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Selection for egg production in native chicken of Kerala for two successive generations

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ABSTRACT

A study was conducted to evaluate the production characteristics of native chicken of Kerala and to improve its egg production through selection. From the base generation (G_0) of native chicken, 775 female and 200 male native chicken (G_1) were produced through a pedigreed hatch and the pullets were evaluated till 40 weeks of age for their production performance. Based on egg number 40, selection was carried out in the population using Osborne's index and 300 dams and 50 sires were selected for producing G_2 generation through a pedigreed hatch. The pullets were evaluated for their production performance till 40 weeks of age. The egg production traits were evaluated and compared in two successive generations. The native chicken of Kerala had a hen housed production of 69.83 eggs, hen day egg production of 70.72 and survivor's egg production of 70.97 at 40 weeks of age. Based on the selection for egg number 40 in G_1 generation of native chicken, the hen day egg production (4.56 eggs) and survivor's egg production (5.90 eggs) was significantly ($p<0.05$) improved but the improvement in hen housed egg production was not evident due to higher mortality in G_2 generation as a result of incidence of infectious neoplastic disease in the flock. However, a positive phenotypic response of 2.26 eggs was obtained on hen housed basis as a result of selection for egg number 40 in G_1 generation. The age at sexual maturity of native chicken was significantly ($p<0.05$) improved in G_2 generation. A significantly ($p<0.001$) lower egg weight was observed for the birds in G_2 generation at 40 weeks of age without any significant difference at 28 weeks.

Keywords: ASM, Hen housed egg production, Native chicken, Selection

Before the onset of commercial layer farming in the neighboring states, Kerala had a thriving poultry sector and exported large quantities of eggs and meat until the 1970s (Pradeep *et al*. 2017). However, indiscriminate crossbreeding and the introduction of exotic breeds for productivity enhancement initiated by public sector agencies and various non-governmental organizations led to a rapid decline in the genetic diversity of the local chicken population. Unfortunately, insufficient efforts were made to conserve and characterise these indigenous birds. Commercial poultry production in Kerala faces several constraints, making large-scale operations less viable. Therefore, promoting backyard rearing of indigenous chicken varieties is essential for enhancing the state's poultry productivity. If the productivity of the native chicken population can be improved, backyard rearing could become more profitable, enabling farmers to command premium prices for their products.

Tellicherry chicken, as documented by Vij et al. (2008), is the only recognised native chicken breed from Kerala which is hardy and adaptable to backyard rearing conditions. It exhibits good mothering ability, moderate egg production and distinctive black plumage with excellent disease resistance and meat quality. To date, most available information on the productivity of Kerala's native chicken is based primarily on survey reports only. Hence a scientific study was conceived to evaluate and compare the production performance of native chicken of Kerala for two successive generations consequent to selection for egg production, under intensive system supported with standard management conditions.

MATERIALS AND METHODS

Four hundred and fifty female and one hundred male native chicken of different age group (25-60 weeks of age) were identified and procured from different regions of Kerala. These birds were quarantined for a period of one month after performing de-worming, dipping and protective vaccination against Newcastle disease. From these birds, 250 female and 50 male birds of solid and multiple plumage

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colours were selected and the population was referred as base generation (G_0)**.** These birds were transferred to individual cages and mating groups were formed among these birds by randomly allotting five females to each male (250:50). Artificial insemination was employed for taking pedigreed hatches. From the base generation (G_0), a total of 2459 chicks were produced by incubating 3697 hatching eggs in six different settings of one week interval through the pedigreed hatch. At 16 weeks of age, 775 females and 200 males with solid and multiple plumage colours were selected and transferred to individual cages and production data were recorded till 40 weeks of age.

After evaluation, selection was practiced in both pullets and cockerels by combining individual's own performance, dam family averages and sire family averages for hen housed egg number up to 40 weeks of age (Osborne, 1957 a & b). Based on the index, 450 top ranking females were selected. Out of 450, 150 birds with white egg shell colour and extreme egg weight at 28 weeks of age were rejected (less than 35 g and more than 47 g). Finally only 300 females and top ranking 50 males was selected as parents for G_2 generation. Mating plans were formulated among these birds by allotting randomly six females to each male by avoiding close inbreeding in dam family level. In G_2 generation 5801 chicks were produced in two different hatches of 10 days interval. At the end of 16 weeks of age, 724 females and 200 males from the first hatch were selected based on distinct plumage and transferred to individual cages for data recording till 40 weeks of age. The significance of difference of means of the traits was determined by Z-test as per Snedecor and Cochran (1994). The birds were fed with chicken breeder feed ad libitum at around 09:00 h. daily from 17 to 40 weeks of age in both the generations. Water was also provided ad libitum from a common source through nipple drinkers. The production traits such as body weight, age at sexual maturity (ASM), egg production up to 40 weeks, egg weight and livability of two successive generations were compared.

RESULTS AND DISCUSSION

Body weight: The mean body weight at day-old, 8, 16 and 40 weeks of age for native chicken of Kerala was 30.72, 358.97, 868.73 and 1305.20 g for females and 32.16, 436.95, 1179.47 and 1888.97 g, respectively for males in G_1 generation (Table 1). The mean body weight of native chicken of Kerala at 8, 16 and 40 weeks of age observed in the present study is similar to the range of body weights reported for native birds of Mysore by Gopinath (2013), Hansli chicken of Odisha by Behera *et al.* (2017), Kadaknath by Haunshi *et al.* (2011) and native chicken of Gujarat (AICRP, 2018). However, lower body weight was reported for Harringhata birds (Vij *et al.* 2015), Miri breeds (Haunshi *et al*. 2009) and for Nicobari birds (Chatterjee et *al*. 2002) compared to present findings. The mean body weight of native chicken observed at all the ages were significantly ($p<0.001$) higher in G_2 generation except at day-old (Table 1). The significantly ($p<0.05$) higher day-old body weight of chicks in G_1 generation may be because, the hatching eggs used for producing G_1 generation chicks were obtained from relatively older parents procured from the field, laying heavier eggs.

Age at Sexual Maturity (ASM): The mean age at sexual maturity of native chicken of Kerala in G_1 generation in the present study was 160.71 days (Table 2). Similar results (159.31-165.70 days) were documented in the annual report of AICRP (2018) for Kadaknath, Mewari breed of Rajasthan and native birds of Gujarat, Karnataka and Punjab. The results are also comparable with that of Ghagus breed (Vij *et al.* 2006), Tellicherry (Vij *et al*. 2008), Harringhata (Vij *et al.* 2015), Mazandaran chicken (Firozjah *et al.* 2015) and indigenous chicken of Mysore (Gopinath, 2013). Higher ASM values (170-214 days) were reported for Tripura black, indigenous breeds of Assam and Bihar (AICRP 2018), Nicobari (Ahlawat and Chatterjee, 2002), Aseel and Kadaknath (Haunshi *et al.* 2011 and 2013) and Thai native chicken (Leotaragul *et al.* 2015) compared to native chicken of Kerala. The studies of Girishkumar (2009) and Thankachan (2011) reported higher ASM values for the native chicken of Kerala in extensive system of rearing than the present study. Miri birds of Assam had a relatively earlier sexual maturity (147 days) as reported by Haunshi *et al.* (2009). The present

Table 1. Body weight (Mean±SE) of native chicken in G_1 and G_2 generations, g

Age (in weeks)	Females		p value	Males		p value
	G_1 (Mean±SE)	G_2 (Mean±SE)		G_1 (Mean±SE)	G_2 (Mean±SE)	
Day-old	30.72^{a}±0.16 (766)	30.21^{b}±0.14 (772)	0.021	32.16^{a}±1.32 (199)	30.37^{b}±0.95 (200)	0.041
8	358.97^{b}±3.22 (752)	455.95^{a}±3.64 (729)	<0.001	436.95^{b}±6.36 (192)	538.11^{a}±4.73 (198)	<0.001
16	868.73^{b}±5.54 (731)	1000.37^{a}±11.84 (611)	<0.001	1179.47^{b}±11.85 (190)	1318.71^{a}±10.38 (185)	<0.001
40	1305.20^{b}±8.05 (726)	1371.70^{a}±10.56 (568)	<0.001	1888.97^{b}±21.08 (187)	2023.04^{a}±10.56 (180)	<0.001

The figures in parenthesis indicate the number of observations, Means bearing different superscripts in the rows within the sex differ significantly

Table 2. Age at sexual maturity and overall egg production of native chicken in G_1 and G_2 generations

Sl. No	Parameter	n	G_1	n	G_2	p value
1	Age at sexual maturity (days)	767	160.71^{a}±0.65	713	157.98^{b}±0.81	0.008
2	Hen Housed egg Number (17-40 weeks)	767	69.83±0.96	713	72.09±1.06	0.114
3	Hen Housed egg Per cent (17-40 weeks)	767	41.59±0.57	713	42.91±0.63	0.114
4	Hen Day egg Number (17-40 weeks)	767	70.72	713	75.28	NA
5	Hen Day egg Per cent (17-40 weeks)	767	41.87^{b}±0.56	713	43.94^{a}±0.62	0.013
6	Survivor's Egg Production (At 40 weeks)	742	70.97^{b}±0.95	611	76.87^{a}±1.02	<0.001

The mean values bearing different superscripts within the rows differ significantly

study shows that sexual maturity attained by native chicken of Kerala was quite early as compared to native chicken varieties of other states. Consequent to selection for egg number 40 in this study, the ASM of the native birds was improved significantly ($p<0.01$) in G_2 generation (Table 2).

Egg production up to 40 weeks of age: The overall (17-40 weeks) hen housed egg (HHN) production obtained for native chicken in G_1 generation in this study was 69.83 eggs (Table 2). The egg production of two chicken varieties, Uttara breed from Utttarakhand reported by Singh *et al*. (2018) and native chicken of Gujarat maintained at Anand Agricultural University (AICRP, 2018), showed higher HHN (74 eggs) than native chicken of Kerala observed in this study. Lower egg production (20-59 eggs) was reported for other native breeds namely Kadaknath, Aseel, Tripura black, Hansli, Ghagus, Mewari, Miri and indigenous birds of Assam, Punjab, Bihar, Karnataka and Himachal Pradesh. Girishkumar (2009) and Thankachan (2011) reported lower egg production for native birds from northern Kerala and Thrissur district (33 and 40 eggs, respectively) reared in extensive system. Based on the literature available, it was observed that the native chicken of Kerala is having good production potential compared to indigenous chicken varieties of other states.

Consequent to selection for egg number 40, the overall HHN increased from 69.83 eggs in G_1 generation to 72.09 eggs in G_2 generation (Table 2) i.e., a positive phenotypic response of 2.26 eggs was observed in the present study. However, the increase in HHN was not statistically significant between two generations. As a result of selection for egg number 40, the overall HHN increased from 70.72 to 75.28 in G_2 generation (Table 2) with a phenotypic response of 4.56 eggs. Similarly, the survivor's egg production increased from 70.97 to 76.87 in G_2 generation (Table 2) with a phenotypic response of 5.90 eggs. The higher mortality percentage in the layer stage of G_2 generation (four times than that of G_1 generation) may be the reason for the absence of significant improvement of hen housed egg production in G_2 generation compared to G_1 generation.

Table 3. Egg weight of native chicken in G_1 and G_2 generation, g

Age (in weeks)	G_1		G_2		p value
	n	Mean±SE	n	Mean±SE	
28	631	39.96±0.15	546	40.11±0.29	0.645
40	447	43.65^{a}±0.20	362	41.71^{b}±0.22	<0.001

The mean values bearing different superscripts within the rows differ significantly

Egg weight: The mean egg weight observed in this study was 39.96 and 43.65 g for native chicken in G_1 generation at 28 and 40 weeks of age, respectively (Table 3). The results of the present study are comparable with the results documented by Girishkumar (2009) for native chicken of northern Kerala. Similar results were observed for Hansli breed of Odisha and native chicken of Karnataka and Himachal Pradesh (AIRCP, 2018). Lower egg weight was reported for native chicken of Mysore (Gopinath, 2013) and Kadaknath (Haunshi *et al.* 2013) than the present study at 28 weeks of age, but the results were similar for the egg weights at 40 weeks. In Mazandaran chicken, higher egg weight (48 g) was reported by Firozjah *et al.* (2015) at 28 weeks of age. Higher egg weight at 40 weeks was observed for Ghagus (Haunshi *et al.* 2015), Aseel (Haunshi *et al.* 2013) and Thai native chicken (Leotaragul *et al.* 2015).

A significantly ($p<0.001$) lower egg weight was observed for the birds in G_2 generation at 40 weeks of age without any significant difference at 28 weeks (Table 3). This indicated that the reason for the decline in egg weight in G_2 at 40 weeks of age may be due to the environmental factors. Similar findings were shown by native birds reared at Anand Agricultural University (AICRP, 2018) wherein egg weight at 40 weeks declined from 44.83 to 43.93 g at 40 weeks in S_1 generation while egg weight at 28 weeks was 36.98 in the base generation and 38.37 in S_1 generation.

Livability: Based on the assumption that the native chicken are hardier as stated in various literature, the chicks in G_1 generation were not subjected to beak trimming. In the present study, the incidence of pecking was more. Occurrence of coccidiosis was also observed

Table 4. Livability of native chicken in G_1 and G_2 generation at different stages, per cent

Age (in weeks)	No. of birds housed		No. of birds died		Mortality		Livability	
	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2
0-8	2458	1774	214	43	8.71	2.42	91.29	97.58
9-16	2244	1500	27	118	1.20	7.87	98.80	92.13
17-40	775	725	25	104	3.22	14.3	96.78	85.70

in the G_1 generation. Due to these problems, the livability per cent during chick stage of G_1 generation was lower (91.29) compared to G_2 (Table 4). Hence, beak trimming was performed at day-old and at 7th week of age (before transferring the birds in to grower sheds) and proper care was taken to reduce the incidence of coccidiosis in chick stage of G_2 generation. As a result of all these precautions, livability was improved to 97.58 per cent in G_2 generation (Table 4).

Excellent livability percentage was observed at grower (98.8) and layer (96.78) stages in G_1 generation (Table 4). But livability per cent of grower and layer stages was affected in G_2 generation due to incidence of neoplastic disease of infectious origin. As a result, livability was reduced to 92.13 and 85.7 per cent in grower and layer stages, respectively in G_2 generation (Table 4). The review indicates that livability during the layer stage was in the range 90-96 per cent for most of the indigenous birds *viz.*, Kadaknath (Valavan *et al.* 2016 a), Aseel (Valavan *et al.* 2016 b), Mewari, Tripura black, Hansli and native chicken of Bihar and Himachal Pradesh (AICRP, 2018) reared under intensive system which is in agreement with the results of the present study. A higher livability of 98.93 and 97 per cent was reported for indigenous layers of Assam and Punjab, respectively (AICRP, 2018). However, a lower livability of 71 per cent and 63.75 per cent was reported for native chicken of Gujarat (AICRP, 2018) and native chicken of Mysore (Gopinath, 2013).

The study was successful in evaluating the egg production traits of native chicken of Kerala in two successive generations through selective breeding. While the G1 generation demonstrated significant improvements in hen day and survivor's egg production, the G2 generation faced challenges due to increased mortality from a neoplastic disease, limiting overall hen-housed production gains. Notably, the age at sexual maturity improved significantly in the G2 generation. However, this generation showed a marked decrease in egg weight at 40 weeks. Overall, the positive phenotypic response to selection suggested that further breeding efforts could yield beneficial results. Future research is required to address the possible health challenges to sustain production improvements.

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