Indian Journal of Animal Sciences **92** (12): 1445–1450, December 2022/Article
https://doi.org/10.56093/ijans.v92i12.102484

Feed and nutrient utilization efficiency and juvenile traits of Vezaguda chicken of Odisha in floor rearing system

A L PATRA[1], L SAMAL[1]✉, N C BEHURA[1], N SAHOO[1], D P DAS[1], A CHAMPATI[1], S MUDULI[1] and H K POPALGHAT[1]

Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751 003 India

Received: 16 July 2020; Accepted: 17 October 2022

ABSTRACT

A study was conducted to evaluate the performance of Vezaguda, an indigenous chicken population of Odisha, up to 8 weeks of age in floor rearing system. Unsexed day-old chicks (100) were selected for this study. Mortality and feed intake were recorded daily while body weight was recorded weekly. Body conformation traits such as shank length, shank circumference, shank width, thigh length, chest girth, keel length, body length, height, back length, wing length, folded wing length, wing span, neck length, head length, skull length, head width, beak length and breast angle were measured at 6th and 8th weeks of age. The 8th week body weight of male and female chicks were 501.58±21.64 g and 423.35±13.44 g, respectively. The cumulative feed conversion ratio (FCR), energy efficiency ratio (EER), and protein efficiency ratio (PER) at 8th week were 4.00±0.06, 8.73±0.12, and 1.25±0.02, respectively. An index of productivity, production efficiency factor (PEF) was calculated taking into account final weight, liveability %, age of the bird and FCR. The PEF at 8th week was 16.38±0.46. At 6th week of age, all recorded conformation traits were higher in male chicks than that of female chicks. At 8th week of age, chest girth, skull length and beak length were significantly higher in male chicks than that of female chicks.

Keywords: Body conformation traits, Feed efficiency, Growth performance, Intensive system, Vezaguda chicken

In India, poultry rearing was largely a backyard venture before 1960s, but today it has been transformed into a vigorous agribusiness with annual turnover of ₹49,000 crores (Ali 2015). In a developing country like India, rural poultry production is of great importance as a prime supplier of eggs and meat and as a source of subsidiary income for the rural poor and marginalised section of the society. An indigenous or native chicken accounts about 49.5% of total chicken population in India (Vetrivel and Chandrakumarmangalam 2013). They are well known for their tropical adaptability, relative resistance to some infectious diseases, and outstanding meat flavour and taste, ability to convert poor quality feed into valuable and high quality protein while their plumage colour helps in protecting themselves against predators (Doviet 2005, Fanatico *et al.* 2005, Mengesha 2012, Padhi 2016).

A native chicken population called 'Vezaguda' is found in Malkangiri district and Jeypore sub-division of Koraput district of Odisha and adjoining areas of Andhra Pradesh. Koya, Matia, Dhulia and Bhumia tribes and Dom community of Koraput have primarily been responsible for the development of Vezaguda fowls (Sethi 2007). These birds are preferred over commercial exotic or synthetic broilers for their palatability of meat in the local areas and fetch a higher price too, even more than 2-3 folds during major social and religious festivals (Kryger *et al.* 2010). These chicken are well adapted to the hot and humid tropical climates of Odisha and have been traditionally reared for meat, egg as well as for game purpose. They are resistant to worm infection like nematodes and tapeworms (Mohapatra *et al.* 2006). They have ability to survive, produce, and reproduce in low plane of nutrition and in harsh environmental conditions. Although few literatures are available on the characteristics of Vezaguda chicken in rural backyard conditions (Mohapatra *et al.* 2006), their genetic potential needs to be exploited in intensive system. In the backdrop of the above facts, the present study was undertaken to evaluate the performance of Vezaguda chicken with respect to their juvenile growth, feed conversion efficiency and body conformation traits in intensive system of management.

MATERIALS AND METHODS

Experimental birds, feeding and management: One hundred (100) unsexed day-old chicks were used in the experiment. All the chicks were wing banded and day-old body weights were recorded. Birds were housed in floor system on deep litter in conventional open-sided house and similar management practices were followed for all

Present address: [1]College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha. ✉Corresponding author e-mail: lipismitasamal@gmail.com

the chicks throughout the experimental period. Proper floor space, feeder space and waterer space was given according to their body weight and age. Routine medication and vaccination procedures were followed for all the experimental birds. All the birds were immunized against Marek's disease on 1st day using HVT strain, Ranikhet disease (RD) or Newcastle disease (ND) on 5th and 28th day using LaSota strain, infectious bursal disease (IBD) on 14th and 35th day, fowl pox on 42nd day and 12th week, RD using R_2B strain at 8th and 16th weeks, ND-IBD killed vaccine at 18th week. Clean and fresh water was made available to the birds all the time. A starter diet with 20% crude protein (CP) and 2866 kcal metabolizable energy (ME)/kg was prepared (Table 1) and fed to the chicks *ad lib*. The experimental diet was analyzed for proximate composition as per AOAC (2000). Mortality was recorded daily and percentage mortality was calculated.

Table 1. Composition of starter diet

Indices	Content
Ingredient composition	g/kg air-dry
Maize	600
Soyabean meal	275
De-oiled rice bran	95
Mineral mixture[1]	21
Common salt	3
L-Lysine (98.5%)	1
DL-Methionine (99%)	1
Trace mineral[2]	1
Choline chloride	0.5
Toxin binder	2
Colistin	0.1
Bioblend	0.1
Ventribee plus	0.3
Chemical composition	g/kg DM
Dry matter (DM)	910.3
Organic matter (OM)	815.8
Crude protein (CP)	197.9
Ether extract (EE)	40.5
Crude fibre (CF)	46.3
Total ash	94.5
Nitrogen-free extract (NFE)[3]	620.8
Calcium	9.1
Phosphorus	4.6
Calculated values	
Metabolizable energy (kcal/kg)	2866
Crude protein (g/kg)	199.3
Lysine (g/kg)	9.3
Methionine (g/kg)	4.6
Methionine + Cystine (g/kg)	7.3
Energy: Protein	143.81

[1]Supplied g/kg: Ca 320, P 60, Mn 2.7, Zn 2.6, I 0.1, Cu 0.1, Fe 0.1, F 0.3; [2]Supplied g/kg: Cu 15, I 1, Fe 60, Mn 80, Se 0.3, Zn 80; [3]Calculated as: OM − (CP + EE +CF).

Protocol design: Body weight of birds was recorded individually at day-old followed by weekly intervals up to 8 weeks of age using a digital electronic balance nearest to 1.0 g accuracy. The body weight gain was calculated by subtracting the initial body weight from final body weight of the periods and cumulative gains for successive weeks were calculated. The feed consumption of the experimental birds was recorded replicate-wise on weekly basis by subtracting the residual feed at the end of the week from total feed offered during the week. Cumulative feed intake (g/bird) was calculated by dividing total feed intake by the birds up to a particular week from number of birds. Week-wise feed conversion ratio (FCR) was calculated from weekly body weight gain and weekly feed consumed. Similarly, cumulative FCR was calculated from cumulative body weight gain and cumulative feed consumed. From the weekly BW, feed CP and ME intake data, feed conversion ratio (FCR = Feed consumption in kg / Body weight gain in kg), feed conversion efficiency (FCE = Body weight gain in kg / Feed consumption in kg), energy efficiency ratio [EER = (Weight gain in g / Total ME intake in Kcal) × 100], energy conversion efficiency [ECE = (Total ME intake in Kcal / Weight gain in g) × 100], protein efficiency ratio (PER = Weight gain in g / Total protein intake in g), protein conversion efficiency (PCE = Total protein intake in g / Weight gain in g) and production efficiency factor [PEF = (Final weight in kg × Liveability % × 100) / (Age in days × FCR)] were calculated (Mishra 2016).

Juvenile traits such as shank length (taken from the posterior aspect of the hock joint to the foot pad), shank circumference (taken at the centre between the hock joint and carpal joint), shank width (taken at the centre between the hock joint and carpal joint), thigh length, chest girth (measured at the centre of the girth region and expressed in cm), keel length [distance between the anterior end of keel bone and the point of keel (posterior end of keel bone) was taken as keel length], body length (taken from the tip of the beak to the tip of the tail and expressed in cm), height (taken from tip of the beak to the tip of the middle toe and expressed in cm), back length, wing length (taken from the tip of the outstretched wing to the base), folded wing length, wing span, neck length, head length, skull length, head width (measured at the widest region in the head in between two eyes), beak length (was taken as the distance between tip of the beak and the base) and 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) were measured at 6th and 8th weeks of age following standard procedures. Except breast angle which was measured by goniometer, all other body conformation traits were determined using measuring tapes (calibrated in centimetres).

Statistical analysis: Data collected were subjected to t-test to know the significance level of different parameters. The results were presented as least square means ± standard error (SE) and the difference between means was declared significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Body weight and weight gain: The male chicks and female chicks grew from their initial body weight of 37.33±0.51 and 36.53±0.36 g to 8th week body weight of 501.58±21.64 and 423.35±13.44 g, respectively (Table 2). The mean day-old body weight of Vezaguda chicks was higher than Hansli (Ekka *et al.* 2016, Nandi *et al.* 2017) and Nusuri (Mohanta *et al.* 2022) chicks of Odisha, Nigerian indigenous chicken (Ogbu *et al.* 2015), indigenous chicken of Assam (Pathak 2013), Aseel and Kadaknath chicks (Haunshi *et al.* 2011), Hazra chicks (Jha *et al.* 2013), non-descript desi, hilly, naked neck chicks (Faruque *et al.* 2013), Fayoumi chicks (Khawaja *et al.* 2012), indigenous Horro chicken of Ethiopia (Dana *et al.* 2010). The 6th week body weight of Vezaguda chicks was higher than that of Nusuri chicks (Mohanta *et al.* 2022), Hazra (Jha *et al.* 2013), Aseel and Kadaknath (Haunshi *et al.* 2011), indigenous chicken, Horro in Ethiopia (Dana *et al.* 2010). However, the body weight of Vezaguda chicks at 6th week was lower than Hansli chicks (Ekka *et al.* 2016, Nandi *et al.* 2017). The 8th week body weight of Vezaguda chicks was higher than that of Hansli (Nandi *et al.* 2017), Nusuri (Mohanta *et al.* 2022), Nigerian indigenous chicken (Ogbu *et al.* 2015), Hazra (Jha *et al.* 2013), Aseel and Kadaknath (Haunshi *et al.* 2011), non-descript desi, hilly, naked neck chicks (Faruque *et al.* 2013).

In both male and female chicks, the weekly body weight gain was highest during 8th week. Male chicks had significantly (P≤0.05) higher body weight gain in 5th and 7th weeks than female chicks. From the present findings, it may be inferred that the body weight of the Vezaguda chicks were higher than the body weight of Hansli, Nusuri, Aseel, Kadaknath, Hazra, Naked neck, and many indigenous poultry birds at similar age. 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: The 8th week cumulative FCR of Vezaguda was recorded as 4.87 in the present investigation (Table 3). The FCR value was higher than the FCR value reported in Hansli (4.52; Nandi *et al.* 2017), Nusuri (3.74; Mohanta *et al.* 2022), native germplasm (3.08) maintained at Bengaluru AICRP centre. Khandoker

Table 2. Mean (±S.E.) body weight and body weight gain of Vezaguda chicken during juvenile phase

Age	Body weight (g)		T-value	P-value	Body weight gain (g)		T-value	P-value
	Male (N=24)	Female (N=68)			Male (N=24)	Female (N=68)		
Day-old	37.33±0.51	36.53±0.36	-0.450	0.657	-	-	-	-
1st week	53.04±1.41	51.54±0.92	-1.884	0.072	15.71±1.33	15.01±0.87	-1.858	0.076
2nd week	81.42±3.10	78.56±1.83	-1.394	0.177	28.38±2.26	27.01±1.18	-0.734	0.470
3rd week	114.75±5.23	108.50±2.33	-1.094	0.285	33.33±3.32	29.94±1.29	-0.117	0.908
4th week	152.50±8.05	139.50±3.55	-1.203	0.241	37.75±3.41	31.00±1.48	-1.127	0.271
5th week	235.04±11.52	203.78±5.82	-2.015	0.056	82.54±6.84[a]	64.28±3.15[b]	-2.284	0.032
6th week	305.92±13.51	273.44±6.98	-1.796	0.086	70.88±4.22	69.66±2.56	-0.100	0.921
7th week	395.33±17.06[a]	339.41±9.89[b]	-2.539	0.018	89.42±7.58[a]	65.97±4.53[b]	-3.335	0.003
8th week	501.58±21.64[a]	423.35±13.44[b]	-2.312	0.030	106.25±7.99	83.94±5.99	-1.454	0.160

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

Table 3. Mean (±S.E.) feed and nutrient utilization efficiency of Vezaguda chicken during juvenile phase

Parameter	Age (weeks)							
	1st	2nd	3rd	4th	5th	6th	7th	8th
PEF	25.47±0.59	20.19±0.08	18.56±0.44	16.00±0.40	17.25±0.48	15.56±0.24	15.72±0.34	16.38±0.46
FCR	2.68±0.02	2.81±0.04	2.83±0.03	3.20±0.05	3.53±0.03	4.33±0.04	4.62±0.06	4.87±0.13
Cum. FCR	2.68±0.02	2.76±0.02	2.79±0.02	2.92±0.03	3.16±0.03	3.49±0.04	3.75±0.04	4.00±0.06
FCE	0.37±0.003	0.36±0.004	0.35±0.004	0.31±0.004	0.28±0.003	0.23±0.002	0.22±0.003	0.21±0.006
Cum. FCE	0.37±0.003	0.36±0.004	0.35±0.004	0.31±0.004	0.28±0.003	0.23±0.002	0.22±0.003	0.21±0.006
EER	13.00±0.10	12.42±0.16	12.32±0.15	10.90±0.15	9.89±0.10	8.06±0.08	7.55±0.09	7.18±0.19
Cum. EER	13.00±0.10	12.62±0.09	12.49±0.11	11.95±0.12	11.04±0.09	9.99±0.10	9.30±0.10	8.73±0.12
ECE	0.08±0.001	0.08±0.001	0.08±0.001	0.09±0.001	0.10±0.001	0.12±0.001	0.13±0.002	0.14±0.004
Cum. ECE	0.08±0.001	0.08±0.001	0.08±0.001	0.08±0.001	0.09±0.001	0.10±0.001	0.11±0.001	0.11±0.002
PER	1.86±0.01	1.78±0.02	1.76±0.02	1.56±0.02	1.42±0.01	1.15±0.01	1.08±0.01	1.03±0.03
Cum. PER	1.86±0.01	1.81±0.01	1.79±0.02	1.71±0.02	1.58±0.01	1.43±0.01	1.33±0.01	1.25±0.02
PCE	0.54±0.00	0.56±0.01	0.57±0.01	0.64±0.01	0.71±0.01	0.87±0.01	0.92±0.01	0.97±0.03
Cum. PCE	0.54±0.004	0.55±0.004	0.56±0.005	0.58±0.006	0.63±0.005	0.70±0.007	0.75±0.008	0.80±0.011

PEF, production efficiency factor; 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. Mean (±S.E.) body conformation traits of Vezaguda chicken at 6th and 8th weeks of age

Attribute	Age (weeks)	Male (N=24)	Female (N=68)	T-value	P-value
Shank Length (cm)	6th	4.83±0.07[a]	4.47±0.03[b]	-11.000	0.008
	8th	5.23±0.17	4.57±0.07	-2.857	0.104
Shank Circumference (cm)	6th	2.70±0.10	2.30±0.06	-3.464	0.074
	8th	2.97±0.13	2.57±0.03	-2.619	0.120
Shank Width (cm)	6th	0.93±0.07	0.73±0.03	-3.464	0.074
	8th	0.97±0.03	0.81±0.05	-0.927	0.452
Thigh Length (cm)	6th	7.47±0.13[a]	6.93±0.07[b]	-8.000	0.015
	8th	8.27±0.44	7.47±0.15	-2.667	0.117
Chest Girth (cm)	6th	19.33±0.67[a]	16.67±0.33[b]	-8.000	0.015
	8th	19.43±0.82[a]	17.80±0.70[b]	-13.590	0.005
Keel Length (cm)	6th	7.67±0.33[a]	5.93±0.07[b]	-6.500	0.023
	8th	7.73±0.47	6.20±0.06	-2.963	0.098
Body Length (cm)	6th	25.33±0.67[a]	21.77±0.54[b]	-7.585	0.017
	8th	26.37±1.13	24.27±0.63	-4.200	0.052
Height (cm)	6th	30.67±1.33	27.00±0.29	-3.355	0.079
	8th	39.07±2.03	34.40±0.15	-2.478	0.132
Back Length (cm)	6th	13.83±0.17[a]	13.00±0.29[b]	-5.000	0.038
	8th	14.17±0.46	13.83±0.17	-3.941	0.059
Wing Length (cm)	6th	15.17±0.33[a]	13.83±0.17[b]	-8.000	0.015
	8th	15.40±0.30	13.87±0.22	-2.963	0.098
Folded Wing Length (cm)	6th	9.83±0.17[a]	8.90±0.10[b]	-14.000	0.005
	8th	10.57±0.30	9.33±0.17	-3.323	0.080
Wing Span (cm)	6th	51.33±0.67[a]	47.67±0.88[b]	-11.000	0.008
	8th	52.23±2.27	48.13±1.04	-2.707	0.114
Neck Length (cm)	6th	6.87±0.13[a]	6.10±0.20[b]	-11.500	0.007
	8th	6.97±0.07	6.37±0.13	-3.000	0.095
Head Length (cm)	6th	5.73±0.07[a]	5.10±0.15[b]	-7.181	0.019
	8th	6.20±0.25	5.83±0.27	-4.158	0.053
Skull Length (cm)	6th	3.90±0.00	3.53±0.12	-3.051	0.093
	8th	4.20±0.15[a]	3.87±0.13[b]	-10.000	0.010
Head Width (cm)	6th	1.87±0.03[a]	1.73±0.07[b]	-4.000	0.057
	8th	1.93±0.07	1.87±0.13	-1.000	0.423
Beak Length (cm)	6th	1.83±0.07[a]	1.57±0.03[b]	-8.000	0.015
	8th	2.07±0.13[a]	1.90±0.10[b]	-5.000	0.038
Breast Angle (°)	6th	27.00±1.00	24.67±0.33	-3.500	0.073
	8th	27.33±0.67	26.00±0.58	-4.000	0.057

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

(1993) reported FCR of 6.36 in indigenous chicken. Faruque *et al.* (2013) in three indigenous breeds recorded FCR of 3.58, 3.45 and 3.34 up to 8 weeks of age. Ogbu *et al.* (2015) reported FCR in two light and heavy indigenous chicken breeds as 8.11 and 5.11, respectively up to 8 weeks of age. The weekly FCR of Vezaguda chicken of Odisha was 2.81, 3.2, 4.33 and 4.87, for 2nd, 4th, 6th and 8th weeks of age. All values were higher than the FCR of Kadaknath breed, The weekly FCR in Kadaknath breed were 2.75, 2.46, 3.09 and 3.84 for 2, 4, 6 and 8 weeks of age (Dubey *et al.* 2013). During 1st week, the FCR and FCE of Vezaguda chicks were 2.68 and 0.37, respectively. At 8th week, the cumulative FCR was 4 and cumulative FCE was 0.21. The EER and PER were gradually decreasing with the advance of age. Similar findings were reported by Mishra (2016), Nandi *et al.* (2017) and Mohanta *et al.* (2022). During 1st week the EER and ECE were 13 and 0.08, respectively. At the end of 8th week, the EER and cumulative EER were 7.18 and 8.73, respectively and the ECE and cumulative ECE were 0.14 and 0.11, respectively. During 1st week, the PER and PCE were 1.86 and 0.54, respectively. At the end of 8th week, the PER and cumulative PER were 1.03 and 1.25, respectively and the PCE and cumulative PCE were 0.97 and 0.80, respectively. The ability to convert feed in to body mass is dependent on the genotype and the nutrient content of the feed. Therefore, the variability in feed and nutrient utilization efficiency values as obtained in the present investigation as compared to other breeds could be attributed to these factors.

Mortality: The mortality was observed to be 8% up to

8 weeks of age. The mortality in native germplasm was reported to be 7.4% from 0-8 weeks of age by Ludhiana AICRP centre, Punjab. Gonmei (2012) reported mortality ranging 5-10% in indigenous chicks from 0-5 weeks of age, 1.30% during 6-20 weeks of age. The mortality up to 8 weeks of age in Hansli was 6.66% (Ekka *et al.* 2016) and 7.88% (Nandi *et al.* 2017). Kalita *et al.* (2012) also reported 6-10% of mortality in indigenous chicks of Assam. Jha *et al.* (2013) reported that the mortality percentage in three indigenous breeds, viz. Hazra, Aseel and Kadaknath under intensive farming system was 7.28, 9.85 and 3.72%, respectively. Desha *et al.* (2015) observed that the mortality (%) of indigenous chicken of Sherpur district in Bangladesh was 19.63%. The mortality in birds is influenced by several factors including the management practices. Therefore, a wide variation in mortality for different genotypes has been reported by several workers.

Body conformation traits: The body conformation traits such as shank length, thigh length, chest girth, keel length, body length, back length, wing length, folded wing length, wing span, neck length, head length and beak length were significantly higher ($P \leq 0.05$) in males than females at 6th week of age (Table 4). Other conformation traits such as shank circumference, shank width, height, skull length, head width and breast angle were similar between males and females. At 8th week of age, all body measurements were similar between males and females except chest girth, skull length and beak length which were significantly higher ($P \leq 0.05$) in males than females. All the body measurements of Vezaguda birds at 6th and 8th weeks of age were lower than Hansli breed of Odisha (Ekka *et al.* 2016, Nandi *et al.* 2017). The body length of male Vezaguda birds (26.37 cm) was lower than the Nigerian native chicken (26.66 cm), whereas body length of female Vezaguda birds (24.27 cm) was higher than the Nigerian native chicken (18.20 cm). The shank length (male- 5.23 cm, female- 4.57 cm) of Vezaguda birds were lower whereas keel length (male- 7.73 cm, female- 6.20 cm) were higher to the values reported by Sahota *et al.* (2003). They observed the shank length (cm) to be 6.48, 6.51 and 6.7 and keel length (cm) to be 5.70, 5.70, and 5.78, respectively for black, dark brown and light brown varieties of desi chickens of Rawalpindi, Pakistan. The shank length and keel length of Vezaguda chicks were found to be higher than the values reported in native germplasm (shank length: 5.05 cm and keel length: 6.06 cm) at 8th week of age maintained by CARI, Izatnagar centre but the breast angle (°) was lower in Vezaguda chicks of Odisha (male- 27.33°, female- 26°) than the values reported in native germplasm maintained by CARI, Izatnagar centre (45.50°) at 8th week of age.

This study provides a baseline data of performance of Vezaguda chicken population of Odisha. Body weight of the Vezaguda chicks were higher than the body weight of Aseel, Kadaknath, Hazra, Naked neck, and many indigenous poultry birds at similar age. So, it can be popularised as a location-specific chicken population in Odisha.

ACKNOWLEDGEMENTS

The authors are grateful to the All India Coordinated Research Project on Poultry Improvement, Post-Graduate Department of Poultry Science, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha for providing the facilities to carry out this research work.

REFERENCES

Ali M M. 2015. Emerging prospective of Indian livestock: A study on poultry industry. *Asian Journal of Managerial Science* **4**(1): 33–39.

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

Dana N, Vander Waaij E H and Van Arendonk J A M. 2010. Genetic and phenotypic parameters estimates for body weights and egg production in Horro chicken of Ethiopia. *Tropical Animal Health Production* **43**: 21–28.

Desha N H, Islam F, Ibrahim M N M, Okeyo M, Jianlin H and Bhuiyan A K F H. 2015. Fertility and hatchability of eggs and growth performance of mini-incubator hatched indigenous chicken in rural areas of Bangladesh. *Tropical Agricultural Research* **6** (3): 528–36.

Doviet M. 2005. 'Effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam.' PhD thesis. Swedish University of Agricultural Science, Sweden.

Dubey P, Joshi S and Chouhan L. 2013. Juvenile growth rate and feed conversion efficiency in Kadaknath breed of fowl, IPSACON National Symposium on poultry production Feed, Food and Environmental Safety, CARI, Izatnagar, Bareilly, India.

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.

Fanatico A C, Pillai P B, Cavitt L C, Owens C M and Emmert J L. 2005. Evaluation of slower-growing broiler genotypes grown with and without outdoor access: Growth performance and carcass yield. *Journal of Poultry Science* **84**: 1321–27.

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 Science* **37**(1): 93–101.

Gonmei G. 2012. 'Performance of indigenous and Vanaraja chicken under deep litter system of rearing.' M.V.Sc. Thesis, Assam Agricultural University, Guwahati, Assam.

Haunshi S, Niranjan M, Shanmugam M, Padhi M K, Reddy M R, Sunitha R *et al.* 2011. Characterization of two Indian native chicken breeds for production, egg and semen quality and welfare traits. *Poultry Science* **90**(2): 314–20.

Jha D K, Prasad S, Soren S K and Bharti A. 2013. Production performance of indigenous chicken in intensive farming system. *Indian Journal of Poultry Science* **48**(1): 105–08.

Kalita N, Barua N, Pathak N and Islam R. 2012. Performance of Vanaraja birds reared under intensive system of management in Assam. *Indian Journal of Poultry Science* **47**(1): 125–27.

Khandoker M A. 1993. 'Performance of indigenous (deshi), Rhode Island Red (RIR) and Deshi×RIR chickens under farm condition.' M.Sc. Thesis. Bangladesh Agricultural University, Mymensingh.

Khawaja T, Khan S H, Mukhta N and Parveen A. 2012.

Comparative study of growth performance, meat quality and haematological parameters of Fayoumi, Rhode Island Red and their reciprocal crossbred chickens. *Italian Journal of Animal Science* **11**(39): 211–16.

Kryger K N, Thomsen K A, Whyte M A and Dissing M. 2010. Small holder poultry production-livelihoods, food security and sociocultural significance. FAO smallholder poultry production, Rome, Paper no. 4, pp. 1–67.

Mengesha M. 2012. Indigenous chicken production and the innate characteristics. *Asian Journal of Poultry Science* **6**(2): 56–64.

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

Mohanta N B, Samal L, Behura N C, Pati P K, Maity A and Bagh J. 2022. Growth performance, feed utilization efficiency and blood biochemical parameters of Nusuri chicken population of Odisha in floor rearing system. *Indian Journal of Animal Sciences* **92**(8): 1006–12. https://doi.org/10.56093/ijans.v92i8.102495

Mohapatra S C, Mishra S C and Das K. 2006. Poultry genetic resources of Orissa, Intercorporation India Delegation, Hyderabad and Indo-SWISS Natural Resources Management Programme, Orissa, Bhubaneswar, pp. 1–58.

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.

Ogbu C C, Tule J J, Nwosu C C and Okpara M. 2015. Effect of genotype and feeding plan on growth and laying parameters of Nigerian indigenous chickens. *Biology* **4**(1): 251–56.

Padhi M K. 2016. Importance of indigenous breeds of chicken for rural economy and their improvements for higher production performance. *Scientifica*, vol. 2016, Article ID 2604685, 9 pages. https://doi.org/10.1155/2016/2604685

Pathak S S. 2013. 'Performance of Indigenous chicken and its cross with PB-2 male line in deep litter system of management.' M.V.Sc. Thesis, Assam Agricultural University, Guwahati-22, Assam.

Sahota A W, Bhatti B M and Akhtar L A. 2003. Growth performance and caracass characteristics as influenced by different varieties of desi chickens. *Pakistan Veterinary Journal* **23**(2): 97–99.

Sethi B. 2007. Backyard Poultry in Orissa. *Orissa Review* pp. 48–52. http://orissagov.nic.in/e-magazine/Orissareview/jan-2007/engpdf/48-52.pdf

Vetrivel S C and Chandrakumarmangalam S. 2013. The role of poultry industry in Indian economy. *Brazilian Journal of Poultry Science* **15**: 287–94.