e-planet **15** (2): 127-132 (December 2017)

Growth performance, feed efficiency and linear body measurements of triple cross progenies of Hansli, CSML and CSFL chickens

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Date of receipt: 13.11.2017 Date of acceptance: 07.12.2017

ABSTRACT

Performances of two genotypes of broiler chicken were studied under intensive system of management to evaluate their growth performance, feed conversion ratio (FCR), livability percentage and linear body measurements. The genotypes were; (i) T_1: Coloured synthetic broiler crosses (CSML ♂ × CSFL ♀ crosses) (ii) T_2: (Hansli × CSML) ♂ × CSFL ♀ crosses. The chicks in T_1 group registered higher ($p < 0.01$) body weight and body weight gain as compared to those in T_2 group at all stages of growth, i.e., from 1st week to 8th week. The cumulative feed intake of the T_2 birds was lower ($p \leq 0.05$) than that of the T_1 birds from 2-5 week of age, but no significant difference ($p \geq 0.05$) was found from 6th to 8th week of age. There was no difference of FCR between both the groups. Similar mortality rate (1.66%) was also observed in both the groups. T_2 chicks showed higher values ($p \leq 0.05$) for breast angle and beak length at 6th week, which became similar at 8th week while T_1 chicks showed higher value ($p \leq 0.01$ or 0.05) in shank length, shank width, body length, body height, body girth, keel length at 6th and 8th week.

Key words: Coloured broiler, FCR, growth performance, Hansli, linear body measurements, triple cross

INTRODUCTION

Indian poultry sector represents one of the biggest success stories of the country over the past decade. Poultry have been reared as an integral part of the mixed agricultural system throughout India. On the basis of their contribution to total farm income in certain areas, chickens rank the highest followed by goats and cattle (Muchenje and Sibanda, 1997). Among the various aspects in poultry science, improvement in genetic makeup by various breeding methods is an important aspect to improve feed efficiency, egg production and egg quality. Crossbred poultry have higher feed efficiency and lower mortality rate as compared to purebreds, which in turn play a very important role in increasing profits in poultry production (Dwivedi et al., 1986). As local chickens are insufficient to provide sufficient meat to the people in a highly populated country, there is a growing demand from the farmers for the exotic hybrids suitable to family production systems. Hence, efforts have been diverted to production of dual purpose breeds and hybrids with improved production profiles. According to Adebambo et al. (2011) genetic progress can be attained either by selection or crossbreeding. Crossbreeding of the indigenous stock with exotic commercial birds will take advantage of artificial selection for productivity in the exotic birds and natural selection for hardiness

in the indigenous birds (Adebambo et al., 2011). Crossbreeding could produce birds with better growth rate, feed conversion efficiency and reproductive traits without sacrificing adaptation to the local environment, thereby resulting in reduced cost of production (Adebambo et al., 2011). To meet the growing demands of the human population and to improve the per capita consumption among the rural and tribal people, many organizations developed improved chicken varieties which are suitable for the free range and backyard farming for rural and tribal areas. Considering the necessity to identify potential poultry crossbreds, suitable for backyard farming as well as commercial farming in different regions of India, which are easily adaptable to high rainfall, high humidity and high environmental temperature, the present study has been studied to evaluate the crosses of native and coloured broiler parent line in respect to their growth performance, feed conversion efficiency, livability percentage and body measurement.

MATERIALS AND METHODS

The study was carried out from 1st March 2016 to 26th April 2016 at Post Graduate Department of Poultry Science, College of Veterinary Science and Animal Husbandry, Orissa University of Agriculture and Technology, Bhubaneswar. Broiler chicken performance of two genotypes was utilized for the study. The genotypes were; (i) T_1: coloured synthetic broiler crosses (CSML ♂ × CSFL ♀ crosses) (ii) T_2: (Hansli × CSML) ♂ × CSFL ♀ crosses. Adult coloured synthetic female line (CSFL) females and coloured synthetic male line (CSML) males at the age of 40 weeks were housed in breeding pens in the ratio 1:7. For crossbreeding, seven CSML males and fifty CSFL females were used. Simultaneously, (Hansli × CSML) ♂ and CSFL ♀ were maintained in the same ratio to obtain pure eggs. Eggs were collected daily for ten days from the two genetic groups, identified with markers and set in the incubator. A total of 120 straight run day-old chicks were taken, sixty each of the two genotype groups and divided into three replicates 20 chicks each. The chicks were numbered by wing band, weighed and randomly distributed in separate pens according to treatments. The chicks were provided with identical care and management throughout the experimental period and were immunized against Marek's disease on 1st day, Ranikhet disease (RD) on day 5 and 28 using LaSota strain, infectious bursal disease (IBD) on day 14 and 35, fowl pox on day 42 and RD using R_2B strain at 8th week. With a brooding space of 0.5 ft^2 $chick^{-1}$, the chicks were brooded up to three weeks. Ad libitum feeding was provided and the amount consumed was recorded in daily basis. The chicks were fed a standard broiler starter ration containing 22 % crude protein and 3150 kcal kg^{-1} ME for four weeks followed by a finisher diet containing 20 % crude protein and 3150 kcal kg^{-1} ME from fifth week till the end of the experiment at eight weeks. The composition of ration is given in Table 1.

Table 1. Ingredient composition of ration (kg per100 kg feed) offered to the chicks

Ingredients	Starter mash	Finisher mash
Maize	58.2	60.0
Soya bean meal	34.0	30.2
Vegetable oil	3.5	5.5
Mineral mixture	3.0	3.0
Salt	0.3	0.3
Feed additives	1.0	1.0
Nutritive value		
CP%	22	20
ME (kcal kg^{-1})	3150	3150

Live weights of mixed sexes were recorded individually at day-old followed by weekly intervals up to eight weeks of age using a digital electronic balance nearest to 1.0 g accuracy. Before supplying the feed the birds were weighed in the morning. 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 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 per bird) was calculated by dividing total feed intake by the bird up to a particular week from number of birds. Feed conversion ratio (FCR) was calculated from cumulative body weight gain and cumulative feed consumed. Chick mortality was recorded daily. Except breast angle which was measured by goniometer, all other body linear measurement traits were determined at 6th week and 8th week using measuring tapes (calibrated in centimetres) as described below:

Beak length: Distance between the base and tip of the beak is the beak length and was expressed in centimeters.

Head width: Head width was measured at the widest region in the head by means of electronic digital calipers and was expressed in cm.

Breast angle: The breast angle of individual bird was recorded with the help of a goniometer to the nearest of one degree accuracy. For measuring the breast angle, the goniometer was placed posterior to the anterior edge of keel bone at 1 cm from the extreme of the tool and had to be adjusted on the left breast or the right breast with the mobile arm and expressed as degree.

Shank length: Length of the tarso meta-tarsus from the hock joint to the meta- tarsal pad of the bird is the shank length and was measured in cm.

Shank width: Diameter of the tarso meta-tarsus just below the spur of the individual bird is otherwise called the shank width and was measured in cm.

Body length: Distance from the tip of the beak through the body trunk to the tail is the body length and was measured in cm.

Height of the bird: It is a measure from the tip of the beak to the tip of the middle toe and was measured in cm.

Body girth: Circumference of the breast region of the bird is the body girth and it was also measured in cm.

Keel length: It was measured from the chest bone to the end towards the abdomen region in cm.

Data retrieved from the experiment were statistically analyzed according to Snedecor and Cochran (1994). Analysis of data was done using t-test to evaluate the difference between the means wherever necessary.

RESULTS AND DISCUSSION

Body weight and weight gain

The mean weekly body weights and weight gain of the T_1 (CSML × CSFL) chicks and T_2 (Hansli × CSML) × CSFL chicks are presented in Table 2. The body weights of the T_1 were significantly ($p \leq 0.01$) higher than that of the T_2 group for all ages for which body weight was recorded except day-old weight. T_2 is a triple cross of broiler parent line and native chicken (Hansli). Hansli being a local breed has a slower rate of growth as compared to the broiler parent lines (Ekka et al., 2016).

The 8th week body weight of the T_2 group in the present experiment was 998 g, whereas Pathak et al. (2015) and Kalita et al. (2017) reported 8th week body weight of PB2 × Native cross as 670.68 g and 670.83 g, respectively. Similarly, Kgwatalala and Segoko (2013) reported the 8th week body weight of Australorp × Native crosses as 728 g. The body weight of T_2 in the present experiment was higher than the 8th week body weight of different broiler and native cross chickens due to the fact that the T_2 group was developed by crossing (Hansli × CSML) ♂ with CSFL ♀ resulting in 75% and 25 % contribution of broiler parent line and native chicken varieties respectively. The native Hansli population used in developing the cross is a promising game bird with good conformational traits and high adult body weight. This could be the reason of getting higher 8th week body weight of the T_2 group as compared to other reported values of native and broiler crosses.

Table 2. Weekly body weight (g) and weight gain of chicks

Age (week)	Body weight (g)		T value	P value	Body weight gain (g)		T value	P value
	T_1	T_2			T_1	T_2		
0 Day	41.0±0.37	42.6±0.42	2.78	0.007	-	-	-	-
1	101.1±1.68	89.4±1.38	-5.88	0.000**	60.1±1.58	46.8±1.39	-7.12	0.000**
2	204.2±4.57	170.5±3.87	-5.67	0.000**	103.1±3.54	81.1±3.34	-4.65	0.000**
3	357.6±14.50	289.1±8.20	-5.35	0.000**	157.0 ±4.97	120.7±4.94	-5.20	0.000**
4	528.1±19.57	407.4±16.98	-6.20	0.000**	170.4±5.82	118.4±5.64	-6.27	0.000**
5	688.1±25.30	534.0±22.77	-5.61	0.000**	160.7±8.32	126.6±6.11	-2.96	0.004**
6	859.2±30.30	669.6±28.38	-5.61	0.000**	171.1±8.17	135.6±9.45	-3.38	0.001**
7	1056.9±36.82	847.1±30.34	-4.95	0.000**	197.6±9.25	177.5±9.38	-1.50	0.138
8	1331.8±0.37	997.9±0.42	-6.83	0.000**	274.9±11.53	150.7±4.87	-10.30	0.000**

** Mean values differ significantly ($p<0.01$)

Feed intake and feed conversion ratio

The mean cumulative feed intakes and FCR of the experimental chicks have been presented in Table 3. There was no significant difference in the feed intake between the T_1 and T_2 group at 6th to 8th week of age. However, the cumulative feed intake for 2nd to 5th week of the T_2 chicks was significantly lower than the T_1 group. The cumulative feed consumption up to 8th week of the T_1 group was significantly ($p\leq0.01$) higher (3956 g) than the T_2 group (3112 g). Similar feed consumption of 3718 g and 2861 g up to 8 weeks of age have been reported by Howlider (2001) for Redbro × Local Naked neck and Local Naked neck × Redbro crosses, respectively. Ekka et al. (2016) reported feed consumption of 2539 g up to 8th week of age, which is lower than that of the 8th week feed consumption of the T_2 group. Broilers are selected for high growth, high feed intake and better feed conversion efficiency. The cross under study being a cross of Hansli × CSML males with CSFL females, the feed consumption could have increased.

The lower FCR values of the T_1 group could be due to better feed conversion efficiency as it is a cross of two broiler parent lines (Table 3). However, in T_2 which derived 25% germplasm from native chicken breed Hansli, having poor feed conversion efficiency (3.26; Ekka et al., 2016), could have contributed to the higher FCR values. Similar FCR values in the 8th week of experiment ranging from 3.2 to 3.8 were observed by for improved and native crosses (Howlider, 2001; Nwachukwu et al., 2006).

Mortality

Among the genotypes under study, both the groups had 1.66 % mortality, which could be due to better adaptability to local climatic conditions. This observation also corroborates the results of zero mortality for local Fayoumi × improved RIR (Ojo et al., 2011). Jha et al. (2013) reported 8.3 % and <2 % of mortality for Dahlem Red × Desi and Native chicken × Dominant Black crosses during 0-8 weeks of age.

Linear body measurements

The mean linear body measurements for the chicks in the T_1 and T_2 group recorded at 6th week and 8th week are shown in Table 4. Except beak length all other parameters are significantly ($p\leq0.05$) higher in the T_1 than T_2 chicks. The T_1 group was a cross of broiler parent lines which were selected over generations for higher breast angle,

Table 3. Weekly cumulative feed intake (g) and feed conversion ratio of chicks

Age (Week)	Weekly cumulative feed intake		P value	Weekly feed conversion ratio		T value	P value
	T_1	T_2		T_1	T_2		
1	94.17±4.17	73.34±1.67	0.000**	1.57±0.09	1.71±0.06	1.01	0.419
2	379.0±19.52	314.7±4.67	0.100	2.23±0.14	2.43±0.14	0.70	0.557
3	777±18.64	687.5±16.33	0.100	2.43±0.01	2.76±0.19	1.65	0.240
4	1158±22.14	1054±19.04	0.100	2.35±0.03	2.86±0.17	2.52	0.128*
5	1725±23.75	1501±15.18	0.000**	2.63±0.01	3.03±0.15	2.55	0.126*
6	2412±44.01	1931±34.91	0.000**	2.91±0.05	3.08±0.22	0.88	0.474
7	3074±55.22	2426±37.32	0.000**	3.03±0.02	3.04±0.17	0.05	0.962
8	3956±74.01	3112±26.35	0.000**	3.06±0.03	3.26±0.15	1.13	0.375

** Mean values differ significantly ($p<0.01$)

Table 4. Linear body measurements of chicks at 6th and 8th weeks of age

Parameter	6th week				8th week			
	T_1	T_2	T value	P value	T_1	T_2	T value	P value
Breast angle (°)	49.8±0.87	51.42±0.90	1.26	0.212	58.98±1.06	56.68±1.02	-1.53	0.132
Beak length (cm)	2.58±0.09	2.88±0.05	2.79	0.007**	3.15±0.09	2.86±0.15	-1.74	0.087
Head width (cm)	2.8±0.07	2.81±0.05	0.07	0.943	3.43±0.10	2.37±0.09	-9.02	0.000**
Keel length (cm)	8.99±0.19	7.15±0.21	-6.35	0.000**	12.12±0.25	10.57±0.20	-4.65	0.000**
Body girth (cm)	28.32±0.51	23.32±0.59	-6.34	0.000**	33.80±0.60	27.93±0.51	-7.32	0.000**
Shank length (cm)	8.08±0.21	6.83±0.14	-4.97	0.000**	10.72±0.21	9.01±0.18	-6.00	0.000**
Shank width (cm)	1.73±0.05	1.32±0.03	-7.57	0.000**	2.08±0.05	1.67±0.04	-6.10	0.000**
Body length (cm)	32.37±0.62	27.88±0.55	-5.30	0.000**	36.80±0.65	34.50±0.66	-2.445	0.017*
Height (cm)	32.08±0.61	28.87±0.52	-3.88	0.000**	38.00±0.67	33.46±0.64	-4.914	0.000**
Head length (cm)	5.28±0.13	4.02±0.08	-8.719	0.000**	6.01±0.11	5.11±0.12	-5.617	0.000**

** Mean values differ significantly ($p<0.01$) * Mean values differ significantly ($p<0.05$)

keel length, and shank length and this could be the reason for obtaining higher values for these parameters in the broiler only group (T_1) than that of T_2 group which was a cross involving a native population with broiler strains.

Chicks in the T_1 group showed lower values ($p \leq 0.05$) for breast angle and beak length at 6th week, while at 8th week, these differences were found non-existent. It might be due to the differences found between the two genotypes in growth pattern of these two crosses. All the body measurements of T_2 group, i.e. (Hansli × CSML) × CSFL were found to be higher than that reported by Behera et al. (2016) in native Hansli breed except head width which was found to be similar. This indicated that the crossbreeding of this native bird with broiler lines improved its body morphological measurements.

Ekka et al. (2016) reported higher breast angle in the Hansli × CSML cross and CSML than the Hansli breed. Correspondingly, they also reported higher beak length, head width, body length, body girth and all other body measurements in CSML than the Hansli and Hansli × CSML cross. The result may be due to the fact that CSML has higher body weight throughout the experimental period of 8 weeks and has been developed from two broiler parent lines.

CONCLUSION

From the present study it is concluded that birds of CSML ♂ × CSFL ♀ crosses are found to have superior growth performance than (Hansli × CSML) ♂ × CSFL ♀ crosses.

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