of males, 85.88% of sows, and 89.02% of gilts) with a

Figure 2. Type and orientation of ears of Philippine native pigs from six selected municipalities of Isabela. A) Droopy and forward orienting ears; B) Semi-lop and forward orienting ears, C) Erect with upward orienting ears, and D) Erect and backwards orienting ears.

predominantly plain coat pattern (83.33% of males, 82.35% of sows, and 85.37% of gilts), while other colors and patterns occur less frequently. Different color patterns of native pig in Isabela is shown in Figure 3.

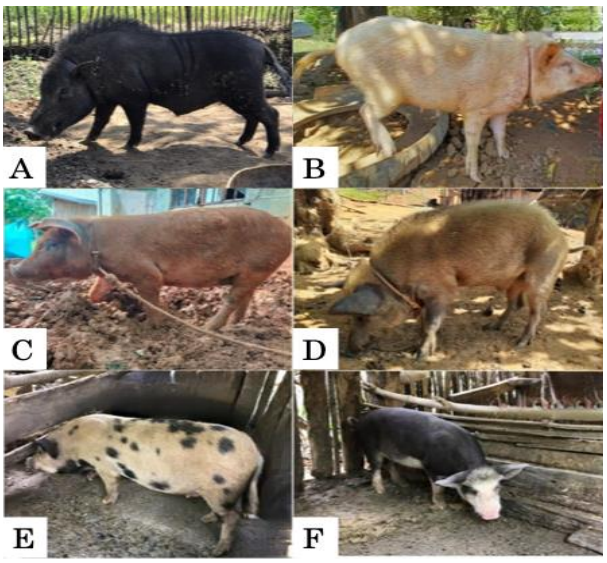

Figure 3. Different color patterns of the Philippine native pigs from different municipalities. A) Plain black color; B) Plain white color; C) Plain dark red; D) Plain light red color; E) Roan color with spots; and F) Black with patches of white in the abdomen, limbs, and face.

Hair type was mostly straight (5.71% in males, 89.41% in sows, and 92.68% in gilts), and hair density was variable, with males evenly distributed and females showing slightly higher proportions of sparse hair (52.94% of sows and 57.32% of gilts).

Skin type was predominantly smooth, observed in 92.86% of males, 91.76% of sows, and 100.00% of gilts with only a few cases of wrinkled skin. Different skin types are shown in Figure 4A,B.

Figure 4. Skin type, backline conformation, hair type, and tail type of Philippine native pigs from six selected municipalities of Isabela. A) Smooth type skin; B) Wrinkled type skin; C) Straight backline; D) Swaybacked; E) Curly, dense hair distribution and straight tail; and F) Straight, sparse hair distribution and curly tail.

Most pigs exhibited a straight backline, observed in 66.67% of males, 68.24% of sows, and 68.29% of gilts. Swayback conformation was present in a smaller proportion across all groups. Backline conformations are presented in Figure 4C,D.

Tail type varied between straight and curly forms. Curly tails were more common in males (64.29%) and gilts (58.54%), while sows showed a higher proportion of straight tails (58.82%). Tail types are presented in Figure 4E,F.

3.3 Quantitative Phenotypic Characteristics

The comparative mean (± SEM) measurements of selected quantitative phenotypic traits of Philippine native pigs in Isabela Province are presented in Table 3.

Male pigs exhibited a mean snout length of 14.53 ± 0.47 cm, which was lower than that of sows (15.48 ± 0.32 cm) but higher than gilts (12.37 ± 0.29 cm). A similar pattern was observed for head length, with males recording 28.29 ± 0.83 cm, sows 30.12 ± 0.51 cm, and gilts 24.83 ± 0.40 cm. Forehead width averaged 12.31 ± 0.29 cm in males, 12.81 ± 0.33 cm in sows, and 11.49 ± 0.32 cm in gilts.

Mean ear length (left) was recorded at 16.52 ± 1.25 cm in males, 17.63 ± 1.58 cm in sows, and 14.46 ± 1.27 cm in gilts. Body length was highest in sows (80.68 ± 2.24 cm), followed by males (73.18 ± 1.65 cm), and lowest in gilts (65.11 ± 2.50 cm).

Heart girth measurements followed the same trend, with sows having the highest mean (94.69 ±

Table 3. Comparative mean (± SEM) measurements of selected quantitative phenotypic traits (cm) in native pigs across male, sow, and gilt groups.

QUANTITATIVE TRAITS (CM)	NATIVE PIGS FROM SIX MUNICIPALITIES OF ISABELA		
	Male (n = 42)	Sow (n = 85)	Gilts (n = 82)
Snout Length	14.53 ±0.47	15.48 ±0.32	12.37 ±0.29
Head Length	28.29 ±0.83	30.12 ±0.51	24.83 ±0.40
Forehead Width	12.31 ±0.29	12.81 ±0.33	11.49 ±0.32
Ear Length (Lt)	16.52 ±1.25	17.63 ±1.58	14.46 ±1.27
Body Length	73.18 ±1.65	80.68 ±2.24	65.11 ±2.50
Heart Girth	87.10 ±2.20	94.69 ±1.49	74.86 ±2.89
Mid-Body Girth	96.45 ±2.41	109.00 ±1.98	87.92 ±2.64
Rump Girth	91.51 ±1.96	104.55 ±2.99	79.67 ±3.20
Pelvic Width	17.50 ±0.53	19.94 ±1.27	15.36 ±0.48
Tail Length	25.05 ±0.89	25.93 ±0.90	21.38 ±1.24
Height at Wither	54.31 ±1.54	56.15 ±1.49	48.12 ±1.98
Height at Rump	60.78 ±1.76	63.89 ±1.54	53.30 ±2.38
Hock Circumference	14.69 ±0.24	14.99 ±0.28	12.99 ±0.46
Hair Length	5.29 ±0.40	6.22 ±0.29	4.30 ±0.30
Teat Pairs	5.65 ±0.13	5.97 ±0.19	5.89 ±0.05

1.49 cm), followed by males (87.10 ± 2.20 cm), and gilts (74.86 ± 2.89 cm). Mid-body girth was also highest in sows (109.00 ± 1.98 cm), compared to males (96.45 ± 2.41 cm) and gilts (87.92 ± 2.64 cm). Similarly, rump girth measurements were greater in sows (104.55 ± 2.99 cm) than in males (91.51 ± 1.96 cm) and gilts (79.67 ± 3.20 cm).

Pelvic width measurements were 17.50 ± 0.53 cm in males, 19.94 ± 1.27 cm in sows, and 15.36 ± 0.48 cm in gilts. Tail length averaged 25.05 ± 0.89 cm in males, 25.93 ± 0.90 cm in sows, and 21.38 ± 1.24 cm in gilts.

Height at withers was recorded at 54.31 ± 1.54 cm in males, 56.15 ± 1.49 cm in sows, and 48.12 ± 1.98 cm in gilts. Height at rump measurements were 60.78 ± 1.76 cm in males, 63.89 ± 1.54 cm in sows, and 53.30 ± 2.38 cm in gilts.

Hock circumference averaged 14.69 ± 0.24 cm in males, 14.99 ± 0.28 cm in sows, and 12.99 ± 0.46 cm in gilts. Hair length was measured at 5.29 ± 0.40 cm in males, 6.22 ± 0.29 cm in sows, and 4.30 ± 0.30 cm in gilts.

The average number of teat pairs was 5.65 ± 0.13 in males, 5.97 ± 0.19 in sows, and 5.89 ± 0.05 in gilts.

4. Discussion

This study provides a phenotypic characterization of native pigs in Isabela Province, showing both uniformity and variation in traits.

The population structure observed was predominantly female, with a boar-to-gilt/sow ratio of 1:5.76, higher than the recommended 1:17 for natural mating. [8] Although this may reduce breeding efficiency, the large number of females indicates a strong breeding base that may support population continuity in the province.

The age distribution of native pigs was primarily within the 6–8 months and 1–2 years age groups, reflecting typical backyard farming management practices. Studies indicates that gilts are bred between 8 and 12 months of age. [9,10] But studies indicate that native pigs reach sexual maturity as early as 4 – 5 months [11] and 7.11 months [12]. These findings suggest that early maturity is characteristic of Philippine native pig populations.

The distribution of live weights recorded were consistent with reports describing smaller body size in native pigs, typically ranging from 40 to 60 kg at maturity or during fattening [11,13]. This indicates that the native pig population in Isabela follows similar growth patterns of Philippine native pigs.

Behavioral observations showed that most pigs in the study were docile, which is advantageous for backyard production systems. Few afraid and aggressive were also observed, likely associated with limited human interaction. Prior studies suggest that regular and positive handling can improve animal behavior [26], highlighting the importance of management practices in influencing temperament.

The observed variation in demographic, weight, and behavioral characteristics across municipalities may reflect differences in management practices and production conditions. It may also indicate the presence of localized subpopulations within the province. Such variation is consistent with findings from genetic studies of Philippine native pigs, which have shown measurable population structure and differentiation across geographic locations, including Isabela Province [21].

Qualitatively, the predominance of plain black coat color, along with traits such as straight head profile, erect or forward-oriented ears, smooth skin, and straight hair, is consistent with descriptions of Philippine native pigs from other regions, including Zamboanga Peninsula, Romblon, Batanes–Quezon–Marinduque, and Bohol [10,15,17,19]. These similarities are also consistent with documentation of provincially named native pig strains (including ISUbela®) presented in the DOST PCAARRD native pig breeds resource [6,18]. Molecular evidence further supports that Philippine native pigs are typically small, black-colored animals with considerable genetic diversity across provinces [20,21]. Black coat color is a common, genetically influenced phenotype in pigs (e.g., MC1R-related pigmentation), and native pigs are raised under tropical conditions where thermoregulation is a known physiological constraint in pigs [24,25]. The presence of minor coat color variations may reflect within - population variation and potential

introgression, which is consistent with evidence that Philippine native pigs represent multiple lineages and show population structure [20,21].

Ear morphology, particularly the dominance of erect ears, reflects a common trait among indigenous pig populations and is consistent with recognized strains such as ISUbela® [18]. This feature may indicate limited genetic dilution from commercial breeds, which typically exhibit drooping ears.

Snout and head profiles were largely straight, which is a typical morphological characteristic of majority of Philippine native pigs [15,17,19]. These features are functionally important for foraging behavior. In backyard farming system, pigs spend considerable time on foraging and retain behaviors similar to wild boars even under domestication [23]. Even in *ad libitum* feeding, rooting behavior persists, which implies that it is an innate and strongly motivated behavior rather than solely driven by hunger [22].

The predominance of smooth skin and straight hair reflects adaptation to the hot and humid climate of Isabela. Sparse to moderate hair density likely enhances thermoregulation by improving heat dissipation under tropical conditions [25].

Quantitative results indicate that native pigs in Isabela are smaller compared to commercial breeds but comparable to other native pigs in the Philippines [15,19]. The smaller body size is well-suited to low-input production systems and supports *in situ* conservation efforts [27], pigs are commonly fed locally available resources, including forage crops and agricultural by-products. [28,32] Native pigs are also recognized for adaptive traits such as tolerance to environmental stress and disease, which enhance their value for backyard farming system [27,31].

Differences in phenotypic characteristics across municipalities suggests the presence of localized variability. This may be influenced by geographic isolation, management practices, and environmental conditions, with limited animal movement contributing to phenotypic differentiation [21].

These findings emphasize the importance of conserving native pig genetic resources to maintain biodiversity and support resilient livestock systems [29]. Breeding programs should improve productivity while preserving adaptive traits [30]. Future studies should include molecular analyses to better understand genetic diversity and population structure, thereby enhancing conservation and improvement strategies.

5. Conclusion

In conclusion, majority of the male native pigs surveyed from the six selected municipalities of Isabela have predominant phenotypic characteristics of having no prominent tusks, straight snout and head profile, erect and forward orienting ears, plain black color, straight hair, smooth skin, straight backline and curly tail, while female native pigs have predominant phenotypic characteristics of having also no prominent tusk, straight, long and thin snout profiles, straight head profiles, erect and forward orienting ears, black plain color, with straight hair, smooth skin, straight backline and straight tail profile for sows and curly tail profile for mature male native pigs and native gilts. Predominant quantitative traits of native pigs from selected municipalities were almost similar to the native pig strains reported by DOST-PCAARRD, and also native pigs from Bohol and Romblon.

Author Contributions

Conceptualization, J.D.C., K.M.G.N.; Methodology, J.D.C.; Investigation, J.D.C.; Writing – Original Draft, J.D.C.; Writing – Review & Editing, J.D.C., K.M.G.N; Funding Acquisition, J.D.C.; Resources, J.D.C.; Supervision, J.D.C., K.M.G.N

Ethics Approval and Consent to Participate

The Institutional Animal Care and Use Committee permit was secured prior to the conduct of the study with Protocol Number: 07-2023 of the ISU-IACUC.

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Conflict of Interest

The authors declare no conflict of interest.

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