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Production performance of indigenous chicken of northeastern region and improved varieties developed for backyard farming

SANTOSH HAUNSHI[1], SUNIL DOLEY[2], and I SHAKUNTALA[3]

ICAR Research Complex for North Eastern Hills Region, Umroi Road, Umiam, Meghalaya 793 103 India

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ABSTRACT

The present study was conducted to evaluate the production performance of indigenous Miri type and improved varieties like Gramapriya and Vanaraja maintained at the Institute farm. All three genetic groups were evaluated for weekly body weight from 0 day to 8 weeks of age, biweekly body weight from 8 to 14 weeks of age and at 20 and 40 weeks of age; feed intake and feed conversion ratio (FCR.) up to 8 weeks of age; age at sexual maturity; egg production rate, shank and keel length and egg quality traits at 40 weeks of age. There were significant differences among all 3 genetic groups for body weights, keel and shank length, sexual maturity, egg production rate, egg weight, egg quality traits such as shell thickness, specific gravity and albumen index. Miri type had significantly early sexual maturity, better shell thickness, higher specific gravity and egg production rate (40 weeks), lesser feed intake and better FCR than the improved varieties. On the other hand improved varieties had significantly higher body weight at different ages, shank and keel length, egg weight (at sexual maturity and 40 weeks of age), and better egg production rate during 40 to 52 weeks of age. Among improved varieties, Vanaraja had significantly higher body weight, shank and keel length, higher feed intake and better FCR than the Gramapriya variety while Gramapriya had better egg production rate, early sexual maturity and higher egg mass. There were no significant differences between Vanaraja and Gramapriya for body weight at day-old and egg weight (at sexual maturity and 40 weeks of age). The study concluded that indigenous chicken could perform better than improved varieties for certain economic traits under same management and rearing conditions.

Key words: Gramapriya, Indigenous chickens, Miri type, Northeast, Performance, Vanaraja

The demand for local chicken and eggs is very high as compared to the broilers and layer eggs due to their better taste, texture and flavour as perceived by the local population (Sapcota *et al*. 2002). However, the existing traditional poultry farming is unable to meet the ever increasing demand for poultry meat and eggs due to growing population of the region. Low productivity of backyard farming is mainly attributed to the poor production potential of existing indigenous chicken germplasm. Therefore, to increase the productivity of backyard poultry farming, the improved varieties which are look alike indigenous chickens or phenotypic replica of indigenous fowl are now being massively introduced in the region (Singh *et al*. 2002). At the same time there is a need to collect, characterize and improve the native chickens for production traits which will otherwise be lost in near future by genetic erosion or due to introduction of improved varieties. Miri type chickens are small sized compact birds mainly reared by Mising (Miri) tribes of Assam (Singh 1996). The reports on its actual production potential of Miri type chickens are scanty in literature. Gramapriya is an egg type and Vanaraja is a dual purpose variety developed at Project Directorate on Poultry for backyard poultry production in rural and tribal areas (Reddy *et al.* 2002). Gramapriya is being introduced for the first time in Meghalaya and its production performance needs to be studied in comparison with Vanaraja chicken. Therefore, the present study was conducted with the objective of evaluating the Miri type chickens and improved chicken varieties such as Gramapriya and Vanaraja under intensive system of rearing for their production performance.

Present address: [1]Project Directorate on Paultry, Rajendra Nagar, Hyderabad 500 0030.

[2]Senior Scientist, [3]Senior Scientist.

MATERIALS AND METHODS

Agroclimatic conditions of the region: The experiment was conducted at the ICAR Research Complex for Northeastern Hill Region, Umiam, which is located at a height of about 1010 m above mean sea level between 91° 55' E longitude and 25° 40' N latitude in the state of Meghalaya, India. The annual maximum temperature ranges from 15.0 to 37.0°C and the annual minimum temperature

ranges from 4.0 to 24.0°C. The average relative humidity remained in the range of 42.25 to 94.0% during morning hours and 46.5 to 94.0% during afternoon hours. About 60 days the average relative humidity was over 88.61% in the morning and 87.00 % in the evening hours inside the poultry sheds during the study period. The rainfall in the study site ranges from 2239 to 2953 mm. The average bright sunshine hours received in the region is lowest in the country (2–5 h during monsoon and 7–8 h during winter).

Experimental populations: Indigenous chickens reared by Mising (Miri) tribes were collected from upper Asom districts like Shibasagar and Tinsukia, and reared at the Institute farm. The Miri type straight run chicks (238) were hatched out following a natural inter-se mating of original stock. Straight run day-old chicks of Vanaraja (815) and Gramapriya (259) were procured from Project Directorate on Poultry, Hyderabad. On arrival, all chicks were provided electrolytes and vitamin supplements in clean drinking water to overcome the transit stress. Birds were brooded in deep litter system using sawdust as litter material up to 6 weeks of age. The chicks of 3 genetic groups were vaccinated against Ranikhet disease on 5th and 30th days using Lasota strain and against Gumboro (IBD) disease on 14th day using intermediate strain. Standard management and healthcare practices were followed throughout the experimental period and were kept constant for all the 3 genetic groups. *ad lib.* drinking water and chick starter ration was provided to the chicks up to 8 weeks of age. Subsequently, the grower ration during growing and layer ration during laying period were provided.

Production traits studied: Performance of 3 genetic groups was assessed by collecting data on body weights at 0 day, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14 20, and 40 weeks of age, Day - old body weights of chicks were recorded to the nearest of 2 g accuracy while weekly and biweekly body weights were recorded to the nearest of 5 g accuracy. Daily feed intake and feed conversion ratio up to eight weeks of age was also assessed. Keel and shank length of birds were measured using Vernier calipers. Age at sexual maturity and hen day egg production (HDEP) up to 40 and 52 weeks of age was recorded. Egg weights at sexual maturity and at 40 weeks of age were recorded in g by Mettlor and Toledo balance (nearest to 0.01 g accuracy) and egg mass was calculated using North's egg mass formula.

Egg quality traits measured: Fresh eggs (75) of Miri type and 50 eggs each from Vanaraja and Gramapriya chicken were collected randomly and used to study external egg quality traits like shape index and specific gravity at 40 weeks of age. Length and breadth of eggs, albumen and yolk were measured using digital Vernier calipers (least count 0.01 mm). Shape index was calculated as per Schultz (1953) and the specific gravity was measured using brine floatation technique (Hamilton 1982). Internal egg quality traits such as shell thickness, albumen index, yolk index and Haugh unit of 30 eggs from each genetic group were studied. The shell thickness was measured using screw gauge (least count 0.01 mm) and heights of albumen and yolk were measured by spherometer (least count 0.01 mm).

Statistical analysis: Means and standard errors of various production, external and internal egg quality traits were calculated using standard statistical procedures (Snedecor and Cochran 1989). Analysis of Variance (one-way) to test the significance and Duncan's multiple range test was carried out to compare the means of various traits of 3 genetic groups using computer software.

RESULTS AND DISCUSSION

The improved varieties had significantly (P<0.01) higher body weight (Table 1) than Miri type chicken. Among improved varieties, Vanaraja was significantly (P<0.01) heavier than Gramapriya at respective weeks of age. There was a significant effect of sex on body weight, shank and keel length traits in three genetic groups. At 20 and 40 weeks of age, Vanaraja had significantly higher combined as well as sex specific body weight and keel and shank lengths (40

Table 1. Growth performance of Miri type and improved chicken varieties (mean±SE)

Parameters	Miri type	Gramapriya	Vanaraja
Day-old body weight (g)	24.05±0.22^{a}	33.44±0.33^{b}	36.88±0.36^{b}
First week body weight (g)	33.62±0.46^{a}	45.29±0.92^{b}	60.81±1.01^{c}
Second week body weight (g)	48.93±0.78^{a}	85.58±2.42^{b}	125.13±2.09^{c}
Third week body weight (g)	64.93±1.34^{a}	108.43±3.19^{b}	173.54±3.17^{c}
Fourth week body weight (g)	81.02±2.08^{a}	181.04±5.14^{b}	254.54±4.35^{c}
Fifth week body weight (g)	98.48±3.22^{a}	265.68±6.98^{b}	370.19±5.99^{c}
Sixth week body weight (g)	132.68±4.65^{a}	343.33±8.24^{b}	481.09±7.10^{c}
Seventh week body weight (g)	183.35±5.48^{a}	403.03±9.61^{b}	640.79±7.77^{c}
Eighth week body weight (g)	243.97±8.45^{a}	492.04±16.51^{b}	779.84±12.01^{c}
Tenth week body weight (g)	353.29±11.91^{a}	760.00±25.04^{b}	1046.25±18.91^{c}
Twelfth week body weight (g)	528.80±16.70^{a}	827.08±26.59^{b}	1548.17±24.59^{c}
Fourteenth week body weight (g)	757.68±15.74^{a}	1151.20±39.92^{b}	1777.50±43.48^{c}

Row-wise figures bearing common superscript do not differ significantly (P < 0.01).

Table 2. Performance of Miri type and improved varieties at 20 and 40 weeks of age (mean±SE)

Particulars	Miri type			Gramapriya			Vanaraja		
	Male	Female	Combined	Male	Female	Combined	Male	Female	Combined
20 week body weight (g)	1297.83 ±20.85[a]	900.00 ±15.25[b]	1094.68 ±24.25[c]	1676.25 ±93.63[a1]	1407.50 ±66.48[b1]	1541.87 ±60.62[c1]	2053.25 ±56.34[a2]	1698.75 ±21.62[b2]	1876.00 ±41.14[c2]
40 week body weight (g)	1507.00 ±44.70[a]	1214.14 ±20.65[b]	1333.67 ±28.38[c]	2544.20 ±62.24 [a1]	1810.42 ±60.38 [b1]	2218.07 ±66.25 [c1]	3323.00 ±64.08 [a2]	2277.00 ±37.02 [b2]	2800.00 ±83.21[c2]
Shank length at 40 weeks (mm)	84.56 ±0.99[a]	69.82 ±0.46[b]	75.84 ±1.15[c]	100.65 ±0.92 [a1]	79.55 ±0.75 [b1]	90.10 ±1.49 [c1]	99.61 ±3.62 [a2]	87.74 ±0.73 [b2]	93.35 ±1.92[c2]
Keel length at 40 weeks (mm)	103.41 ±1.15[a]	88.79 ±1.19[b]	94.76 ±1.33[c]	130.89 ±0.91 [a1]	111.72 ±1.26 [b1]	121.31 ±1.47 [c1]	131.75 ±1.04 [a2]	115.95 ±0.82 [b2]	123.42 ±1.25 [c2]

Figures row wise bearing common superscript do not differ significantly (P<0.01).

weeks) followed by Gramapriya and Miri type chicken (Table 2). Daily and weekly feed intakes of Miri type chicken from day-old to 8 weeks of age were less than those of Gramapriya and Vanaraja (Table 3). It was observed that Miri type chicken had significantly lower age at sexual maturity as compared to Gramapriya followed by the Vanaraja (Table 4). Similarly, Miri type had significantly better 40 weeks HDEP as compared to Gramapriya and Vanaraja (Table 4). Among improved varieties, Gramapriya had significantly (P<0.01) better 40 weeks HDEP than that of Vanaraja variety. However, after 40 weeks of age, HDEP of Miri type was started declining whereas HDEP of improved varieties started increasing. Gramapriya and Miri type had significantly (P<0.01) higher HDEP up to 52 weeks of age as compared to that of Vanaraja. However, improved varieties had significantly higher HDEP from 40 to 52 weeks of age than that of Miri type while there was no significant difference among improved varieties. Egg weights of improved varieties at sexual maturity and at 40 weeks of age were significantly (P<0.01) higher than those of Miri type while there were no significant differences between improved varieties for egg weights at respective periods. Significantly higher egg mass (40 weeks) was recorded in Gramapriya followed by Miri type and Vanaraja variety. Miri type had significantly (P<0.01) better shell thickness and specific gravity than those of improved varieties. Among improved verities Vanaraja had significantly better shell thickness and specific gravity than those of Gramapriya. There was no significant difference for shape index and internal egg quality traits such as yolk index and Haugh unit between Miri type and improved varieties. However, improved varieties had significantly higher albumen index than that of Miri type chicken. Miri type chicken had creamy white to light brown colored shells whereas improved varieties had brown colored shells.

Performance of Miri type chicken: Reports regarding performance of Miri type chicken are scanty in literature to compare the findings of the present study. The body weights of Miri type chickens recorded at four to eight weeks of age were slightly better than those reported for Nicobari fowl (Chatterjee *et al.* 2002). However, Miri type chickens were superior to the Naked neck (900±36) and Frizzle (860±25) fowls of A & N Islands for average body weight recorded at 20 weeks of age (Padhi *et al.* 2001). The lower body weight of Miri type chicken was on expected line since indigenous chickens are known to have lighter and compact body weight to escape from the predators in free range system of rearing. Average daily and weekly feed intakes of Miri type chicken were very less although they increased with the age of the

Table 3. Average daily and weekly feed intakes (g) per bird and FCR (8 weeks) of Miri type and improved varieties (mean±SE)

Age	Miri type		Gramapriya		Vanaraja	
	Daily feed intake	Weekly feed intake	Daily feed intake	Weekly feed intake	Daily feed intake	Weekly feed intake
First week	3.53±0.51	24.74	6.78±0.14	47.48	13.37±0.58	93.62
Second week	4.94±0.56	34.61	11.85±0.19	82.97	21.78±0.18	152.49
Third week	5.76±0.87	40.34	23.08±0.06	161.57	27.35±1.35	191.49
Fourth week	8.90±3.00	62.33	37.05±0.67	259.36	32.15±0.34	225.07
Fifth week	11.73±4.42	82.14	45.87±1.49	321.11	35.57±1.05	249.05
Sixth week	16.64±2.58	116.52	38.80±1.11	271.64	40.29±0.69	282.10
Seventh week	22.23±4.55	155.65	44.24±0.87	309.71	52.24±1.31	365.75
Eighth week	27.87±2.28	195.12	55.66±1.12	361.69	66.56±1.48	465.89
FCR	2.91		3.56		2.62	

Table 4. Egg production and egg quality parameters of Miri type and improved varieties (mean±SE)

Parameters	Miri Type	Gramapriya	Vanaraja
Age at sexual maturity (days)	147.00±1.10[a]	179.50±0.96[b]	197.70±1.26[c]
H.D.E.P. (40 weeks of age)	33.59±0.997[a]	26.82±1.622[b]	13.37±1.097[c]
H.D.E.P. (52 weeks of age)	31.24±0.72[a]	32.35±1.09 [a]	25.86±1.22[b]
H.D.E.P. (48–52 weeks of age)	27.80±0.89[a]	39.17±0.99 [b]	38.24±1.03[b]
Egg mass (40 weeks of age)	11.75±0.35[a]	13.76±0.82 [b]	6.738±0.55[c]
Egg weight at sexual maturity (g)	31.31±0.35[a]	45.16±0.46[b]	45.40±0.57[b]
Egg weight at 40 weeks of age (g)	38.67±0.31[a]	57.22±0.72[b]	55.42±0.46[b]
Increase in egg weight (g)	7.37	12.06	7.17
Shape index at 40 weeks of age	75.23±0.36[a]	76.43±0.53[a]	75.25±0.57[a]
Shell thickness at 40 weeks (mm)	0.386±0.012[a]	0.319±0.005[b]	0.352±0.006[c]
Specific gravity at 40 weeks	1.1019±0.001[a]	1.0849±0.001[b]	1.0901±0.001[c]
Albumen index at 40 weeks	0.060±0.003[a]	0.0714±0.003[b]	0.072±0.002[b]
Yolk index at 40 weeks	0.36±0.012[a]	0.37±0.006[a]	0.35±0.006[a]
Haugh unit at 40 weeks	69.94±1.54[a]	69.10±1.41[a]	67.41±2.71[a]
Shell color	Creamy to light brown	Brown to Dark Brown	Brown

Row-wise figures bearing common superscript do not differ significantly (P< 0.01).

bird (Table 2). Further, it was observed that Miri type chickens had a preference for grainy portion and avoided the powdery (mash) portion of feed such as rice polish. Thus, it would be better to feed indigenous chicken with feed ingredients having coarse texture than mash type of feed. The information regarding feed intake of Miri type chickens is sparse in literature to compare with present findings. However, feed intake and FCR were comparable to that reported for Nicobari fowl under intensive system of rearing (Chatterjee *et al.* 2002).

In the present study Miri type chickens had early sexual maturity (147.00±1.10 days). This observation was somewhat startling and unexpected since most of the studies reported higher age at sexual maturity for indigenous chickens as compared to the Miri types. Age at sexual maturity reported for Hill fowl (193.35±1.04 days) of Uttarkhand (Pant *et al.* 2007), Aseel breed (202.58 days) of chicken (Singh *et al.* 2000), Naked neck (189±3.01) and Frizzle fowl (192±4.03) of A & N Islands of India (Padhi *et al.* 2001) and Daothigir chicken (180 days) indigenous to Assam (Vij *et al.* 2007) were all higher than that of Miri type. This character makes Miri type unique among indigenous chicken breeds of the country.

Percent HDEP of Miri type chicken was low as it was expected in local chicken which could be attributed to their persistent broodiness character. Similar observation was made by Buragohain *et al.* (2006) for HDEP (33.35±2.48) of indigenous chicken of Asom at 42 weeks of age. The egg weight at age at sexual maturity and at 40 weeks of age was relatively less than that of Aseel breed (41 g) of chicken (Singh *et al.* 2000) and Naked neck (41±0.33) and frizzle (42±0.30) chicken of A & N Islands of India (Padhi *et al.* 2001). There was an improvement of 7.37 g in egg weight from age at sexual maturity to 40 weeks of age. It was interesting to note that shape index, albumen index and shell thickness of Miri type chicken eggs were better than those reported for Nicobari fowl by Padhi *et al.* (2003). This observation was quite an expected one since it was observed that indigenous chicken had smaller egg size and hence better shell thickness and specific gravity and also it is well established that the indigenous chickens are known to have better shell thickness (Vij *et al.* 2007). Pant *et al.* (2007) reported the albumen index of 0.08±0.01, yolk index of 0.37±0.01 and Haugh unit of 74.54±0.48 respectively for Uttarkhand hill fowl. Our observations of internal egg quality traits of Miri type chicken were consistent with earlier reports with other native chickens.

Performance of Gramapriya: Gramapriya is predominantly an egg producing variety developed at Project Directorate on Poultry, Hyderabad, for village rearing. Niranjan and Singh (2005) reported relatively higher body weight for Gramapriya variety under intensive system of rearing at Tripura conditions at different weeks of age than those observed in the present study. They further reported that the cumulative feed consumption of Gramapriya variety up to 6 weeks of age was 1165 g against the present finding of 872.49 g bird. There was an improvement of 12.06 g in egg weight from age at sexual maturity to 40 weeks of age. Panda and Pasupalak (2007) observed that age at first egg of Gramapriya chicken at Orissa state's climatic conditions was 5.0 months and the egg size of Gramapriya was 55 to 65 g.

Performance of Vanaraja: Vanaraja chicken was developed for backyard rearing by crossing random bred meat control population as the female line and Red Cornish population as the male line at Project Directorate on Poultry, Hyderabad (Rao *et al*. 2004). We observed relatively lower body weight and FCR as compared to the earlier studies (Kumaresan *et al*. 2007). Daily feed intake of Vanaraja

chicken at 6 weeks of age was lesser than those reported by Buragohain *et al*. (2006, 2007). Kumar *et al*. (2005) reported that average age at sexual maturity was 171 days for Vanaraja chicken while Bhattacharya *et al*. (2005) reported that the age at sexual maturity and average egg size of Vanaraja chicken ranged from 172 to 185 days and between 46 and 55 g respectively. We observed relatively higher age at sexual maturity and comparable egg weights in Vanaraja variety as compared to the earlier reports. The relatively lower body weights and higher age at sexual maturity of improved varieties observed in this study might have been due to the environmental effects such as high rainfall and humidity, high altitude and less intensity and duration of sunshine prevailing in the state of Meghalaya. However, size of the eggs of improved varieties seems to be not affected by these climatic factors. Reports regarding egg quality traits of improved varieties are scanty in literature. From the present study it may be concluded that indigenous Miri type chicken could perform better or equivalent to improved varieties with respect to some economic characters and that there is a scope for improvement of local chicken for body weight and egg weights.

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