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Growth performance, feed utilization efficiency and blood biochemical parameters of Nusuri chicken population of Odisha in floor rearing system

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ABSTRACT

A study was conducted to evaluate the performance of indigenous Nusuri chicken germplasm of Odisha maintained in floor rearing system. Seventy birds were selected for this study. Body weight and feed consumption were recorded up to 20 weeks. Feed conversion ratio (FCR), energy efficiency ratio (EER) and protein efficiency ratio (PER) were calculated. The body conformation traits (breast angle, body length, keel bone length, shank length, shank width, shank circumference, body girth, beak length, head width and height of the bird) were measured at 8th, 12th, 16th and 20th week of age. Blood was collected for estimation of haematological and serum biochemical parameters at 20th week. The day-old, 8th, 16th and 20th week body weights were 24.15, 250.92, 767.09 and 1033.38 g, respectively. The mean cumulative 8th and 20th weeks FCR was 3.74 and 5.46, respectively. The mean cumulative EER and PER was 9.07 and 1.23 at 8th week and 7.39 and 1.15 at 20th week, respectively. All recorded linear body measurements were higher in male birds than the female birds. Haematological parameters such as haemoglobin (12.27 g%), total erythrocyte count (3.57 mm^3), total leucocyte count (9.80 mm^3), packed cell volume (44.64%), mean corpuscular haemoglobin (39.49 pg), mean corpuscular volume (124.99 fL) and mean corpuscular haemoglobin concentration (27.84 g%) and serum biochemical parameters such as glucose (142.61 mg%), total protein (2.91 g%), albumin (1.86 g%), globulin (1.05 g%), urea (4.79 mg/dL), uric acid (6.00 mg/dL), cholesterol (106.74 mg/dL) and triglycerides (35.25 mg/dL) were recorded. This study provides a baseline data of growth performance, nutrient efficiency and blood metabolites of Nusuri chicken germplasm of Odisha.

Keywords: Body weight, Blood metabolites, Body conformation traits, Floor rearing, Nusuri, Odisha

In India, poultry rearing was largely a backyard venture before 1960, but today it has been transformed in to a vigorous agribusiness valued at about ₹80,000 crore (NAPEP 2017). Rural backyard poultry production plays a vital role in the rapidly growing economy of India. It provides livelihood security to the family in addition to securing the availability of food. Unemployed youth and women can also earn an income through poultry farming. Indigenous or native poultry birds are the mainstay and backbone of rural backyard small holder production system. The indigenous chickens are widely distributed in rural and peri-urban areas where they play the important role of income generation, food production and social aspect (Mwalusanya *et al.* 2001, Thornton *et al.* 2002, Moreki *et al.* 2010). They are superior in adaptability to local climate and can survive, produce and reproduce on low plane of nutrition. The indigenous chicken populations are well known for their tropical adaptability and disease resistance, while their plumage colour helps in protecting themselves against predators (Padhi 2016). Eggs and meat from indigenous chicken contribute to the protein nutrition of various household in the country. Culturally indigenous chickens have been used in traditional medicine and for various cultural rites (Moreki *et al.* 2010). The recent development of environmentally rural relations and consumer requests for food safety encourages use of indigenous chickens in a gastronomical niche market (Ekka *et al.* 2016). There is an increase in demand of local chicken meat and eggs in India owing to their unique taste and high nutritional value compared to products from exotic commercial strains. In this regard, the increased demand, need to be matched with quality which to a larger extent will depend on the management systems to be adopted.

Nusuri, a dwarf chicken population, is mostly found in Mayurbhanj district of Odisha. It is a lesser-known poultry population of Odisha having unique phenotypic characteristics. They play a major role in economic upliftment of the rural poor and marginalized section of the people besides providing them with nutritious egg and meat for consumption. These birds are well adapted to harsh environment of free range, and produce eggs and meat at least possible cost. No study has been conducted

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so far on this indigenous dwarf Nusuri chicken population and so their genetic potential needs to be exploited in floor rearing system. In the backdrop of the above facts, the present study was undertaken to evaluate the performance of Nusuri chicken population in floor rearing system.

MATERIALS AND METHODS

The experiment was conducted in the Central Poultry Development Organization (Eastern Region), Jayadev Vihar, Bhubaneswar to study the performance of Nusuri chicken population of Odisha up to 20 weeks of age under intensive system of management. The experiment was conducted during winter season. At the age of 40 weeks, female and male birds were housed in breeding pens in the ratio 8:1 in eight breeding pens each to obtain pure eggs for the lines. Day-old chicks (70) were selected for this study. All the chicks were wing-banded and day-old body weight of chicks was recorded. During brooding, chicks were provided with 0.5 ft^2 brooding space and there after 1 ft^2/chick. Routine medication and vaccination procedures were followed for all the experimental birds. Experimental diets were prepared and fed to the birds *ad lib*. The experimental diets were analyzed for proximate composition as per AOAC (2000). The composition of the starter and grower diets is given in Table 1. Clean and fresh water was made available to the birds all the time.

Body weight, weight gain and feed consumption: Body weight of all birds was recorded at day-one and at weekly interval up to 20 weeks. Body weight was recorded using a digital electronic balance nearest to 1 g accuracy. The weight gain for a particular week was calculated by subtracting the body weight of previous week from the recorded body weight of current week. The feed consumption of the experimental birds was recorded replicate-wise on weekly basis by subtracting the left-over feed at the end of the week from the total feed offered during the week.

Feed conversion ratio (FCR), energy efficiency ratio (EER) and protein efficiency ratio (PER): From the weekly weight gain and feed consumption, weekly feed conversion ratio (FCR) was calculated [FCR = Feed consumption in kg / Weight gain in kg]. From the weekly weight gain and total metabolizable energy intake, weekly energy efficiency ratio (EER) was calculated [EER = (Weight gain in g / Total ME intake) × 100]. From the weekly weight gain and total protein intake, weekly protein efficiency ratio (PER) was calculated [PER = Weight gain in g / Total protein intake in g]. Feed conversion efficiency (FCE) was calculated as weight gain in kg divided by feed consumption in kg. Similarly, protein conversion efficiency (PCE) and energy conversion efficiency (ECE) were calculated.

Body conformation traits: Body conformation traits such as breast angle (recorded with the help of a goniometer to the nearest of one degree accuracy and was measured posterior to the anterior edge of keel bone), body length (measured from the tip of the beak to the tip of the tail and expressed in cm), keel bone length (distance between the anterior end of keel bone and the point of keel (posterior end of keel bone) was taken as keel length), shank length (length between hock joint and carpal joint), shank width (measured at the centre between the hock joint and carpal joint), shank circumference (measured at the centre between the hock joint and carpal joint), body girth (measured at the centre of the girth region and expressed in cm), beak length (measured as the distance between the base and tip of the beak), head width (measured at the widest region in the head i.e. in between two eyes) and height of the bird (measured from tip of the beak to the tip of the middle toe and expressed in cm) were measured at 8th, 12th, 16th and 20th weeks following standard procedures. Except breast angle which was measured by goniometer, all other conformation traits were determined using measuring tapes (calibrated in centimeters).

Table 1. Composition of experimental diets

Particular	Starter	Grower
Ingredient composition) (% air-dry)		
Maize	50	44
Soybean meal	35	16
De-oiled rice bran	12	37
Mineral mixture[1]	3	3
Common salt	0.3	0.3
L-Lysine (98.5%)	0.1	0.05
DL-Methionine (99%)	0.1	0.05
Trace mineral[2]	0.1	0.1
Choline chloride	0.05	0.05
Toxin binder	0.2	0.2
Colistin	0.01	0.01
Bioblend	0.01	0.01
Ventribee plus	0.025	0.025
Chemical composition (% DM)		
Moisture	9.22	9.14
Crude protein	19.9	15.9
Ether extract	4.16	4.55
Crude fibre	4.23	4.91
Total ash	9.45	10.2
Acid insoluble ash	2.62	2.66
Nitrogen free extract	64.2	69.8
Calcium	0.92	0.93
Available phosphorus	0.48	0.45
Calcium: Phosphorus	1.46	1.07
Metabolizable energy (MJ/Kg)	11.3	10.7

[1]Supplied: 32% Ca, 6% P, 0.27% Mn, 0.26% Zn, 0.01% I, 0.01% Cu, 0.01% Fe, 0.03% F. [2]Supplied per kg: 15 g Cu, 1 g I, 60 g Fe, 80 g Mn, 0.3 g Se and 80 g Zn.

Blood biochemical parameters: Blood was collected from wing veins at 20 weeks for estimation of haematological and serum biochemical parameters. Blood collection was carried out at early morning and late evening. Twelve birds each from both sexes were randomly selected. Blood (5 ml) was collected from each bird and 2 ml and 3 ml were separately transferred immediately into EDTA vials and plain blood collection vials respectively for haematological and serum biochemical tests. All

haematological tests were performed within 48 h of blood collection whereas plain vials containing blood were kept overnight to facilitate serum separation and then centrifuged to obtain uniformly clear serum. Biochemical assays were performed using the standard recommended procedures. Haemoglobin was estimated by Sahli-Hellige's method. Total erythrocyte count (TEC) and total leucocyte count (TLC) were performed using Neubauer's Haemocytometer. Packed cell volume (PCV) was estimated by using Wintrobe's haematocrit method. Mean corpuscular volume (MCV) was calculated using standard formula i.e. MCV = PCV × 10/RBC count in millions. MCV was expressed in femtolitres (fL). Mean corpuscular haemoglobin (MCH) was calculated using standard formula i.e. MCH = Hb% × 10/RBC count in millions. MCH was expressed in picograms (pg). Mean corpuscular haemoglobin concentration (MCHC) was calculated using standard formula i.e. MCHC = Hb% × 100/PCV. MCHC was expressed in gram%. Blood glucose was estimated by GOD/POD method. Serum total protein was measured by Biuret method. Albumin was determined by BCG method. Triglyceride concentration was estimated by GPO/PAP method. Cholesterol was estimated by CHOD/PAP method. Urea was estimated by modified Berthelot method. Uric acid was measured by uricase/PAP method.

Elementary statistical analysis was carried out with IBM SPSS Statistics 25.0 (IBM Corp., Armonk, NY, USA). Data is presented as arithmetic mean and standard error. The data obtained was subjected to t-test to know the significance level of different parameters and declared significant at P≤0.05.

RESULTS AND DISCUSSION

Body weight and weight gain of indigenous Nusuri chicken from 0–20 weeks of age: The body weights (BW) were similar at day-old up to 3rd week, 6th week, and 8th week in both males and females (Table 2). However, there was a trend of increase in BW in males at 4th, 5th and 7th week. The BW in males was significantly higher than females from 9th to 11th week. The trend of increase in BW in males continued from 12th to 17th week of age. However, the weights were similar from 18th to 20th week of age. In male birds, the weekly weight gain was highest during 7th and 12th week which was higher than the weekly weight gain of all other weeks with significant difference (P<0.05) between them in 7th week but the difference was non-significant in 12th week. In female birds, during 6th and 18th week, weight gain was higher than other groups without any significant difference between them. When compared between the groups, male birds had significantly (P<0.05) higher weight gain in 4th, 7th and 9th week than female birds.

The mean day-old BW of indigenous Nusuri chicks was lower than other indigenous chicks of Odisha like Hansli (28.40 g; Ekka *et al.* 2016) and Hazra (31.48 g; Jha *et al.* 2013). The mean day-old BW was also lower than other chicken breeds of India like Assel (33.19 g) and Kadaknath (28.55 g) (Haunshi *et al.* 2010). Though the day-old BW of indigenous Nusuri birds (24.15 g) was lower than Kadaknath (28 g), the 4th week BW was comparable between both (111.60 g vs. 111 g) (Thakur *et al.* 2006). However, average BW of indigenous Nusuri birds from 6 to 20 weeks which ranged from 178 to 1033 g

Table 2. Weekly body weight of Nusuri chicken from 0-20 weeks of age

Age (Week)	Body weight (g)		P value	Weight gain (g)		P value
	Male (N=24)	Female (N=46)		Male (N=24)	Female (N=46)	
0 day	24.4±0.72	23.7±0.56	0.456	-	-	-
1st	34.8±1.12	34.5±0.58	0.844	10.4±1.24	10.8±0.66	0.758
2nd	65.6±4.71	63.1±2.31	0.638	30.9±1.24	28.6±2.00	0.598
3rd	91.5±6.61	84.6±3.10	0.356	25.9±2.13	21.5±1.12	0.082
4th	123±9.92	104±3.33	0.097	31.1±4.35[a]	19.7±1.60[b]	0.023
5th	152±13.4	128±4.99	0.109	29.6±4.35	24.0±2.50	0.270
6th	194±19.8	169±8.43	0.244	42.5±6.91	40.7±4.26	0.825
7th	258±24.6	208±9.92	0.074	63.5±8.27[a]	39.3±2.89[b]	0.012
8th	283±34.6	238±12.1	0.228	46.4±9.43	29.4±3.09	0.102
9th	375±41.5[a]	276±15.3[b]	0.036	70.5± 13.2	38.3±4.43	0.033
10th	445±47.0[a]	337±17.8[b]	0.043	69.9±10.1	57.2±4.74	0.267
11th	516±55.5	396±19.8	0.056	70.8±10.8	59.5±5.13	0.356
12th	604±66.8	468±22.7	0.068	88.6±14.5	72.2±6.01	0.311
13th	657±68.4	517±24.4	0.068	52.9±8.13	48.6±4.10	0.643
14th	734±76.7	580±26.8	0.073	76.9±11.0	63.6±5.29	0.198
15th	808±89.5	654±28.9	0.119	85.3±9.67	73.3±4.47	0.276
16th	869±92.9	716±31.2	0.135	61.4±6.40	62.2±5.02	0.925
17th	929±98.1	774±34.2	0.154	59.3±9.40	57.6±5.93	0.882
18th	998±99.9	855±37.8	0.198	69.2±5.83	81.5±6.70	0.174
19th	1064±100	920±38.7	0.197	66.0±6.53	65.1±4.30	0.906
20th	1132±102	984±39.5	0.194	68.1±7.40	64.0±3.36	0.617

[a,b]Mean with different superscripts in a row differ significantly (P<0.05).

was higher than the corresponding BW of Kadaknath which ranged from 168 to 868 g (Thakur *et al.* 2006). From the present findings, it may be inferred that the BW of the indigenous Nusuri chicks is lower than the BW of most of the indigenous/non-descript poultry breeds at similar age but higher than Kadaknath breed. The BW obtained in this study also showed that the indigenous birds are of the light ecotype class, as described by Atteh *et al.* (1990). The study further revealed that the indigenous birds have not undergone appreciable gene mixing with the exotic breeds, otherwise their body weight could have been high. Sexual dimorphism with respect to body weight was also expected due to differential growth rates of the males and females.

Feed and nutrient utilization efficiency of indigenous Nusuri chicken from 1-20 weeks of age: The mean daily feed intake pattern showed a gradual increase with advancing period of experimentation from 26.67 g/bird during the first week to 128.89 g/bird at the 8th week, and 266.67 g/bird during the 9th week to 460.00 g/bird at the 20th week for Nusuri chicken. At the completion of 20th week, the cumulative feed intake was 5150.44 g/bird, for Nusuri bird.

The FCR (feed conversion ratio) of indigenous Nusuri chicken was 2.49 (during 1st week) and 4.70 (during 9th week) (Table 3). The cumulative FCR of indigenous Nusuri chicken was 3.74 (at 8th week) and 5.46 (at 20th week). The 5th week FCR of Nusuri chicken reported in the present study (3.18) was lower than that reported in native germplasm (3.31) maintained at Assam AICRP centre. The 8th week FCR of indigenous Nusuri chicken recorded in the present investigation (3.74) was higher than that reported in native germplasm (3.08) maintained at Bengaluru AICRP centre. Faruque *et al.* (2013) recorded FCR of 3.58, 3.45 and 3.34 up to 8 weeks of age in three indigenous breeds. Ogbu *et al.* (2015) reported FCR as 8.11 and 5.11 in light and heavy indigenous chicken breeds, respectively, up to 8 weeks of age.

Highest EER was observed in 2nd week (17.7) during starter stage and in 12th (10.48) week during grower stage respectively (Table 3). At the end of 8th week, cumulative EER was 9.07. Highest ECE was observed in 8th week (0.16) and cumulative ECE was 0.11 at end of 8th week. Highest ECE was observed in 17th week (0.18) during grower phase. At the end of 20th week, cumulative EER was 7.39 and cumulative ECE was 0.14. Highest PER and PCE was observed in 2nd week (2.39) and 8th week (1.19) respectively. At the end of 20th week, cumulative PER was 1.15 and cumulative PCE was 0.87 (Table 3).

Body conformation traits: The height and body length were higher in male birds than that of female birds with significant difference ($P<0.05$) at 16th and 20th week (Table 4). The keel length was longer in male birds with significant difference at 16th week. The measurements of shank length, shank width, shank circumference, body girth, beak length and head width of the birds also followed the similar trend to that of keel length measurements. The circumference of the shank was significantly ($P\leq0.05$) higher in male than female birds at 8th, 12th, 16th and 20th week. Moreover, shank length and shank width were also significantly ($P\leq0.05$) higher in male than female birds at 16th and 20th week. Body girth, beak length and head width were higher numerically in male birds than female

Table 3. Feed intake and feed utilization efficiency of Nusuri chicken for 1-20 weeks of age

Age (week)	FI (g)	Cum. FI (g)	FCR	Cum. FCR	FCE	Cum. FCE	EER	Cum. EER	ECE	Cum. ECE	PER	Cum. PER	PCE	Cum. PCE
1st	26.7	26. 7	2.49	2.49	0.22	0.22	8.19	8.19	0.12	0.12	1.11	1.11	0.90	0.90
2nd	80.0	107	2.72	2.66	0.48	0.38	17.7	13.94	0.06	0.07	2.39	1.89	0.42	0.53
3rd	71.1	178	3.09	2.82	0.31	0.35	11.5	12.94	0.09	0.08	1.56	1.75	0.64	0.57
4th	75.6	253	3.31	2.95	0.20	0.30	7.49	11.26	0.13	0.09	1.01	1.52	0.99	0.66
5th	100	353	3.94	3.18	0.22	0.28	8.16	10.29	0.12	0.10	1.10	1.39	0.91	0.72
6th	164	517	4.03	3.41	0.25	0.27	9.11	9.94	0.11	0.10	1.23	1.34	0.81	0.74
7th	207	724	4.28	3.62	0.23	0.26	8.50	9.61	0.12	0.10	1.15	1.30	0.87	0.77
8th	129	853	4.60	3.74	0.17	0.25	6.20	9.07	0.16	0.11	0.84	1.23	1.19	0.82
9th	267	1119	4.70	3.93	0.22	0.24	8.44	8.96	0.12	0.11	1.36	1.25	0.74	0.80
10th	306	1425	5.11	4.13	0.23	0.24	8.77	8.93	0.11	0.11	1.41	1.27	0.71	0.79
11th	342	1767	5.60	4.33	0.23	0.24	9.13	8.96	0.11	0.11	1.47	1.30	0.68	0.77
12th	433	2200	5.59	4.53	0.27	0.24	10.5	9.18	0.10	0.11	1.69	1.35	0.59	0.74
13th	286	2486	5.85	4.65	0.16	0.23	6.09	8.76	0.16	0.11	0.98	1.30	1.02	0.77
14th	409	2895	5.92	4.79	0.19	0.22	7.47	8.59	0.13	0.12	1.20	1.29	0.83	0.77
15th	462	3357	5.98	4.93	0.16	0.22	6.11	8.30	0.16	0.12	0.98	1.26	1.02	0.80
16th	396	3753	6.39	5.05	0.16	0.21	6.21	8.07	0.16	0.12	1.00	1.23	1.00	0.81
17th	398	4150	6.84	5.18	0.14	0.20	5.61	7.82	0.18	0.13	0.90	1.20	1.11	0.83
18th	540	4690	6.98	5.34	0.17	0.20	6.67	7.70	0.15	0.13	1.07	1.19	0.93	0.84
19th	460	5150	7.04	5.46	0.15	0.20	5.89	7.54	0.17	0.13	0.95	1.17	1.06	0.86
20th	467	5617	7.14	5.46	0.15	0.19	5.77	7.39	0.17	0.14	0.93	1.15	1.08	0.87

FI, Feed intake; FCR, feed conversion ratio; FCE, feed conversion efficiency; EER, energy efficiency ratio; ECE, energy conversion efficiency; PER, protein efficiency ratio; PCE, protein conversion efficiency.

Table 4. Body conformation traits of Nusuri chicken at different periods

Attribute	Age (week)	Male	Female	P value
Breast angle (degree)	8th	40.44±1.50	40.06±1.05	0.836
	12th	47.27±1.21	44.92± 0.79	0.116
	16th	52.40±1.10	50.13±0.82	0.111
	20th	53.70±2.06	49.85±1.64	0.153
Height (cm)	8th	25.33±0.69	24.46±0.52	1.505
	12th	31.61±1.49	29.51±1.49	1.060
	16th	40.80±1.40[a]	35.73±1.01[b]	0.006
	20th	45.64±2.21	40.71±1.34	0.067
Body length (cm)	8th	25.55± 0.81	24.46±0.45	0.256
	12th	30.27±1.11	29.60±0.54	0.592
	16th	36.23±0.92[a]	32.80±0.65[b]	0.005
	20th	38.94±1.85[a]	34.00±1.10[b]	0.030
Keel length (cm)	8th	6.22±0.28	5.81±0.13	0.209
	12th	7.52±0.32	7.25±0.19	0.470
	16th	10.14±0.35[a]	9.01±0.23[b]	0.013
	20th	24.76±0.56	21.78±0.33	0.132
Shank length (cm)	8th	6.31±0.30	5.95±0.14	0.289
	12th	8.05±0.29	7.78±0.17	0.442
	16th	10.80±0.34[a]	9.10±0.23[b]	0.0003
	20th	10.98±0.66[a]	9.35±0.35[b]	0.040
Shank width (cm)	8th	0.71 ±0.04	0.63±0.02	0.141
	12th	0.84±0.03	0.78±0.02	0.160
	16th	1.11±0.04[a]	0.94±0.02[b]	0.001
	20th	1.22±0.07[a]	1.02±0.04[b]	0.032
Shank circumference (cm)	8th	3.31±0.10[a]	2.99±0.04[b]	0.010
	12th	3.80±0.10[a]	3.54±0.06[b]	0.047
	16th	4.34±0.08[a]	3.77±0.07[b]	0.00002
	20th	4.51±0.19[a]	3.97±0.11[b]	0.023
Body girth (cm)	8th	16.69±0.71	15.99±0.04	0.268
	12th	21.00±0.87	20.21±0.48	0.438
	16th	24.34±0.08[a]	22.18±0.80[b]	0.014
	20th	25.82±1.15	23.57±0.79	0.118
Beak length (cm)	8th	2.25±0.07	2.21±0.03	0.625
	12th	2.67±0.05	2.63±0.04	0.619
	16th	2.91±0.05[a]	2.71±0.02[b]	0.003
	20th	2.93±0.09	2.70±0.05	0.079
Head width (cm)	8th	2.06±0.07	2.05±0.04	0.936
	12th	2.38±0.05	2.30±0.03	0.213
	16th	2.55±0.04	2.43±0.04	0.073
	20th	2.72±0.09	2.56±0.06	0.182

[a,b] Mean with different superscripts in a row differ significantly (P≤0.05).

birds with significant difference at 16th week of age.

The shank length (male: 6.31 cm and female: 5.95 cm), keel length (male: 6.22 cm and female: 5.81 cm) and breast angle (male: 40.44º and female: 40.06º) of Nusuri chicks were lower than the values reported in Hansli breed of Odisha (shank length: 7.96 cm in male and 6.96 cm in female; keel length: 7.6 cm in male and 6.64 cm in female; breast angle: 43.72º in male and 42.41º in female) and higher than the values reported in native germplasm maintained by CARI, Izatnagar (shank length: 5.05 cm and keel length: 6.06 cm) at 8th week of age with the exception of breast angle which was lower in Nusuri chicks than the values reported in native germplasm maintained by CARI, Izatnagar centre (45.50º) at 8th week of age. Chatterjee *et al.* (2002) observed the shank length, keel length and breast angle of Kadaknath and Aseel to be 7.75 cm, 6.89 cm and 70.45º and 9.52 cm, 8.40 cm and 81.65º, respectively at 15th week. In the present study, the linear body measurements of male birds were higher than female birds. Similar to the present findings, Nandi *et al.* (2017) and Mishra (2016) also observed higher values with significant difference (P<0.05) with respect to parameters such as body length, body girth, keel length, shank length, shank width, and shank circumference in males than females at 8th, 12th, 16th and 20th week in Hansli breed of Odisha.

Blood biochemical parameters of indigenous Nusuri chicken: The haemoglobin (g%) of male birds (12.45±0.36) was higher than that of female birds (11.94±0.53) without any significance (Table 5). Total erythrocyte count (TEC) (mm^3) was lower in male (3.54±0.03) than that of female (3.63±0.05) birds without any significance. Lower value of total leucocyte count (TLC) (mm^3) was observed in male (9.74±0.16) than female (9.89±0.47) birds. Higher packed cell volume (PCV) was observed in male (44.68±1.14%) followed by female (44.55±1.7%) birds. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) also followed the similar trend to that of haemoglobin. The MCH (p.gm) was 39.91±1.01 and 38.74±1.59 for male and female birds, respectively. The MCV (f.L.) was 126.25±3.61 and 122.75±4.87 for male and female birds, respectively. Maximum MCHC (g%) was observed in male birds (28.22±1.24) followed by female birds (27.17±1.73). In the present study, similar haematological profile was observed between male and female chicks. In contrast, Albokhadaim *et al.* (2012) observed higher TEC, TLC and PCV values in male than female chicks. Similar to the present findings, haemoglobin and blood indices were not significantly different in all birds (Albokhadaim *et al.* 2012). The haemoglobin and PCV values were close to 13.68% and 41%, respectively reported by Ladokun *et al.* (2008) in Nigerian indigenous naked neck chickens but the MCV, MCH and MCHC values were higher than that reported by Ladokun *et al.* (2008).

The glucose (mg%) of male birds (146.45±4.69) was higher than that of female birds (140.45±7.49) without any significance. Total protein (gm%) was higher in male (2.98±0.15) than that of female (2.88±0.13) birds without any significance. Higher albumin (gm%) was observed in male (1.86±0.09) than female (1.86±0.07) birds. Higher globulin (gm%) was observed in male (1.12±0.14) followed by female (1.01±0.09) birds. The urea, uric acid, cholesterol and triglycerides were opposite to that of glucose and total protein. The urea (mg/dl) was significantly (P≤0.05) lower in male birds (4.18±0.20)

Table 5. Blood biochemical parameters of Nusuri chicken at 20 weeks of age

Parameter	Male	Female	P value
Haematological parameters			
Haemoglobin (g%)	12.5±0.36	11.9±0.53	0.440
TEC (mm^3)	3.54±0.03	3.63±0.05	0.206
TLC (mm^3)	9.74±0.16	9.89±0.47	0.767
PCV (%)	44.7±1.14	44.6±1.75	0.950
MCH (p.g.)	39.9±1.01	38.7±1.59	0.263
MCV (f.L.)	126±3.61	123±4.87	0.571
MCHC (g%)	28.2±1.24	27.2±1.73	0.628
Serum biochemical parameters			
Glucose (mg%)	146±4.69	140±7.49	0.504
Total protein (g%)	2.98±0.15	2.88±0.13	0.614
Albumin (g%)	1.86±0.09	1.86±0.07	0.938
Globulin (g%)	1.12±0.14	1.01±0.09	0.512
Urea (mg/dL)	4.18±0.20[b]	5.13±0.20[a]	0.003
Uric acid (mg/dL)	5.05±0.43[b]	6.54±0.43[a]	0.025
Cholesterol (mg/dL)	106±4.43	107±2.42	0.803
Triglycerides (mg/dL)	29.2±4.97	38.7±4.93	0.191

than female birds (5.13±0.20). The uric acid (mg/dL) was significantly (P≤0.05) lower in male birds (5.05±0.43) than female birds (6.54±0.43). The cholesterol (mg/dL) was 105.92±4.43 and 107.21±2.42 for male and female birds, respectively. Minimum triglycerides (mg/dL) was observed in male birds (29.20±4.97) followed by female birds (38.65±4.93). The serum cholesterol was 106.74 mg/dl in the present study. Similar to the present findings, Durotoye *et al.* (2000) reported cholesterol as 104.7 mg/dL in the chicken in the hot tropical climate. In contrast to the present findings, Durotoye *et al.* (2000) reported higher urea (22.9 mg/dl) and lower total protein (6.18 mg/dl). Similar to the present findings, Aengwanich *et al.* (2004) also reported uric acid to be 5 mg/dL and cholesterol 102.4 mg/dL in Thai native chickens. In contrast to the present findings, Hernawan *et al.* (2012) observed comparatively higher glucose values (166.46 to 173.32 mg/dL) and triglyceride levels (77.45-87.26 mg/dL) in broilers. In Khazak native chicken, Jahantigh *et al.* (2015) reported similar values of albumin (male: 2.07 g/dL, female: 2.76 g/dL), total protein (male: 4.12 g/dL, female: 4.81 g/dL), and uric acid (male: 5.48 mg/dL, female: 4.83 mg/dL) as reported in the present study. Result of the present study though corroborated with earlier studies, is at variance with some others. This is not unexpected as it has been shown that several ambient factors like photoperiod, feed availability, temperature, geographical location etc., affect the physiology of birds under natural condition.

This research provides a baseline data on performance of Nusuri, an indigenous dwarf chicken germplasm of Odisha. Better growth and production performance can be obtained by genetic improvement through selective breeding. Realizing the uniqueness in disease resistance and low-input system of rearing, it may be registered as a breed by National Bureau of Animal Genetic Resources (NBAGR), Karnal and efforts may be made towards its conservation and improvement.

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REFERENCES

Aengwanich W, Simaraks S and Chinrasri O. 2004. Haematological, electrolyte and serum biochemical values of the Thai indigenous chickens (*Gallus domesticus*) in northeastern, Thailand, Songklanakarin. *Journal of Science and Technology* **26**(3): 425–30.

Albokhadaim I. 2012. Haematological and some biochemical values of indigenous chickens in Al-Ahsa, Saudi Arabia during summer season. *Asian Journal of Poultry Science* **6**: 138–45.

AOAC. 2000. *Official Methods of Analysis* (17th ed.). Association of Official Analytical Chemists, Washington, DC.

Chatterjee R N, Ahlawat S P S, Yadav S P, Senani S, Kundu A, Jeya Kumar S *et al.* 2002. Comparative growth performance of Nicobari fowl and their cost effectiveness under backyard and intensive system. *Indian Journal of Poultry Science* **37**: 63–66.

Ekka R, Behura N C, Samal L, Nayak G D, Pati P K and Mishra P K. 2016. Growth performance and linear body measurements of Hansli, CSML and Hansli × CSML cross under intensive system of rearing. *Journal of Livestock Science* **7**: 114–21.

Faruque S, Islam M S, Afroz M A and Rahman M M. 2013. Evaluation of the performance of native chicken and estimation of heritability for body weight. *Journal of Bangladesh Academy of Sciences* **37**(1): 93–101.

Haunshi S, Niranjan M, Shanmugam M, Padhi M K, Reddy M R, Sunitha R, Rajkumar U and Panda A K. 2010. Characterization of two Indian native chicken breeds for production, egg and semen quality and welfare traits. *Poultry Science* **90**(2): 314–20.

Hernawan E, Wahyuni S and Suprapti H. 2012. The levels of blood glucose, triglyceride, final body weight and abdominal fat percentage of broiler under sex-separated and straight run rearing system. *University of Agricultural Sciences and Veterinary Medicine Iasi* **57**: 28–33.

Jha D K and Prasad S. 2013. Performance of improved varieties and indigenous breed of chicken in Jharkhand. *Indian Journal of Poultry Science* **48**(1): 109–12.

Ladokun A O, Yakubu A, Otite J R, Omeje J N, Sokunbi O A and Onyeji E. 2008. Haematological and serum biochemical indices of naked neck and normally feathered Nigerian indigenous chickens in a sub humid tropical environment. *International Journal of Poultry Science* **7**(1): 55–58.

Mishra R C. 2016. 'Effects of dietary crude protein levels on performance of Hansli birds under intensive system of management.' M.V.Sc. Thesis, College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar.

Moreki J C, Dikeme R and Poroga B. 2010. The role of village poultry in food security and HIV/AIDS mitigation in Chobe District of Botswana. *Livestock Research for Rural Development* **22**: 5.

Mwalusanya N A, Katule A M, Mutayoba S K, Mtambo M M A, Olsen J E and Minga U M. 2001. Productivity of local chickens under village management conditions. *Tropical Animal Health and Production* **34**: 405–16.

Nandi B, Samal L, Behura N C, Nayak G D and Das D P. 2017. Growth, efficiency and body conformation traits of Hansli breed of Odisha under intensive management system. *Journal of Entomology and Zoology Studies* **5**(6): 2398–2403.

NAPEP (National Action Plan for Egg & Poultry)-2022 For Doubling Farmers Income by 2022. 2017. Department of Animal Husbandry, Dairying & Fisheries Ministry of Agriculture & Farmers Welfare Government of India. Accessed Feb. 2020. https://dahd.nic.in/sites/default/filess/Seeking%20Comments%20on%20National%20Action%20Plan-%20Poultry-%202022%20by%2012-12-2017.pdf.

Ogbu Cosmas C, Joseph J, Tule, Chijioke C and Nwosu. 2013. Effect of genotype and feeding plan on growth and laying parameters of nigerian indigenous chickens. *Global Journal of Biology, Agriculture and Health Sciences* **4**(1): 251–56.

Padhi M K, Rajkumar U, Haunshi S, Niranjan M, Panda A K, Bhattacharya T K, Reddy M R, Bhanja S K and Reddy B L N. 2012. Comparative evaluation of male line of Vanaraja, control broiler, Vanaraja commercial in respect to juvenile and carcass quality traits. *Indian Journal of Poultry Science* **47**(2): 136–39.

Thornton P K, Kruska R L, Henniger N, Kristjanson P M, Atieno F, Odero E N and Ndegwa T. 2002. Mapping poverty and Livestock in Developing World. ILRI, Nairobi, Kenya, 124.