



Phenotypic characterization of Paraoakan chicken (*Gallus gallus domesticus* Linnaeus, 1758) in selected municipalities of Palawan, Philippines

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ABSTRACT

This study assessed the Paraoakan chicken *Gallus gallus domesticus* (Linnaeus, 1758) characteristics such as the birds' morphology, productivity, adaptability, and raising challenges through survey interviews of 96 raisers from seven municipalities of Palawan. Primarily raised for personal consumption, these chickens exhibit normal and plain feather morphology with varied plumage colors and pea combs. Paraoakans predominantly had white skin, yellow shanks, red earlobes, and pea-sized combs. The roosters, on the average, weighed 2.3 kg, measured 40.83 cm in body length, and had a chest circumference of 35.35 cm, with shanks and wingspan measuring 9.98 cm and 43.90 cm, respectively. The hens are generally smaller averaging 1.67 kg weight, 36.90 cm body length, 31.63 cm chest circumference, 8.44 cm shank length, and 43.10 cm wingspan. Paraoakans lay small-sized, white, and brown-colored eggs. Raisers reported that these chickens had a hatchability rate of 86.57%. With a range of 20 to 50 eggs per year, egg production of Paraoakan peaks at 6-8 months. Paraoakan plays a vital role in local food security and rural livelihoods in Palawan, being considered the biggest native breed in the country. At a slaughter weight of 1.0 to 1.5 kg and a 0.5 kg average carcass yield, it is regarded as having a good dressing percentage of 50% to 66%. However, despite being regarded as disease-tolerant, common issues like coryza, fowlpox, and lice infestation are usual issues faced by raisers. This study provides baseline data for sustainable and productive breeding and conservation programs. A comprehensive breeding and training program can be started for growers to establish best practices, enhance disease management, and improve flock health and performance.

Keywords: livestock, native chicken, Palawan chicken, phenotypic characterization

INTRODUCTION

The Philippines' native chicken is an important livestock resource. The DOST-PCAARRD (2016) reported that it generates extra income for

families and offers social, nutritional, and cultural benefits. The village poultry is an add-on to primary livelihoods, thereby providing additional income while also affording high-quality protein that is otherwise rare to poor families (FAO 2010).



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According to Dolberg (2003), poor families in India and Bangladesh trade poultry products among themselves, alongside vegetables and cereals, thereby reducing the consumption of animal-origin foods like meat, fish, and milk and enhancing food security.

Prominent for its positive features like its muscular frame, overall vigor, and hardiness to pests and diseases (Baguio 2019; Slow Food Foundation for Biodiversity 2023), Paraoakan *Gallus gallus domesticus* (Linnaeus, 1758) is an indigenous Philippine chicken commonly raised in Palawan. As the largest among native poultry breeds in the Philippines, they are characterized by long legs, an elongated neck, and a more extensive body and head than other local breeds (Slow Food Foundation for Biodiversity 2023). Baguio (2019) supported this view by stating that of the several strains of native chickens in the Philippines, like the “Zampen” of Zamboanga and “Darag” of Bicol, Paraoakan is the biggest of them all. Female Paraoakan chickens are typically black, while males have reddish feathers. Roosters can reach a weight of 3-5 kg, typically attaining 1.2-1.3 kg within 6 months after hatching (Chicken Breed Guide 2021). Large bones, broad shoulders, and an upright stance characterize them. The eggs are usually tinted white to pale brown.

However, these characteristics and the overall population of local Paraoakan chickens may decline due to crossbreeding with non-native chickens primarily used for cockfighting (FAO 2012). To address this, the Department of Science and Technology (DOST), through the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), is conducting a breeding program to establish sustainable breeding populations of Paraoakan native chickens in Palawan. This study characterizes Paraoakan chickens based on morphological traits and productivity that are important information to come up with conservation strategies.

The baseline survey of the breeding program explored Paraoakan chicken growers' views on the bird's feather morphology and plumage characteristics, morphological traits, productivity traits, adaptation, and resilience or the challenges growers face in raising Paraoakan. By keeping a record of the existing phenotypic characteristics of Paraoakan chicken in the province, this study provides a reference point to monitor future changes of these characteristics and evaluate the outcomes of the breeding program over time. This information is necessary to set breeding goals, select traits to improve the breed, ensure the breeding program aligns with local values, and increase breeder participation and support. Moreover, it documents the genotype variations necessary for maintaining genetic diversity and sustainability of the breed over time.

METHODS

Study Site and Respondents

The respondents in the study were 96 Paraoakan chicken raisers of seven municipalities of Palawan Province, the majority of whom are male aged between 31 and 40. They came from Puerto Princesa, the capital city, Roxas in the north, and Sofronio Española, Quezon, Rizal, Brooke's Point, and Bataraza in the south. Most raisers grew Paraoakan chicken for family use or consumption.

Research Instrument

A structured interview and a questionnaire were used as the study's instruments. Using a checklist from the Food and Agriculture Organization (FAO 2012) as a guide, the questionnaire was developed, comprising three parts. One is the phenotypic characterization, which includes feather morphology, plumage color, plumage pattern, skin and shank color, ear lobe color, comb type, body measurements, adaptation, and the chicken's resilience to pests, diseases, and climatic conditions. The second part encompasses specific chicken traits, including egg production, egg size, egg color, as well as egg-quality traits, reproduction characteristics, growth performance, mortality, and carcass characteristics. The third part was on the issues or problems encountered by the raisers.

Data Gathering Procedure

Since the study considered Paraoakan chicken raisers as the actual population, purposive sampling was employed to select respondents. The selection was facilitated by barangay officials and representatives from the Department of Agriculture, particularly the heads and personnel of the Municipal Agriculture Offices. To obtain the phenotypic identification and body measurements, the study examined 96 pairs of 1-year-old male and female chickens randomly picked from each respondent's flock of Paraoakan chickens (Figure 1).



Figure 1. Male and female Paraoakan chickens.

The chicken's weight was obtained in kilograms. A tape measure was used to measure the body, which comprised the chickens' wingspan, chest circumference, body length, and shank length. To ensure accuracy and comparability across different birds, and to provide a consistent location for measurement, the chest circumference was measured around the pectus. The body measurement was taken with the neck fully extended, starting from the tip of the beak to the tip of the tail, excluding the feathers (Figure 2). The chicken's wingspan was obtained by fully stretching the wings and measuring across the back of the bird. To get the shank length, the hock joint to the spur of either leg was measured. Data related to the productivity traits, adaptation, and resilience, and the issues encountered in growing the Paraoakan chicken were collected through surveys and interviews.



Figure 2. Measuring of wing span and body length of chicken done during the baseline survey.

Data Analysis

The study employed descriptive statistics, specifically frequency counts, range, mean, and percentages, to analyze the collected data.

RESULTS

Feather Morphology and Plumage Characteristics

The feather morphology of the Paraoakan in Palawan is generally normal. However, 36.46% of raisers reported having chickens with muffs and beards, 19.79% with naked necks, 10.42% with feathered shanks and feet, and 7.29% with crested chickens (Table 1). Plumage patterns include plain (67.70%), mottled (30.21%), laced (26.04%), and barred (26.04%). Plumage colors vary (Figure 3), with black and wheaten/light brown being the most common (85%), followed by white (52%).

Table 1. Percentage distribution of feather morphology of Paraoakan native chicken Respondents have multiple answers (n=96).

Phenotypic Characteristics	Frequency	Percentage
Feather Morphology		
Normal	96	100
Frizzle	8	8.33
Silky	0	-
Feather Morphology		
Normal	96	100
Muffs & Beard	35	36.46
Naked Neck	18	19.79
Feathered Shanks & Feet	10	10.42
Crest	7	7.29
Plumage Pattern		
Plain	96	100
Mottled	65	67.7
Laced	29	30.21
Barred	25	26.04
Plumage Color		
Black	82	85.42
Wheaten/Light Brown	82	85.42
White	50	52.08
Red	38	39.58
Gray	11	11.46
Blue	4	4.17
Golden	2	2.08

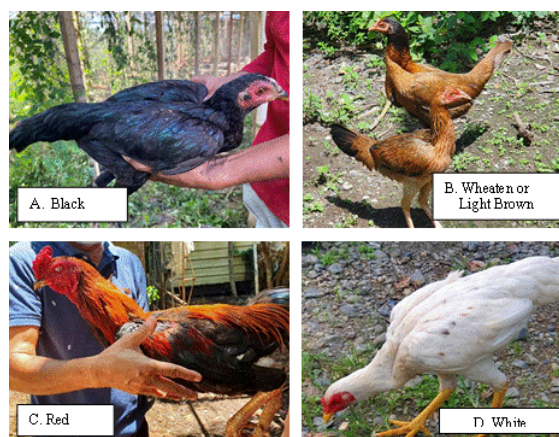


Figure 3. Various Paraoakan chicken plumage colors raised by respondents: A-Black; B- Wheaten or Light Brown; C- Red and D-White

Morphological Traits

Skin, shank, and earlobe colors. Predominantly white skin (71.88%) and yellow skin (54.17%) were reported. Yellow shanks (90.63%) were the most common, followed by black shanks (52.08%) and white shanks (41%). Red earlobes (44.79%) and white earlobes (38.54%) were most common. Some raisers also noted yellow and red/white earlobes (Table 2).

Comb type. Pea combs (66.67%) and cushion combs (33.33%) were prevalent. Small combs were also noted in 73.96% of the chickens (Table 3).

Table 2. Percentage distribution of skin, shank, and earlobe colors of Paraoakan native chicken (Respondents have multiple answers n=96)

Phenotypic Characteristics	Frequency	Percentage
Skin Color		
White	69	71.88
Yellow	52	54.17
Blue-Black	2	2.08
Shank Color		
Yellow	87	90.63
Black	50	52.08
White	41	42.71
Green	10	10.42
Gray	8	8.33
Blue/Bluish	2	2.08
Brown	1	1.04
Earlobe Color		
Red	43	44.79
White	37	38.54
Yellow	32	33.33
White & Red	25	26.04
Black	1	1.04
Orange	1	1.04

Body measurements. Roosters had an average weight of 2.3 kg. with the heaviest recorded in Rizal, a body length of 40.83 cm with the longest observed in Quezon, chest circumference of 35.35 cm with the most significant found in Espanola, a shank length of 9.98 cm with the most extended shank length recorded in Brookes' Point, and wingspan of 43.90 cm with the broadest wingspan observed in Roxas. Hens averaged 1.67 kg in weight, 36.90 cm in body length, 31.63 cm in chest circumference, 8.44 cm in shank length, and 43.10 cm in wingspan (Table 4).

Table 3. Percentage distribution of comb characteristics of Paraoakan native chicken (Respondents have multiple answers. n=96)

Phenotypic Characteristics	Frequency	Percentage
Comb Type*		
Pea	64	66.67
Cushion	32	33.33
Strawberry	18	18.75
Rose	18	18.75
Single	13	13.54
Walnut	7	7.29
Carnation	5	5.21
V-shaped	-	
Double/Buttercup	1	1.04
Comb Size*		
Small	71	73.96
Medium	55	57.29
Large	10	10.42

Productivity Traits

Egg production. Some of the respondents (43.75%) reported that their Paraoakan chickens laid eggs at 6 months, while 16.67% reported at 7-8 months. The highest annual egg production recorded was 20-50 pieces, 69.76% (Table 5).

Egg size and color. Most chicken raisers (43.75%) reported that their Paraoakan chickens laid small-sized eggs (45-54 g), with only 29.17% indicating medium-sized eggs, 55-59 g (Table 6). Sixty-nine percent (69%) of Paraoakans lay cream-colored, while 44% lay white-colored eggs (Figure 4).

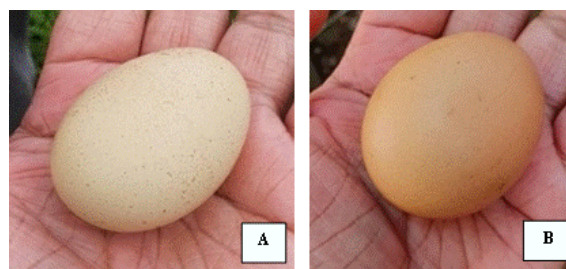


Figure 4. Chicken lay either cream-colored A) or brown-colored eggs (B).

Table 4. Body measurements (\pm sd) of Paraoakan roosters and hens in the respondent municipalities.

Municipality	Weight (kg)		Body Length (cm)		Chest Circumference (cm)		Shank Length (cm)		Wing Span (cm)	
	Rooster	Hen	Rooster	Hen	Rooster	Hen	Rooster	Hen	Rooster	Hen
Roxas	2.18 (\pm 0.21)	1.52 (\pm 0.18)	41.03 (\pm 1.24)	38.96 (\pm 1.23)	33.73 (\pm 2.28)	30.1 (\pm 1.85)	8.58 (\pm 1.12)	7.75 (\pm 0.6)	48 (\pm 2.43)	48.36 (\pm 2.53)
Espanola	2.55 (\pm 0.21)	1.95 (\pm 0.18)	41 (\pm 1.24)	36.04 (\pm 1.23)	38.38 (\pm 2.28)	35.14 (\pm 1.85)	10.38 (\pm 1.12)	8.75 (\pm 0.6)	40 (\pm 2.43)	41.5 (\pm 2.53)
Quezon	2.32 (\pm 0.21)	1.88 (\pm 0.18)	42.54 (\pm 1.24)	37.33 (\pm 1.23)	37.17 (\pm 2.28)	32.17 (\pm 1.85)	10.42 (\pm 1.12)	8.38 (\pm 0.6)	45 (\pm 2.43)	42.08 (\pm 2.53)
Rizal	2.63 (\pm 0.21)	1.58 (\pm 0.18)	40.88 (\pm 1.24)	36.13 (\pm 1.23)	37.58 (\pm 2.28)	31.33 (\pm 1.85)	10.13 (\pm 1.12)	8.96 (\pm 0.6)	44.67 (\pm 2.43)	42.42 (\pm 2.53)
Brookes' Point	2.17 (\pm 0.21)	1.58 (\pm 0.18)	41.67 (\pm 1.24)	36.67 (\pm 1.23)	32.96 (\pm 2.28)	29.58 (\pm 1.85)	11.17 (\pm 1.12)	8.67 (\pm 0.6)	43.25 (\pm 2.43)	43.83 (\pm 2.53)
Bataraza	2.15 (\pm 0.21)	1.68 (\pm 0.18)	38.57 (\pm 1.24)	37.83 (\pm 1.23)	34.36 (\pm 2.28)	32.39 (\pm 1.85)	10.93 (\pm 1.12)	9.05 (\pm 0.6)	43.57 (\pm 2.43)	42.89 (\pm 2.53)
PPC	2.12 (\pm 0.21)	1.49 (\pm 0.18)	40.14 (\pm 1.24)	35.35 (\pm 1.23)	33.25 (\pm 2.28)	30.73 (\pm 1.85)	8.28 (\pm 1.12)	7.5 (\pm 0.6)	42.83 (\pm 2.43)	40.65 (\pm 2.53)
Average	2.3	1.67	40.83	36.9	35.35	31.63	9.98	8.44	43.9	43.1

Table 5. Egg production characteristics of Paraoakan native chicken in the respondent municipalities.

Egg Production Characteristics	Frequency	%
Age at First Egg (month)		
4	7	7.29
5	5	5.21
6	42	43.75
7	16	16.67
8	16	16.67
9	2	2.08
10	1	1.04
No Data	7	7.29
Annual Egg Production		
20-50	67	69.76
51-70	16	16.67
71-90	6	6.25
Above 90	-	-
No Data	7	7.29

Reproduction characteristics. The majority of the raisers (85%) disclosed the Paraoakan chicken “usually” reproduces, with an estimated hatchability of 86.57% (Table 7).

Growth Performance. At eight weeks, most raisers (41.67%) claimed roosters weigh 0.6-1.0 kg; at 12 weeks, 42% claimed 0.5-1.0 kg. In adulthood, 35% weigh 2.1-3.0 kg, followed by 33% at 1.1-2.0 kg. Paraoakan hens, on the other hand, weigh 0.2-0.5 kg at eight weeks (49%), 0.35-1.0 kg at 12 weeks (64%), and 1.1-2.0 kg. at adulthood (57%) (Table 8).

Table 6. Egg quality traits of Paraoakan native chicken in the respondent municipalities (n=96).

Egg Quality Traits	Frequency	%
Egg Weight (g)		
Peewee <45	1	1.04
Small 45-54	42	43.75
Medium 55-59	28	29.17
Large 60-64	17	17.71
Extra-large 65-69	-	-
Jumbo >70	1	1.04
No Data	7	7.29
Shell Color		
White	42	43.75
Brown	11	11.46
Cream	66	68.75
Dotted	1	1.04

Mortality. Very few raisers did not answer the question related to mortality, but 6% disclosed chicks usually die between 0-1 weeks (Table 9).

Carcass characteristics. A predominant 45.83% of the chicken raisers prefer slaughtering chickens at 4-6 months. At this stage, most roosters (42.70%) and hens (58.33%) typically have a live weight of 1.0-1.5 kg. The raisers further reported an average dressing loss of approximately 0.5 kg, representing the difference between live weight and carcass weight (Table 10; Table 11).

Adaptation and Resilience

Most raisers noted high tolerance to feed and water availability, diseases, parasites, and temperature extremes. Coryza was the most common disease reported (83%), followed by fowlpox (23%), poultry lice, and mites (14%), which were also noted as the common problems raisers raised in growing Paraoakan (Table 12).

Table 7. Reproduction characteristics of Paraoakan native chicken in the respondent municipalities.

Reproduction Characteristics	%
Broodiness	
Usual	85
Sometimes	6
Rare	
Hatchability (Average)	86.57%

Table 8. Weight and growth of Paraoakan roosters and hens in respondent municipalities (n=96).

Weight	Roosters		Hens	
	Frequency	%	Frequency	%
8 Weeks (kg)				
0.25-0.5	34	35.42	49	51.04
0.6-1	40	41.67	30	31.25
1.1-1.5	6	6.25	6	6.25
1.6-2	6	6.25	2	2.08
No data	10	10.42	9	9.38
12 Weeks (kg)				
.5-1	40	41.67	61	63.54
1.1-1.5	29	30.21	18	18.75
1.6-2	9	9.38	7	7.29
2.1-2.5	7	7.29	-	-
>2.5	1	1.04	1	1.04
No Data	10	10.42	9	9.38
Adult (kg)				
.75-1	3	3.13	6	6.25
1.1-2	32	33.33	55	57.29
2.1-3	34	35.42	24	25
3.1-4	14	14.58	2	2.08
>4	3	3.13	-	-
No Data	10	10.42	9	9.38

Table 9. The mortality rate of Paraoakan chicken in the respondent municipalities.

Age of Mortality (Weeks)	%
0-1	6
1-8	1
8-20	-
20-n	-

Table 10. Preferred slaughter age of respondents' chickens.

Characteristics	Roosters		Hens	
	Frequency	%	Frequency	%
Age (mos.)				
3-Jan	19	19.79	19	19.79
6-Apr	44	45.83	44	45.83
9-Jul	15	15.63	15	15.63
12-Oct	3	3.13	3	3.13
No data	15	15.63	15	15.63

Table 11. Live and carcass weights of Paraoakan roosters and hens in the respondent municipalities.

Live Weight (kg)	Carcass Weight (kg)	Roosters		Hens	
		Frequency	%	Frequency	%
1-1.5	.5-1	41	42.71	56	58.33
1.6-2	1.1-1.5	26	27.08	14	14.58
2.1-2.5	1.6-2	6	6.25	7	7.29
2.6-3	2.1-2.5	6	6.25	1	1.04
>3	>2.6	2	2.08	-	-
No Data		15	15.63	18	18.75

Table 12. Adaptability traits of Paraoakan native chicken in the respondent municipalities.

Adaptability Traits	Frequency	%
<u>Has tolerance or resistance to diseases and parasites</u>		
Yes	78	81
No	18	19
<u>Diseases or parasites incurred n=18</u>		
Coryza	15	83.33
Not specified	3	16.66
<u>Has tolerance to extremes of temperature</u>		
Yes	75	78
No	21	22
<u>Has tolerance or susceptibility to relevant diseases, ectoparasites, and endoparasites</u>		
Yes	74	77
No	22	23
<u>Relevant diseases, ectoparasites, and endoparasites n=22</u>		
Fowl Pox	5	23
Poultry Lice and Mites	3	14
Pests (immunization)	3	14
Round Worms	1	5
Not Specified	10	45

Adaptability Traits	Frequency	%
<u>Has tolerance relevant to feed and water availability</u>		
Yes	84	88
No	12	13
Adaptability Traits	Frequency	%
<u>Has tolerance or resistance to diseases and parasites</u>		
Yes	78	81
No	18	19
<u>Diseases or parasites incurred n=18</u>		
Coryza	15	83.33
Not specified	3	16.66
<u>Has tolerance to extremes of temperature</u>		
Yes	75	78
No	21	22
<u>Has tolerance or susceptibility to relevant diseases, ectoparasites, and endoparasites</u>		
Yes	74	77
No	22	23
<u>Relevant diseases, ectoparasites, and endoparasites n=22</u>		
Fowl Pox	5	23
Poultry Lice and Mites	3	14
Pests (immunization)	3	14
Round Worms	1	5
Not Specified	10	45
<u>Has tolerance relevant to feed and water availability</u>		
Yes	84	88
No	12	13

DISCUSSION

Feather Morphology and Plumage Characteristics

Feather morphology among Paraoakan chickens was generally described by raisers as phenotypically normal, displaying both plain and diverse plumage colors, which are comparable to those observed in Aseel chicken populations in Bangladesh. Consistent with this observation is Sarker et al.'s (2018) report about considerable variation in plumage colors among indigenous chickens with black and wheaten as most prevalent phenotypes. Santiago et al. (2022), who documented predominantly black plumage in Paraoakan roosters and predominantly white plumage in hens, supported these findings. However, the pattern contrasts with the report of Lopez et al. (2013), which identified plain red as the most common feather color among native chicken populations in Palawan. Given the variability in phenotypic traits reported across studies, further molecular and genetic analyses

are recommended to validate breed identity and establish a more definitive morphological profile of the Paraoakan chicken population.

Morphological Traits

Skin, shank and earlobe colors. Like Bangladesh's Aseel chicken, Paraoakans predominantly have white skins, red earlobes, yellow shanks, and pea-type combs. Similarly, South-western Ethiopian native male chickens have mainly white and yellow skins, shanks, and red earlobes (Tadele 2018). Indonesian native chickens also have predominantly yellow shanks (Maharani et al. 2019). Paraoakan's predominant white skin color is also shared with the other Philippine native chicken counterparts, which Santiago et al. (2022) also reported as white. Paraoakan's predominant red earlobe color in this study coincides with Santiago et al.'s (2022) report that, along with Boholano and Zampen, Paraoakan roosters exhibited red earlobes.

Lopez et al. (2013), identified yellow and white as predominant skin colors in Palawan native chickens. However, black shanks were the second-highest in this study, deviating from Lopez et al.'s identification of green shanks as the second-highest color. This supports Santiago et al. (2022), who reported that among the Philippine native chicken groups studied, Paraoakan and Darag mostly had black shanks, while samples from other native groups had green, white, and yellow. Additionally, this study identified seven shank colors, compared to Lopez's five in 2013. Except for the inclusion of yellow earlobes in this study, the same red earlobe color was also reported, as evident in the study by Lopez et al. (2013) on the characterization of Palawan native chicken.

Comb type. Paraoakan chicken's predominant pea and cushion combs are similar to those of Aseel chicken, which Sarker (2018) reported to also have pea combs. This, however, differs from the chickens in South-western Ethiopia, which commonly have single and rose combs (Tadele 2018). Moreover, Santiago et. al (2021) noted single combs among other Philippine native chickens like Paraoakan, Darag, Boholano, Camarines and Zampen. Lopez et al. (2013) also noted single comb as the most common among Palawan native chickens. This study's results also did not support the findings of Lopez et al. (2013), who identified single comb as the most common among Palawan native chickens. However, although past studies' findings on comb types differ, native chickens like Paraoakan, Camarines and Bolinao, consistently have small-sized combs (Santiago 2021).

Body measurements. Among the municipalities studied, Rizal and Española appear to offer environments that favor heavier roosters and hens, respectively. In terms of muscular build, Espanola offered the largest chest circumferences for both roosters and hens, suggesting that the chickens in these areas are more broad-breasted and have more vigorous body types. The longest body lengths of Quezon and Roxas chickens suggest better growth conditions or height-increasing genetic traits. Wing span and shank length also vary across municipalities, with the longest shanks observed in Brookes' Point and the widest wingspan in Roxas, physical characteristics that may make the chicken stand out in appearance and give them a more advantageous position in foraging and escaping from predators.

Generally, the findings provide valuable insights into the body measurements and other physical characteristics of Paraoakan chickens in Palawan, which breeders and growers can potentially use as desirable traits to improve chicken characteristics either for aesthetic or economic purposes.

Compared with other Philippine native breeds, Paraoakan roosters in this study appear heavier than Patani, the black native chicken of CARAGA, Philippines. Austral et al. (2022) considered Patani the heaviest among the five genetic groups of the county's native chickens they studied, namely, Patani, Zampen, Boholano, Camarines, and Darag. The same authors reported that Patani weighed 1.9 kg, had a body length of 24 cm, and a chest circumference of 33.5 cm. However, in this study on the phenotypic characterization of Paraoakan chicken, actual measurements showed that, on average, roosters and hens in Palawan weighed 2.3 kg and 1.67 kg, respectively, with a body length of 40.83 and 36.90 cm and chest circumference of 35.35 and 31.63 cm.

These measurements were, however, lower than those of the Aseel chicken of Bangladesh, where adult males' average live weight is 3.7 kg and adult female birds' live weight is 2.06 kg. Aseel and Paraoakan chicken have comparable shank lengths, ranging from 10-12 cm among adult Paraoakans, while adult male Aseels had 12.79 cm (Sarker et al. 2018).

Study results support the other studies' findings that comparing male and female, hens' body measurements were generally smaller across all body measurements (Lopez et al. 2013; Tadele et al. 2018; Austral et al. 2022). The same authors suggested that this difference could be attributed to the general body structure of males, which is adapted for muscle development. In contrast, the body structure of hens is designed for reproduction.

Productivity Traits

Egg production. The study findings revealed that Paraoakans typically start laying eggs approximately 1.5 months later than the estimated onset of egg production of Darag chicken which usually begins at 18 weeks or 4.5 months (Manila Bulletin Agriculture 2022), and other native hens whose start of laying period is 18 to 20 weeks (Ebarle and Arevalo 2023). This delay in egg production could be attributed to an adaptive adjustment that enhances survival in scavenging environments, a situation similar to that of Paraoakan chickens, as raisers commonly keep them under free-range conditions and feed them a mix of commercial feed and natural foraging. Osei-Amponsah et al. (2015) explained that egg production requires a substantial amount of nutrients and can be affected by factors such as quantity and quality of feed, water, poor housing conditions, and parasite infestation. It is likely that the bird must first build its reserves adequately before laying eggs under a free-range setup, hence it tends to start later rather than earlier. The reproductive efficiency of chickens, including late maturity and egg production, was mainly affected by breed and dietary management (Jacob et al. 2014).

The recorded highest annual egg production of 20-50 pieces per year in this study supports Sarker et al. (2018) who reported that annual egg production was between 24 and 48 eggs per year. The finding that production peaks when hens are between 6 and 8 months old is also in conformity with Osei-Amponsah et al. (2015) who reported that the egg production curves of the experimental Ghanaian chickens followed the typical egg production curve for a flock which increases during the first 8 or 9 weeks of production and decreases towards the end of the production period. A similar observation was noted in the indigenous chickens in Ethiopia, where egg production also peaked between the ages of 26 and 29 weeks (Osei-Amponsah et al. 2015).

Tadele (2018) noted that the productive performance of indigenous chickens may vary due to several factors, like disease, predation, nutrition, feed, and overall management. The elements in animal diet, like energy, protein, and calcium, are necessary for consistent egg production because hens' daily nutritional requirements also increase once they start laying eggs (Jacob et al. 2014).

Egg size and color. Tadele (2003) observed that the small eggs of native chickens usually demonstrate low productivity. Sazzad (1992) reported that exotic chicken breeds have an average egg weight of 72% higher than that of local breeds. Similarly, in addition to low egg production, local chickens exhibited low output characterized by small egg size, slow growth rate, and poor survival of chicks (Osei-Amponsah et al. 2015). He added that under village conditions, the yearly egg production per bird ranges from 20 to 100 eggs, with an average weight ranging from about 30–50 g. Bondoc et al.'s (2021) view that eggs from native Philippine chicken breeds such as Banabang Kalabaw, Joloano, Paraoakan, and Palawan Lasak were remarkably small support these viewpoints. Bondoc et al. (2021) also noted that compared to indigenous chicken breeds from other nations, these small-sized Philippine eggs closely resembled those reported for nine local breeds across Asia. One remarkable finding, however, was that despite its relatively small size, Paraoakan eggs weighed the highest among the country's native chicken breeds (Bondoc et al. 2021). Although white eggs could also be found, the Paraoakan egg color was similar to that of Aseel chicken, which was primarily light brown (Sarker et al. 2018).

Reproduction characteristics. The Paraoakan raisers' estimated chicken hatchability of 86.57% was higher than that of Lopez et al. (2014), which mean number of eggs hatched per clutch was recorded at 8.50 ± 2.12 pieces, giving an average hatchability rate of $79.38 \pm 13.48\%$. These studies on Palawan native chickens reported a higher estimated hatchability than Aseel chickens, which stands at 71.68% (Sarker et al. 2018). This metric was

influenced by various factors, including egg quality, incubation process, and the overall health of the breeding stock (Serkalet al. 2023). Based from a study on the reproductive performance of the Philippines' Caraga black native chicken, there was a potential relationship between fertility and the age of the chicken, because it is crucial that the chicken's reproductive ova are mature and ready (Austral et al. 2022).

Growth performance. Notably, there was no consistent weight increase with age among roosters, suggesting that, other than age, there could be other predictors for chicken growth. On the other hand, Paraoakan hens, exhibited more consistent and evident weight increases. Sarker et al. (2018) noted that the growth performance of Aseel chickens was up to 3.91 months weeks or 4 months, and their seemingly higher observed growth performance was related to the breed (Chatterjee 2007; Sarker 2018). This, could be attributed to different genotypes and management practices (Sarker et al. 2018). Meanwhile, Desha et al. (2016) identified the non-genetic factors affecting the growth performance of indigenous chickens in rural villages in Bangladesh such as sex, batch, farm, brooding system, and feeding system.

Consistent with the reports of Lopez et al. (2013), Deshna et al. (2016), Tadele et al. (2018), and Austral et al. (2022) reported that the sex of birds affected growth performance at different ages, and that weight is higher in male than in female. Regarding batch effects on the growth performance of chickens, Gambo et al. (2023) observed that hatch batch had a significant effect on weekly body weight, body weight gain, and growth rate at day-old and at subsequent weeks until maturity of Nigerian indigenous Tiv chickens. Wolanski et. al (2006) noted a strong correlation between egg weight and one-day chick weight, which, in turn, affects chick size and development. On the other hand, farms or households differed in management practices, like housing and hygiene, brooding systems, and supplemental feeding, which are known to influence productivity and performance in village chicken systems. Abdelqader et. al (2007) reported that the main features of the production systems were improper housing and inadequate hygiene, and that there was a significant positive correlation between management level and chickens' performance. Hatchability, survivability, flock size, number of clutches, egg weight, and egg mass were the major parameters that improved significantly with improvement in management practices. Padhi (2016) cited that the performance of native chickens can be improved through changes in husbandry, feeding, and better health cover. Rashid et al. (2020) reported better growth performance and profitability with electricity and diesel-burner brooding for early chicks, which depend heavily on temperature stability and heat availability. On the

other hand, Roxas and Escarlos (2000) noted that different temperatures and relative humidity combinations did not affect the average final weights of native chickens.

Mortality. A low mortality rate, indicative of a healthy flock, efficient management practices, and an efficient feed conversion rate were essential characteristics for the prosperity of a poultry business (Grobelaar et al. 2010); Osei-Amponsah et al. 2015). This is because a high mortality rate can result in financial loss due to the cost of replacing birds and the loss of potential egg production.

Paraoakan raisers reported that chicks usually survived to maturity once they are more than one week old. Tadele et al. (2003) noted an elevated mortality rate among chicks, reaching up to 49% before they reached eight weeks old. The same study showed an increase in survival rate with a larger number of chicks hatched per incubation. According to Lopez et al. (2014), native chickens in Palawan had a percent livability of chicks from hatching to weaning of 66.89 ± 20.20 , indicating the proportion of chicks that survived from hatching until weaning. Lopez et al. (2014) also noted that the most common causes of chick mortality were disease and predatory attack.

Carcass characteristics. The respondents' observation of a 0.5 kg difference between the live and carcass weights points to a good dressing percentage in Paraoakan chicken for meat production, suggesting an efficient conversion of live weight into edible meat where there is less loss due to feathers, viscera, and edible parts, and therefore greater economic value per chicken. In terms of the respondents' preference for slaughtering chickens at four to six months, this is possibly associated with the ideal weight range of 1.0-1.5 kg, considering the trade-offs between feed utilization and meat standards.

Haunshi et al. (2022) noted that the carcass yield of Kadaknath, a native chicken in India, was significantly lower than that of broilers. Moreover, the authors noted that Kadaknath chicken also had significantly lower absolute weights and yields of organs such as the liver, heart, and gizzard (giblets) compared to broilers at 27 weeks of age. However, while the weight of the breast was significantly higher in the broiler, the Kadaknath chicken's weights in cut-up parts like legs, back, and neck was significantly higher.

The efficient conversion of feed into usable meat of Paraoakan, combined with the raisers' preference to slaughter the chicken at lighter weights, makes Paraoakan chickens a practical and economically viable choice for poultry meat production.

Adaptation and Resilience

The majority of the raiser respondents consider Paraoakan chickens to be resilient to feed and

water limitations, as well as temperature changes. This aligns with the information shared by San Agustin in a DA-BAR online seminar, where it was noted that native chickens, like other indigenous animals, are renowned for their robustness and adaptability to local agro-climatic conditions, requiring minimal care (DA-BAR 2022). Gheyas et al.'s study in 2021 also noted that African indigenous chickens have genetically been climate-tolerant, having adapted to harsh environments. Another study by Kpomasse et al. (2023) referenced Ajayi (2010), who reported that indigenous chickens possess genetic traits from seven to nine significant adaptive genes for tropical environments, thus shielding them from the adverse effects of heat stress.

In terms of disease infection, study results indicate that coryza was the most common disease among Paraoakan chickens. Coryza has respiratory symptoms that often affect semi-mature or adult birds (Serbessa et al. 2023). A reservoir hosts, birds transmit the disease through various means, reducing egg production in layer flocks. The results of the study show that most respondents were unable to specifically identify a disease other than coryza, nor an ectoparasite, nor an endoparasite affecting their chickens. This highlights a significant challenge that may hinder local chicken production, potentially leading to increased mortality rates. Improved information on poultry rearing is therefore crucial for improving production management practices.

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GENERATIVE AI STATEMENT

The author utilized OpenAI's GPT-4 to assist in surveying existing literature on the phenotypic characteristics of native chickens. The same tool was consulted when certain terms or statements from cited authors appeared unclear, for elaboration and clarification. The author acknowledges the tool's potential limitations and biases, and she takes full responsibility for the interpretation and presentation of the findings.

ETHICAL CONSIDERATIONS

This study did not involve minors or individuals below 18 as respondents. All Paraoakan raisers who participated in the study were fully informed about the purpose of the interviews, and only those who voluntarily consented were included. The respondents were not subjected to any financial burden, and the study did not involve any procedures that could harm or endanger the health of the chickens. No personally identifiable information is disclosed in this study; only aggregated results from the data analysis are presented in this paper.

DECLARATION OF COMPETING INTEREST

The author declares no competing interests in this work.

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