Research Article

Phenotypic Characterization of Indigenous Backyard Poultry Birds in Tando Allahyar, Pakistan

Rameez Raja Kaleri[1,2*], Hubdar Ali Kaleri[1], Nazeer Hussain Kalhoro[5], Raza Ali Mangi[3], Ghulam Mustafa Solangi[4], Deepsh Kumar Bhuptani[6], Sher Muhammad Khosa[1], Abdul Wahid Solangi[1], Ayaz Ali Lashari[7] and Sheva Dari[1]

[1]Department of Animal Breeding and Genetics, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam, Pakistan; [2]Poultry Production, Tando Allahyar Livestock and Fisheries Department, Government of Sindh, Pakistan; [3]Department of Veterinary Anatomy and Histology, Faculty of Biosciences, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand, Pakistan; [4]Department of Veterinary Pathology, Faculty of Veterinary Sciences, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand, Pakistan; [5]Director General Livestock, Sindh, Pakistan; [6]Department of Meat Technology, Faculty of Animal Product and Technology, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand, Pakistan; [7]Agriculture Research Seed Farm Usta Muhammad, Balochistan, Pakistan.

Abstract | This study was carried out in Tando Allahyar district of Sindh, Pakistan to observe the phenotypic characterization of indigenous backyard poultry birds in Tando Allahyar. For this purpose, total 470 birds with 240 male and 230 females were brought under the study. Their phenotypic characteristics were collected thorough observing by the researchers from different UCs of district Tando Allahyar. The data regarding quantitative traits were observed using the measuring tap mentioned in the (FAO) manual. The findings of our study 86.69% out of the 470 birds recorded with normal feather pattern. The common color of shank was found 27.71% white with 89.11% pea comb. The result for body weight revealed that significantly higher body weight was recorded in male birds as compared with female 2425±27 and 1482±11, respectively. The result for overall average body weight was revealed in our study 20.37±25.76 gram. In our study strong positive and significant correlation was observed among the average body weight and linear body measurement of poultry birds. We have used two principal components in our study with (PCI-55.21% and 12.13% that revealed total variability the together 67.11%. In this study 1st component was recorded 57.32% of variance showed highly significant loading to overall body measurements excluding shank circumferences result. It is concluded that PCI is a useful selection standard for improving the body weight of indigenous backyard poultry birds. In this study many variations observed showed that huge potential of birds have for improvement by selection and better breeding strategies.

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***Correspondence** | Rameez Raja Kaleri, Department of Animal Breeding and Genetics, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam, Pakistan; **Email:** rameezkaleri@gmail.com
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Keywords | Backyard poultry, Indigenous, Phenotype, Characterization, Tando Allahyar, Principal component analysis

Introduction

Poultry industry considered as a major livestock sub-sector of Pakistan playing a key role in the rural development and economic growth. Term backyard poultry designates the rearing of poultry birds on small scale 10 to 12 birds for family purpose and up to some extent cash income for next generation. In rural areas mainly farmers kept these birds for getting egg and meat for their family requirement (Mushi *et al*., 2020) and Farooq *et al*. (2004). The indigenous production system of poultry is highly extensive in nature characterized by input of nutrition and housing with disease preventions. The chicken has less growth rate and low egg production is known as indigenous chicken (Kindji and Tamiru, 2021). However, these chicken breeds are highly disease resistance and can grow under harsh environment and poor nutritional conditions with higher temperature as compared with broiler and other commercial breeds (Liswaniso *et al*., 2023). However, commercial level poultry industry has been extended with rapid during recent years with highly egg and meat producing birds have been introduced for boosting the egg and meat production, but still backyards poultry playing a major role for egg production in various countries of the world Laenoi *et al*., 2015; Mtilani *et al*., 2012). Number of researchers reported that backyard poultry birds have ability to produce more number of egg and meat from their present production if they have been given proper nutritional supplement with better management conditions including vaccination Ullah *et al*. (2019), Naila *et al*. (2001). Moula *et al*. (2011), reported that due to negligence and improper care the poor production performance of backyard poultry birds have been recorded due to poor management conditions and improper vaccination Ullah *et al*. (2021). This demand of growing world can only be achieved by applying breeding strategies and proper selection methods. However, the most important requirement in characterization of indigenous chicken includes identification of backyard poultry birds with their morphological and phenotypic characterization that would be beneficial for selection of superior birds (De La Baara *et al*., 2019). Tando Allahyar is being a remote district of Sindh Province of Pakistan. It is highly dependent on backyard poultry for meat and egg than other livestock species due to high prices of fodder and other expenses. Due to major population of Tando Allahyar belonging to rural areas, the specific communication with latest commercial farming system has not been well aware. Except few trainings of female staff of backyard poultry birds have been carried out by Non-Governmental Organization (NRSP) and Sindh Government by (BBSHRRDP) and (AAP) Sindh Action Accelerated Project and were also distributed Golden Misri and Rhode Island Red chicken breeds for improving egg production. Ullah *et al*. (2021), Prietoet *et al*. (2006). The aim of study was to characterize phenotypically backyard poultry birds in Tando Allahyar, in order to start the basic strategies for bringing improvement in backyard poultry birds.

Materials and Methods

Geography

Present study was carried out in April, 2022 in Tando Allahyar district of Sindh. Tando Allahyar is situated in the east of District Hyderabad and Karachi. The weather remains hot and humid with average range of annual temperature rise up to 40^0C during summer and less than 14^0C in winter. The district Tando Allahyar receives an average 15.31 mm (0.6) inches per rainfall per year (weahterspark.com), December 31-2022. This study involved the selection and sampling of a total of 470 chickens from small scale farmers in Tando Allahyar District, Sindh. The sample included 240 males and 230 females, chosen at random.

Selection of birds

For the purpose of characterization, this study followed the recommendation of Liswaniso *et al*. (2023) and selected only birds that were above 5 months of age. The chickens were raised in a traditional extensive management system, with access to scavenging for their nutritional requirements and basic housing. To minimize interference with urban allied management system remote areas were included (Desta *et al*., 2013).

Data

The quantitative data was collected on the individual bases through observing the birds for various phenotypic features as suggested by manual published on the phenotypic characterization of poultry farm genetic resources manual of (FAO, 2012), such as comb sex, shank color (grey-blue, black, yellow, green or white), comb type (single, double orpea, cushion and rose), color of eyes (pearl, brown, orange and red), ear lobe (red-white, blue, white and red). The data regarding body weight, each sampled chicken

was individually weighed on electric weight balance. In this study total 8 linear body measurements were utilized with measuring tape (centimeter).

Parameters

The parameters were body length (BL), keel length (KL), thigh length (TL), shank length (SL) shank circumference (SC), chest circumference (CC) and corpus length (CL). The above-mentioned parameters were recorded according to the formula as suggested by (Liswaniso *et al.*, 2023). The data was collected using a computer and stored in MS Excel 2013. Statistical software, specifically SPSSS-22, was utilized for data analysis. To determine the significant difference among means, the Tukey's test was employed. The correlation coefficient between linear body measurements was calculated to recorded correlation association upon the bases of 1st principle component analysis. In this way to confirm the correlation matrix Bartletts test of sphericity was performed. Furthermore, favorability of sample for principle component analysis was performed through the Kaiser Meyer Olkin test that revealed 0.60 or above in accordance with Desta *et al.* (2013).

Result and Discussion

In this study, the authors investigated the variation in color of eye of, color of ear lobe, feather pattern and shank color 470 backyard poultry birds in Tando Allahyar, Sindh Province. The majority of birds had normal feathers (86.69%), with 12.22% having crested feathers and 1.09% having naked neck feathers. The shank color varied, with green (22.13%), white (27.71%), grey blue (25.32%), black (17.87%), and yellow (6.97%) being observed. The comb type varied as well, with pea (89.11%), single (3.15%), cushion (2.97%), and rose (4.77%) being observed. The ear lobe color ranged from pearl (12.24%), blue (2.12%), white (37.65%), red (16.76%), and red-white (43.47%). The eye color also varied, with brown (51.24%), pearl (13.59%), orange (15.93%), and red (19.2%) being observed.

The authors noted that the variation in shank color recorded in out result was permanent as compared with other studies performed in this area, which found that black, yellow, white, green, and grey blue shanks were present with varying frequencies. The differences in shank color could be attributed to geographical variations in pigmentations that control the expression of the shank color gene. The authors also observed that the single comb type was the most common, which is consistent with other latest investigations performed in similar regions.

Furthermore, authors have properly cited their sources and acknowledged previous studies that have contributed to their findings.

The importance of comb size in relation to heat loss in poultry birds has been previously reported (Ullah *et al.*, 2021). Large comb sizes have been suggested as an effective way of heat resistance (Apuno *et al.*, 2011). Several studies have investigated the variation in ear lobe color (Ahmed *et al.*, 2011; Usman *et al.*, 2014; Melesse and Negesse, 2011), with red-white and white ear lobe colors being the most predominant. While Dana *et al.* (2010) attributed differences in ear lobe color to breed-specific characters influenced by nutritional factors; our study found that brown eye color was the most prevalent in Tando Allahyar, present with result of Maharani *et al.* (2021) as well as other studies conducted in Pakistan and Nigeria. Our study also found that the color of the eyes was commonly influenced by carotenoids and the supply of fresh blood (Ullah *et al.*, 2021). Table 1 in our study shows differences in average body and linear body measurement measurements among backyard poultry birds in Tando Allahyar district of Sindh, Pakistan.

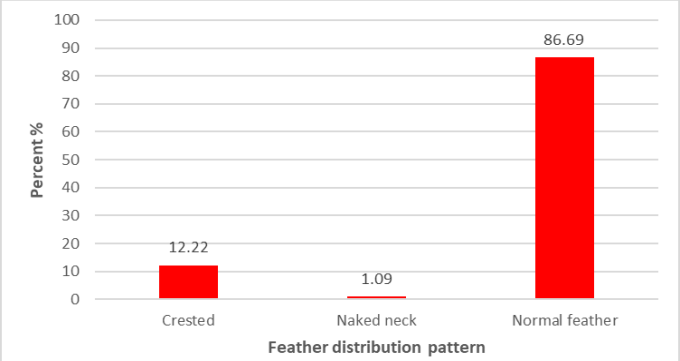

Figure 1: *Feather distribution pattern of 470 backyard poultry birds at district Tando Allahyar.*

The study found that male birds was observed heavier as compared with female with mean body weights 2425±27 and 1487±11g, respectively. According to previous research by Bekele *et al.* (2021), male birds were significantly superior in all linear body measurements considered. Daikwo *et al.* (2011) also concluded that body weight in poultry birds is related to weight, condition and size of the birds.

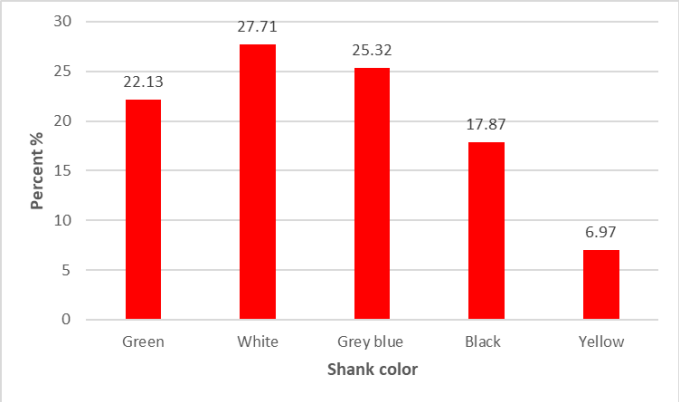

Figure 2: *Shank color of 470 backyard poultry birds at district Tando Allahyar.*

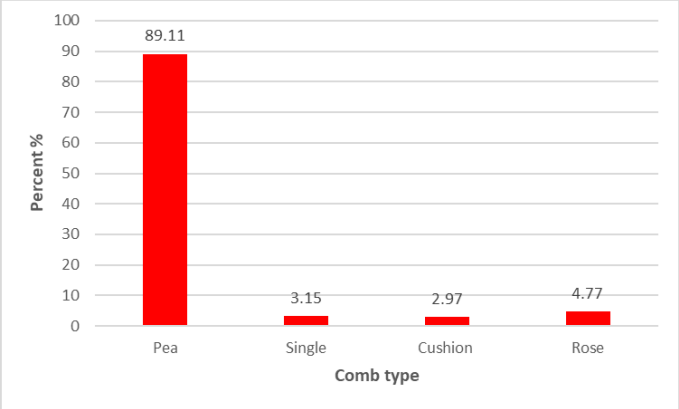

Figure 3: *Comb type of 470 backyard poultry birds at district Tando Allahyar.*

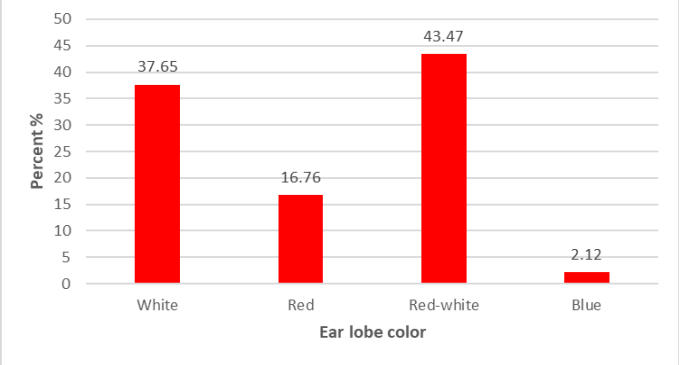

Figure 4: *Ear Lobe color of 470 backyard poultry birds at district Tando Allahyar.*

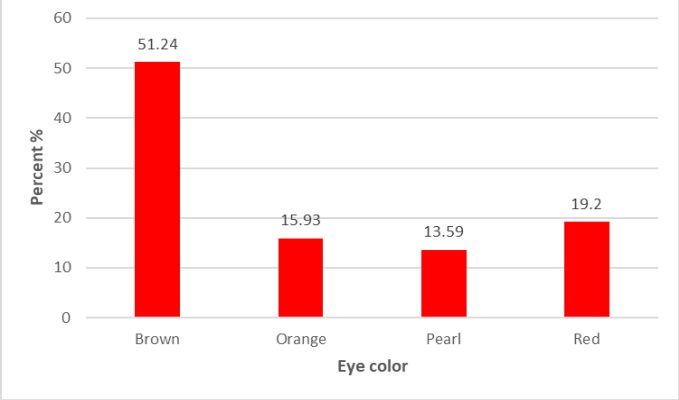

Figure 5: *Eye color of 470 backyard poultry birds at district Tando Allahyar.*

The result of body weight of birds in our study was related with the result revealed by Dahloum *et al.* (2016) and Tyasi *et al.* (2017) in Dagu and Chinese backyard poultry birds. In this study, male birds were significantly heavier than females, which could be explained by the variation in hormones that bring rapid body growth and a larger body frame of males (Msoffe *et al.*, 2002). The result for sexual dimorphism was recorded similar with the result revealed by Youssao *et al.* (2010), Msoffe *et al.* (2002), Zaky and Amin (2007) and Yakubu and Ari (2018), details are given in Figure 1, 2, 3, 4 and 5.

The lower female body weight observed in this study indicates that backyard poultry birds in Tando Allahyar have not been subjected to intermixing of genes through crossing with other exotic poultry breeds. Table 2 and 3, shows the correlation between the linear body measurements of backyard poultry birds in Tando Allahyar.

Table 1: *Mean Standard Errors body weight and body measurement of backyard poultry birds in Tando Allahyar.*

Trait	Sex			Overall
	Male birds	Female birds	Mean ±SE	CV%
BW (g)	2425±27[a]	1487±11[b]	20.37±25.67	30.89
CL (cm)	25±0.21[a]	21±0.17[b]	23.35±0.27	11.03
CC (cm)	35±0.45[a]	27±0.21[b]	33.57±0.13	15.29
TL	16±0.19[a]	14±0.09[b]	15.23±0.31	17.09
TC (cm)	12±0.11[a]	10±0.10[b]	9.91±0.07	21.61
SC (cm)	7±0.39[a]	5±0.03[b]	5.93±0.33	98.89
SL (cm)	13±0.20[a]	11±0.09[b]	11.21±0.13	18.17
KL (cm)	14±0.13[a]	12±0.07[b]	13.39±0.05	14.19
BL (cm)	50±0.15[a]	38±0.11[b]	45.13±0.23	11.01

The entries in each row with different superscripts showed significant differences (P≤0.05).

The results of the PCII analysis indicated low loading values for all traits, and length of body and length of keel was observed negative loading. The result for communalities was revealed 0.47 to 0.97 for shank and chest circumferences which revealed higher amount of variability in the result. Aslam *et al.* (2020) suggested that the degree of convenience sampling of the data could affect the results of PCA, similar to the findings of Mukhtar *et al.* (2012). The result of Bartlett test of sphericity was revealed level of P=0.00. These findings are comparable with the results of Yakubu and Ibrahim (2011) and Saikhom *et al.* (2018), who also found high loading values for body

weight in PCI. Mendes (2011) found that the first component of PCA was not specific to body weight, but was related to body weight during the 35 to 42 days of chicken age. Prieto *et al.* (2006) concluded the 1st principle component had proven better result for statistics for ground studies. The results of Udeh and Ogbu (2011) and Egena *et al.* (2014) are consistent with the findings of our study, as they also conducted similar investigations.

Table 2: *Correlation among body measurements (cm) of backyard poultry birds in district Tando Allahyar.*

	BW	CL	CC	TL	TC	SC	SL	KL
CL	0.67**							
CC	0.61**	0.38**						
TL	0.65**	0.39**	49**					
TC	0.75**	0.55**	0.53**	63**				
SC	0.11*	0.7	0.6	0.6	0.11*			
SL	0.73**	0.55**	0.57**	0.59**	0.51**	0.07		
KL	0.75**	0.49**	0.43**	0.63**	0.05**	0.59**		
BL	0.71**	0.62**	0.48**	0.56**	0.04**	0.61**	0.63**	

*The ** mean P≤0.01 and * P≤0.05.*

Table 3: *The Eigenvalues, % of total variance with rotated component matrix communalities.*

Trait	PCI	PCII	Communalities
BW	0.94	0.6	0.84
SL	0.81	0.02	0.66
TC	0.79	0.10	0.64
BL	0.80	-0.04	0.65
KL	0.80	-0.04	0.64
TL	0.74	0.05	0.53
CL	0.73	0.04	0.51
CC	0.71	0.02	0.47
SC	0.05	1.00	0.97
Eigenvalues	5.21	1.76	
Variance %	55.21	12.13	
Cumulative variance %	57.32	67.11	

Conclusion and Recommendations

The variation was observed among phenotypic characteristics in backyard poultry birds of Tando Allahyar, Sindh, Pakistan. It is concluded that backyard birds have maximum potential that there would be possible improvement through selection and effective breeding programs. The information of present study can be a good base for selection as well as designing of effective breeding program in poultry.

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Novelty Statement

Indigenous poultry birds have great importance for livelihood of rural people by providing nutrition through egg and meat with low cost. Hence possible efforts should be taken for improvement of these backyard poultry breeds with effective breeding programs.

Author's Contribution

Rameez Raja Kaleri: Conducted the study.
Hubdar Ali Kaleri and Nazeer Hussain Kalhoro: Supervised and Co-Supervised the study.
Raza Ali Mangi, Ghulam Mustafa Solangi and Deepsh Kumar Bhuptani: Provided technical assistant at every step.
Rameez Raja Kaleri, Sher Muhammad Khosa and Abdul Wahid Solangi: Statistical analysis.
Ayaz Ali Lashari and Sheva Dari: Proof reading and help in field work.

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