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## Phenotypic characterization and economic traits of native chicken of Chotanagpur plateau of Jharkhand

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#### Abstract

The present study was conducted to characterize the native chicken reared under backyard system in three districts of Chotanagpur plateau of Jharkhand. Data on phenotypic and body measurements were recorded of 540 adult chickens; 180 male and 360 females drawn from 270 households. The overall flock size differed significantly ( $P \leq 0.01$ ) in the study area. In males, mixed plumage color in Ranchi and red plumage in Ramgarh and Bokaro were the dominant phenotypic traits. However, female chickens were characterized by brown plumage. The predominant shank colour was yellow. The color of ear lobe and comb were red and skin was white in all the birds. The predominant comb type was single followed by pea and rose. The body weight and shank length of birds of Ranchi were significantly higher ( $P \leq 0.05$ ) than other two districts. The age at first egg lay, clutch size, laying cycles per year and annual egg production were significantly differed. The study revealed that most of the parameters studied showed similar results in Ramgarh and Bokaro but significantly higher in Ranchi. The present study has developed the baseline data of indigenous chickens for recognition as a distinct breed in future. However, molecular characterization must be taken to conserve the indigenous chicken population.

**Keywords:** Native chicken, phenotypic, characterization, production, genetic

#### Introduction

Native chickens are widely reared under backyard system in rural and peri-urban areas of Jharkhand. According to livestock census 2019, the total backyard poultry population in our country is 317.07 million, which is increased by 45.8% over previous census [1]. Women of rural areas are mainly concerned for the rearing and marketing of their native chickens, whereas youths have been interested in cock fighting game at local market. The local birds are very active, hardy, fast runner, thrive well on leftover food, require minimum managerial care and can withstand most of the natural calamity [21, 14]. It plays an important role in human nutrition, employment, and income generation to meet their day to day petty expenses. Most of the consumers prefer to eat meat and egg of native chicken because of their taste, leanness and health benefits [18]. Despite of their late sexual maturity, poor egg production, slow growth, broodiness, smaller egg and body size, the native chickens are better in disease resistance and tropical adaptability. Systematic studies on morphological characters and the economic traits of indigenous chicken in Jharkhand had not been studied. Therefore, the present study was conducted to characterize the production potential, qualitative and quantitative traits of native chickens reared in Ranchi, Ramgarh and Bokaro districts of Chotanagpur plateau of Jharkhand.

#### Materials and Methods

The study was conducted during March 2019 to March 2020 in rural areas of Ranchi, Ramgarh and Bokaro districts of Chotanagpur plateau of Jharkhand. The study area is located between 23°20'39.5340" N to 23°40'9.4656" N latitude and 85°17'45.6468" E to 86°9'4.0140" E longitude. The area receives an average annual rainfall of 56.34 inches and an average annual temperature of 23.7°C.

**Sampling framework and data collection procedure:** The field survey was designed according to guidelines of ICAR- National Bureau of Animal Genetic Resources, Karnal [16].

The survey of native chickens were carried out from three blocks under each three district randomly selected i.e. Ranchi, Ramgarh and Bokaro by personal interviews using structured questionnaire to collect data on production performance, qualitative and quantitative traits of indigenous chicken. The chickens of eight months and above age were selected randomly with two birds from each household. The closely related households were skipped to avoid the risk of sampling chickens sharing the same cock. The total number of chickens surveyed in each block was 60 including 20 male and 40 females from 30 households. Thus total number of chickens studied in nine blocks of Ranchi, Ramgarh and Bokaro districts were 540 with 180 males and 360 females among 270 households.

The chickens were studied for their phenotypic characters such as color of plumage, shank, skin, comb and ear lobe and comb type. The biometric measurements of chickens such as body weight and shank length were also taken from both the sexes. The production potential of hens such as age at first egg lay, clutch size, clutch interval, number of clutches per cycle, number of eggs per cycle, laying cycles per year, pause, annual egg production and hatchability on the basis of total

eggs were also recorded.

### Statistical Analysis

Data collected were coded and entered using MS Excel and analysed using SPSS statistical package. Body weight and shank length were analysed using the General Linear Model (GLM) procedures of statistical analysis system. The model was fitted to main effects of district and sex on body weight and shank length of chickens. Qualitative traits were analyzed by frequency procedure.

### Results and Discussion

#### Flock composition of indigenous chickens

As shown in Table 1, the effect of districts on flock size per household was found to be highly significant ( $P \leq 0.01$ ) with Ranchi having highest flock size followed by Bokaro and Ramgarh. The overall flock size was  $11.84 \pm 0.438$  which was almost similar to the flock size i.e. 13 in Bundi district of Rajasthan [7] and Southeastern Ethiopia [17]. The average number of cocks, hens and chicks were also significantly higher for Ranchi than other two districts.

**Table 1:** Flock compositions of households in the surveyed area of Chotanagpur plateau of Jharkhand (mean  $\pm$  S.E.)

Parameters	Farmers (n=270)			Overall(n=270)	F-value
	Ranchi(n=90)	Ramgarh(n=90)	Bokaro(n=90)		
Number of cocks	2.36 $\pm$ 0.163 <sup>b</sup>	1.36 $\pm$ 0.123 <sup>a</sup>	1.59 $\pm$ 0.133 <sup>a</sup>	1.77 $\pm$ 0.80	14.995**
Number of hens	3.69 $\pm$ 0.204 <sup>b</sup>	2.63 $\pm$ 0.172 <sup>a</sup>	2.84 $\pm$ 0.179 <sup>a</sup>	3.05 $\pm$ 0.106	10.988**
Number of chicks	8.91 $\pm$ 0.316 <sup>b</sup>	5.46 $\pm$ 0.248 <sup>a</sup>	6.78 $\pm$ 0.276 <sup>a</sup>	7.02 $\pm$ 0.330	9.826**
Flock size	14.97 $\pm$ 0.410 <sup>b</sup>	9.45 $\pm$ 0.326 <sup>a</sup>	11.21 $\pm$ 0.355 <sup>a</sup>	11.84 $\pm$ 0.438	15.381**

Figure in parentheses indicates number of households.

Values bearing same superscript in small letters within a row do not vary significantly with each other ( $p \geq 0.01$ ).

SE, standard error of the mean.

#### Qualitative traits

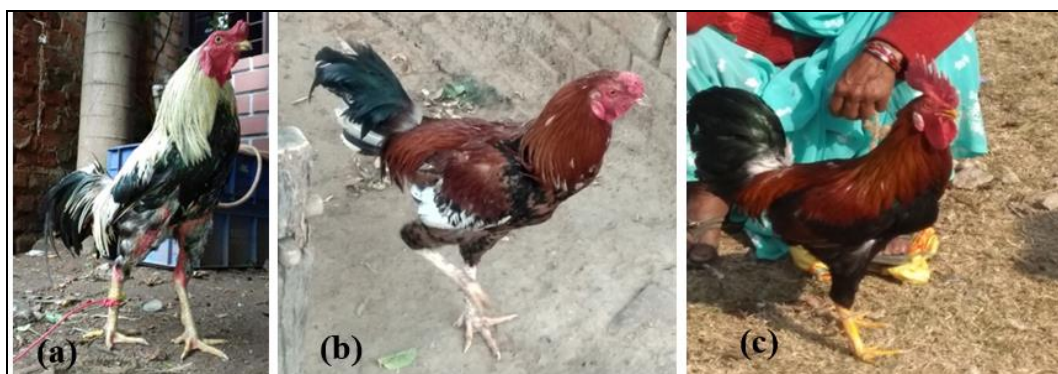
About six different plumage color patterns were observed in chicken populations reared in Chotanagpur plateau of Jharkhand (Table 2). The predominant plumage color of cocks in Ranchi district was mixed followed by black & white and red. The mixed feather colors predominate over any single feather color which was in accordance of the findings of other workers [3, 13]. The birds of Ranchi district usually had elongated body with long neck and long shank which was in agreement with the Kaunayen bird [26]. Cocks generally had shining off-white or golden feathers on neck, back, wings and greenish black feathers on tail (Figure 1a). The hens generally had brown or dark brown feathers on neck, wings and back and black feathers on tail (Figure 2a). The birds of Ramgarh and Bokaro district had rectangular body with comparatively short shank. Majority of male birds had red plumage color. The present findings pertaining to red plumage color found similarity with those observed in other native chickens [8, 4, 17, 22]. The facts that brown color was predominant (52.78%) in hens of all three districts were also in good agreement with

the observations in native chickens of Western Visayas, Philippines [4]. Diverse plumage color of native chicken in the study area may be due to lack of selection of breeding programme [19]. The color of shank was predominately yellow followed by slaty-black (Table 2). The predominate yellow color corresponds to that found in native chicken of Shekha Zone of Ethiopia [2], Kaffa Zone of South-Western Ethiopia [22] and Aseel male [5]. The yellow color of shank may be due to feeding of naturally available food materials, kitchen and household wastes responsible for the formation of carotenoid pigments. The findings revealed that all the chickens had red ear lobe (Figure 3c) and white skin (Table 2). Dominant red ear lobes were also observed in Aseel male [5] and native chicken of Karnataka [23]. Predominate white skin color were also reported in native chicken of Kaffa Zone of South-Western Ethiopia [22] and in Khadia breed of Odisha [15]. The color of comb in both male and female were red. The predominant comb type was single followed by pea and rose in both the sexes (Figure 4). Similar pattern was also reported in native chicken of Karnataka [23].

**Table 2:** Percentage distribution of phenotypic parameters among indigenous chicken in three districts of Chotanagpur plateau of Jharkhand (n=540).

Parameters	Ranchi (n=180)		Ramgarh (n=180)		Bokaro (n=180)		Overall	
	Male (n=60)	Female (n=120)	Male (n=60)	Female (n=120)	Male (n=60)	Female (n=120)	Male (n=180)	Female (n=360)
<b>1. Plumage color</b>								
White	8.33(5)	6.67(8)	11.67(7)	16.66(20)	8.33(5)	13.33(16)	9.44(17)	12.22(44)
Black	10(6)	30.83(37)	6.66(4)	13.33(16)	3.33(2)	14.16(17)	6.67(12)	19.44(70)
Brown	8.33(5)	44.17(53)	5(3)	57.5(69)	20(12)	56.67(68)	11.11(20)	52.78(190)
Black and white	18.33(11)	15.83(19)	3.33(2)	7.5(9)	16.66(10)	2.5(3)	12.78(23)	8.61(31)
Mix	41.66(25)	2.5(3)	30(18)	4.16(5)	10(6)	2.5(3)	27.22(49)	3.06(11)
Red	13.33(8)	NR	43.33(26)	0.83(1)	41.66(25)	10.83(13)	32.78(59)	3.89(14)
<b>2. Shank color</b>								
Yellow	96.66(58)	77.5(93)	98.33(59)	90(108)	98.33(59)	89.16(107)	97.78(176)	85.56(308)
Slaty black	3.33(2)	22.5(27)	1.66(1)	10(12)	1.66(1)	10.83(13)	2.22(4)	14.44(52)
<b>3. Ear lobe color</b>								
Red	100(60)	100(120)	100(60)	100(120)	100(60)	100(120)	100(180)	100(360)
<b>4. Skin color</b>								
White	100(60)	100(120)	100(60)	100(120)	100(60)	100(120)	100(180)	100(360)
<b>5. Comb color</b>								
Red	100(60)	100(120)	100(60)	100(120)	100(60)	100(120)	100(180)	100(360)
<b>6. Comb type</b>								
Single	56.67(34)	62.5(75)	55(33)	58.33(70)	43.33(26)	42.5(51)	51.67(93)	54.44(196)
Pea	31.67(19)	29.17(35)	26.67(16)	32.5(39)	41.67(25)	40.83(49)	33.33(60)	34.17(123)
Rose	11.66(7)	8.33(10)	18.33(11)	9.17(11)	15(9)	16.67(20)	15(27)	11.39(41)

Figures in parentheses indicate number of observations; NR, not reported



**Fig 1:** Indigenous male chicken of Ranchi (a), Ramgarh (b) and Bokaro (c) district.



**Fig 2:** Indigenous female chicken of Ranchi (a), Ramgarh (b) and Bokaro (c) district.



**Fig 3:** Indigenous chicken with yellow shank (a), slaty-black shank (b) and red ear lobe(c).



**Fig 4:** Variations of comb type among indigenous chicken of Chotanagpur plateau of Jharkhand (a) Cock with single comb, (b) Cock with pea comb, (c) Cock with rose comb, (d) Hen with single comb, (e) Hen with pea comb and (f) Hen with rose comb.

### Quantitative traits

The body weight of female and male chickens of Ranchi district was significantly ( $p \leq 0.05$ ) higher than Ramgarh and Bokaro (Table 3). The overall average body weight of females and males was  $1182.04 \pm 14.307$  and  $1552.18 \pm 27.461$  gram, respectively, which was almost similar to reported in indigenous chicken of Assam [11]. Body weight of males were observed to be significantly ( $p < 0.05$ ) heavier than females (Table 3). This was in agreement with the reports of several

other workers [6, 12, 13]. Sexual dimorphism with respect to body weight was also expected due to differential growth rates of the males and females. The shank length of both sexes varied significantly ( $p \leq 0.05$ ) in each district. In the present study the overall average shank length of males and females was found to be  $9.85 \pm 0.083$  and  $8.73 \pm 0.051$  cm respectively, which was comparable to those reported in indigenous chicken of Mizoram [9].

**Table 3:** Linear body measurements of male and female indigenous chicken populations in the three districts of Chotanagpur plateau of Jharkhand (mean  $\pm$  SE).

Morphometric traits	Sex	Ranchi (n=180)	Ramgarh (n=180)	Bokaro (n=180)	Overall
Body weight	Male	$1738.58 \pm 42.856^{Bb}$	$1491.68 \pm 43.975^{Ba}$	$1426.32 \pm 46.624^{Ba}$	$1552.18 \pm 27.461^{B**}$
	Female	$1302.24 \pm 23.481^{Ab}$	$1098.83 \pm 23.906^{Aa}$	$1145.04 \pm 23.209^{Aa}$	$1182.04 \pm 14.307^{A**}$
Shank length	Male	$11.3 \pm 0.03^{Bc}$	$9.24 \pm 0.073^{Bb}$	$9.01 \pm 0.055^{Ba}$	$9.85 \pm 0.083^{**B}$
	Female	$9.88 \pm 0.039^{Ab}$	$8.11 \pm 0.050^{Aa}$	$8.19 \pm 0.052^{Aa}$	$8.73 \pm 0.051^{**A}$

<sup>a, b</sup>Values with different superscript across rows differ significantly at  $p \leq 0.05$ .

<sup>A, B</sup>Values with different superscript within columns differ significantly at  $p \leq 0.05$ .

Figures in parentheses indicate number of observations; SE, standard error of the mean.

### Correlation between body weight and shank length

In the present study, significant correlation (0.665) between body weight and shank length was observed which was in agreement to that reported in indigenous chicken of Ethiopia [17]. Thus, the results suggested that the selection of birds on the basis of shank length may cause direct improvement in body weight.

### Production performance:

The performance characteristics of indigenous chickens (Table 4) revealed that age at first egg laying of hens of Ranchi district was significantly higher ( $p \leq 0.01$ ) than other two districts. The overall value was comparable to those observed in Danki breed [25] and local bird of Banswara, Rajasthan [13]. The overall average number of eggs laid/clutch/ hen (clutch size) showed significant variations ( $p \leq 0.01$ ) between the different districts under study. This value was comparable to 4-6 eggs in Telicherry breed [24] and within the range of (5-15 eggs) clutch size reported in Hazra

chickens of Odisha [20]. The overall mean value of inter clutch interval was similar to 1-2 days reported in Telicherry breed [24] and 1.11 days reported in Kerala [12].

The annual egg production of native chicken was spread in  $3.32 \pm 0.025$  cycles separated by pause period of  $107.6 \pm 0.423$  days. The average egg production in a cycle was found to be  $13.16 \pm 0.107$ . The egg in a cycle was laid in  $2.64 \pm 0.026$  clutches and the clutches were separated by an inter-clutch interval of  $1.311 \pm 0.001$  days. The pause period covered both incubation and brooding and the overall value was found to be  $107.6 \pm 0.423$  days which agreed with  $107.05 \pm 0.52$  days in native chicken of southern Rajasthan [13]. The number of eggs per cycle and number of clutches per cycle was in agreement to that found in native chicken of Kerala [12]. The mean number of egg laying cycle of population under study showed significant differences ( $p \leq 0.05$ ) between districts. The overall value was in consistent with those reported in native chicken of Chittorgarh and Dungarpur districts of southern Rajasthan [13]. The annual egg production was significantly higher ( $p \leq$

0.05) in Ranchi, than Ramgarh and Bokaro. The overall mean number of eggs laid per hen per year was recorded to be  $43.394 \pm 0.395$  eggs. Weyuma *et al.* [27] reported annual egg production of  $44.20 \pm 9.6$  eggs for native chicken of Bishoflu; Tadele *et al.* [22] reported  $44.0 \pm 6.0$  eggs for native chicken of South western Ethiopia and Mishra *et al.* [13] reported

$43.16 \pm 0.39$  eggs for native birds of Southern Rajasthan. The overall mean percent hatchability was  $76.11 \pm 0.431$  which did not show significant variations between the districts. This value was closer to hatchability of 70-80 percent recorded for native chickens of Kerala [12] and 77-81 percent for native chickens of Kashmir [10].

**Table 4:** Production performance of indigenous chicken populations in the three districts of Chotanagpur plateau of Jharkhand (mean  $\pm$  SE).

Parameters	District (n=360)			Overall mean $\pm$ S.E.	p-value
	Ranchi (n=120)	Ramgarh (n=120)	Bokaro (n=120)		
	Mean $\pm$ S.E.	Mean $\pm$ S.E.	Mean $\pm$ S.E.		
Age at first egg laying (days)	220.43 $\pm$ 1.36	215.44 $\pm$ 1.35	213.85 $\pm$ 1.34	216.51 $\pm$ 0.902	0.0081**
Clutch size(days)	5.45 $\pm$ 0.214	5.01 $\pm$ 0.205	5.05 $\pm$ 0.206	5.16 $\pm$ 0.604	0.0047**
Clutch interval (days)	1.34 $\pm$ 0.106	1.311 $\pm$ 0.105	1.29 $\pm$ 0.104	1.311 $\pm$ 0.001	0.7553
Number of clutches per cycle	2.55 $\pm$ 0.146	2.66 $\pm$ 0.15	2.69 $\pm$ 0.15	2.64 $\pm$ 0.026	0.066
Number of eggs per cycle	13.33 $\pm$ 0.335	12.89 $\pm$ 0.3292	13.27 $\pm$ 0.339	13.16 $\pm$ 0.1073	0.2153
Cycles per year	3.41 $\pm$ 0.169	3.311 $\pm$ 0.167	3.24 $\pm$ 0.165	3.32 $\pm$ 0.025	0.0200*
Pause (days)	107.68 $\pm$ 0.951	107.12 $\pm$ 0.948	108.13 $\pm$ 0.953	107.6 $\pm$ 0.423	0.6215
Hatchability (%)	75.59 $\pm$ 0.7969	76.43 $\pm$ 0.801	76.34 $\pm$ 0.800	76.11 $\pm$ 0.431	0.6863
Annual egg production	44.90 $\pm$ 0.614	42.66 $\pm$ 0.598	42.56 $\pm$ 0.598	43.394 $\pm$ 0.395	0.024*

n= number of observations.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; SE, standard error of the mean.

## Conclusions

From the present study it may be concluded that native chickens of Chotanagpur plateau of Jharkhand had multiple variations in plumage color and physical traits. The most prevalent plumage color of male chicken in Ranchi district was mixed and red in Ramgarh and Bokaro. Whereas, prevalent plumage color of female chicken in all three districts was brown. The highest flock size, body weight and shank length was detected in the chickens of Ranchi than other districts. The birds were maintained under backyard condition with low production but they contribute to the genetic pool because of their hardiness and ability to survive and produce under rural low input conditions. The current study was one of the steps taken to document the chicken genotype in the region. However, conservation efforts need to be immediately undertaken especially to prevent the native chicken from genetic dilution with exotic breed of chicken.

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