

Comparative Study on Growth Performance and Meat Yield Characteristics of Different Crosses of Chicken

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Abstract – A study was conducted to evaluate body weight, weight gain and meat yield characteristics of different broilers produced by crossing 4 lines of chickens i.e. Male line white (MLW), Female line white (FLW), Male line colored (MLC), Female line colored (FLC). A total number of 193 crossbred chicks were produced by using the different crosses of MLW (♂) × FLW (♀), MLW (♂) × FLC (♀), MLC (♂) × FLW (♀) and MLC (♂) × FLC (♀). Ad libitum feeds were given to the experimental birds from day-old to 42 days of age. Two chickens (one male and one female) from each cross were sacrificed to determine their meat yield characteristics. CB (Commercial Broiler) was used as control along with experimental crosses of chickens to evaluate the meat yield. The body weight at 1, 2, 3, 4, 5 and 6 weeks of age was significantly ($P < 0.001$) different among different crosses of chickens. Significantly ($P < 0.05$) higher body weight was found in MLW × FLW followed by MLW × FLC, MLC × FLW and MLC × FLC. The weight gain was obtained the similar trend as the body weight. Dressing yield of MLW × FLW was higher than that of other crosses of chickens. The findings of this study suggested that the MLW × FLW may be suitable for producing white feathered broiler, while the MLC × FLC as colored broiler.

Keyword – Body Weight, Body Weight Gain, Chicken, Meat Yield.

I. INTRODUCTION

Broiler production is a substantial contributor to meet up the high quality animal protein in the growing demand of human diet in Bangladesh. It is one of the most important rapid growing industries for producing huge amount of animal protein in this country. Broiler production exposes the maximum return within the fact of minimum expenditure. Commercial broiler farming requires small area of land. Small farmers of densely populated countries like Bangladesh can be utilized their available land area by raising small-scale commercial broiler. So, Bangladesh has a great scope of broiler farming for proper utilizing the available small land area of rural farmers in our country. However, there are several problems that hampering the profitable and sustainable broiler farming in Bangladesh. Because of the most inputs like parent chick, feed, vaccine and medicine of broiler farming are imported from abroad. A lot of foreign currency is spent for importing parent and

grandparent stock in each year in Bangladesh. 2500 thousand broiler parents and 280 thousand layer parents are imported from abroad by expending the foreign currency of US \$10 million in a year [1]. Now-a-days, the price of parent and grandparent stocks is increased more compared to before. Moreover, imported parents and grandparents from foreign countries are not fully adapted to our environmental condition. These might be acts as a carrier of some exotic diseases that affects the growing poultry industry in the country [2]. That is why government is searching alternatives ways that would be ensured to make more revenue or save some foreign currency for the sustainable development of the poultry industry in this country. For doing this, Bangladesh can rear its own broiler grandparents and parents to produce quality day old broiler chicks with reasonable price. However, no initiative was taken to develop broiler parents from our locally available chicken Germplasm. In a study, [3] stated that the synthetic meat type bird grow almost similar to commercial broilers. But growth rate of Desi (indigenous) chicken is poor and takes long time to attain market weight. Meat of Desi chicken was the best in respect of flavor and taste while synthetic broiler was the best for tenderness and juiciness with best growth and feed conversion ratio reported by [4]. The dressing yield was the best for Desi crossbred i.e. 74.8%. People prefer Desi chicken for its moderate tenderness and special taste even with higher prices.

In Bangladesh, some people prefer colored chicken and pay more than fast growing white feathered broiler because of their watery and soft meat. So, developing colored chicken with somehow tough meat will be more acceptable than that of commercial broilers. The department of poultry science under the faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh has taken an initiative to develop a suitable meat type chicken through poultry breeding program for our country. Development of broiler sire and dam lines from synthetic and available genetic resources would be our own broiler parent stock with better adaptability. At the same time it might protect our poultry industry from endemic disease like avian influenza and other emerging diseases. Therefore, the present study was undertaken to evaluate growth performance and meat yield

characteristics of white and colored broilers produced by developed sire and dam lines of chicken.

II. MATERIALS AND METHODS

Location:

This study was conducted at the Bangladesh Agricultural University Poultry Farm, Mymensingh, for a period of six weeks from July 20 to September 7, 2012.

Experimental birds

A total of 193 straight run day old chicks from four line crosses (Male line white × Female line white, Male line white × Female line colored, Male line colored × Female line white, Male line colored × Female line colored) were used to evaluate their growth performance and meat yield characteristics.

Management of experimental birds

All chicks of whole line crosses were wing banded, weighed and randomly distributed in separate pens according to genotype. The chicks were brooded with electric brooder for 3 weeks. *Ad libitum* commercial broiler starter and grower feed from a reputed feed company named Nourish Poultry Feed Limited were provided to birds from day old to 21 days, 22 days to 42 days of age, respectively. Standard vaccination schedule were strictly followed for the prevention of economic diseases of broiler birds. Improved broiler farm management, housing facilities, rearing techniques and farm bio-security were ensured for the better production performance. Same lighting program were given to all birds during experimental period.

Processing of chicken

At the end of the 6 weeks, one male and one female of nearly similar body weight from each genotype and one male and one female commercial broiler were fasted first. Feed was withdrawn 12 hours prior to slaughtering to facilitate proper bleeding. The initial weight before feed withdrawal and final weight before slaughtering was recorded. Then they were slaughtered, bled, scalded, defeathered and eviscerated gradually. After slaughtering complete bleeding was facilitated and then the chicken were immersed in pre-warmed water (51– 55°C) for 120 seconds in order to loosen the feather of the carcasses. Then feathers along with the head, shanks, viscera, oil gland and lungs were removed. Thus, the dressed weight of the carcasses was recorded including giblets and dressing percentage was calculated.

Data collection

Data were recorded on weekly body weight, daily feed consumption and mortality. Two broilers (male and female) from each cross and two commercial broilers with similar body weight were slaughtered to compare their meat yield characteristics.

Body weight gain

Weekly body weight gain was calculated by using the following formula:

$$\text{Body weight gain} = \text{Final weight} - \text{Initial weight}$$

Feed conversion ratio (FCR)

Feed conversion ratio was calculated by using the following formula:

$$\text{Feed Conversion Ratio} = \frac{\text{Feed intake (gm)}}{\text{Live weight gain (gm)}}$$

Shrinkage measurement

After recording weight before and after fasting the shrinkage percentage was calculated from the following formula:

$$\text{Shrinkage (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Statistical analysis

The collected and computed data were analyzed using Linear Mixed Model implemented in JMP (Statistical Discovery Software, SAS Institute Inc., USA). Significant differences between genotypes were identified by Turkey's HSD Test.

III. RESULTS

Body weight

The least squared means for body weight of mixed sex line crossed progenies are presented in Table 1. The day old weights were significantly different among the crosses. The highest day old body weight found in MLC×FLW (37.16g) which was almost similar with the day old weight of MLW×FLW (36.98g) and it means that there was no difference in the day old weight of white female line cross bred chicks. But the day old weight of MLC×FLC (30.80g) and MLW×FLC (31.09g) crossbred chicken were intermediate compared with the white female two line crosses and no significant difference was also observed in the colored female line crossed chicken. The body weights of different line crossed male chicken and female chicken upto 6 weeks of age are presented in Table 2&3. It is evident that the final body weight of male was highest in the line crossed chicken come from MLW×FLW (1215.94g) and the intermediate weight was found in MLW×FLC (1170.72g) and no significant difference between them. The final body weight of male up to 6 weeks of age in MLC×FLC (724.73g) and MLC×FLW (737.88g) was significantly lower ($p > 0.001$) than that of MLW×MLW and MLW×FLC two crosses. The body weight of different four line crossed female chicken were found the similar trend as male line crossed chicken (Table 3).

The body weight gain of sex combined line crossed chicken is shown in Table 4. The weight gain of MLW × FLC was 247, 184 and 318g at 4, 5 and 6 weeks of age respectively that varied from other three crosses. But no difference was observed between the MLC×FLC and MLC×FLW. The trend in weight gain was almost similar in all crosses and significantly differed from each other ($p < 0.001$) among the four crosses. Higher difference in weekly weight gain was observed when the cumulative weight gain was considered for day old to 3rd weeks, 3rd to 6th weeks and day old to 6 weeks and the highest value was obtained from MLW×FLW than that of other three crosses and the differences were also significant.

Meat Yield

Meat yield and their quality characteristics of four broilers such as MLW × FLW, MLW × FLC, MLC × FLW and MLC × FLC were compared with the commercial broiler. Among five genotypes (Table 5) edible meat was highest in commercial broiler followed by MLW × FLW, MLW × FLC, MLC × FLW, MLC × FLC and the differences were significant ($P < 0.01$). Dressed weight was significantly ($P < 0.01$) highest in commercial broiler and lowest in MLC

× FLC while the other line crosses MLW × FLW, MLW × FLC and MLC × FLW were similar. The breast meat yield follows similar pattern as dressed weight. It is evident (Table 5) that all of the line crosses MLW × FLW (75.48%), MLW × FLC (74.09%), MLC × FLW (74.95%) and MLC × FLC (73.13%) had higher dressing percentages than commercial broiler (69.35%) though the difference was non-significant ($P > 0.05$).

Table 1: Sex combined body weight (g) of different line crossed chicken up to 6 weeks of age

Genotype	Age (Week)						
	DOC	1 st	2 nd	3 rd	4 th	5 th	6 th
MLC × FLC	30.80± 0.52 ^b	52.88± 1.83 ^d	125.80± 3.91 ^d	218.23± 6.59 ^d	336.84± 11.96 ^d	483.07± 17.47 ^c	625.58± 24.96 ^c
MLC × FLW	37.16± 0.36 ^a	60.89± 1.25 ^c	146.33± 2.66 ^c	243.42± 4.49 ^c	372.14± 8.15 ^c	509.76± 11.90 ^c	660.98± 17.01 ^c
MLW × FLC	31.09± 0.36 ^b	69.00± 1.26 ^b	199.27± 2.68 ^b	349.61± 4.53 ^b	597.40± 8.22 ^b	781.65± 12.01 ^b	1100.53± 17.16 ^b
MLW × FLW	36.98± 0.36 ^a	92.23± 1.25 ^a	225.60± 2.66 ^a	378.96± 4.49 ^a	657.64± 8.15 ^a	868.07± 11.90 ^a	1164.54± 17.01 ^a
LS	***	***	***	***	***	***	***

Data are least squared mean ± SE. ***: $P < 0.001$; Values not connected by same superscript letter are significantly different. DOC: Day Old Chick, FLC: Female Line Color, MLC: Male Line Color, MLW: Male Line White, FLW: Female Line White, SE: Standard Error

Table 2 Body weight (g) of different line crossed male chicken up to 6 weeks of age

Genotype	Day old	Age (Week)					
		1 st	2 nd	3 rd	4 th	5 th	6 th
MLW×FLW	36.94± 0.51 ^a	89.42± 1.66 ^a	221.71± 3.10 ^a	376.51± 5.80 ^a	664.97± 6.41 ^a	890.20± 13.85 ^a	1215.94± 17.78 ^a
MLW×FLC	32.16± 0.61 ^a	65.80± 1.97 ^b	202.20± 3.67 ^b	357.16± 6.86 ^a	626.04± 11.85 ^b	821.72± 16.39 ^b	1170.72± 21.04 ^a
MLC×FLW	36.66± 0.62 ^b	61.66± 2.01 ^b	150.29± 3.75 ^c	253.95± 7.01 ^b	400.87± 12.09 ^c	561.20± 16.73 ^c	737.88± 21.47 ^b
MLC×FLC	31.00± 91 ^b	53.18± 2.97 ^c	130.00± 5.53 ^d	230.72± 10.35 ^b	365.00± 17.86 ^c	541.27± 24.72 ^c	724.73± 31.72 ^b
LS	***	***	***	***	***	***	***

Data are least squared mean ± SE. ***: $P < 0.001$; Values not connected by same superscript letter are significantly different. DOC: Day Old Chick, FLC: Female Line Color, MLC: Male Line Color, MLW: Male Line White, FLW: Female Line White, SE: Standard Error, LS: Level of significance

Table 3: Body weight (g) of different line crossed female chicken up to 6 weeks of age

Genotype	Day old	Age (Week)					
		1 st	2 nd	3 rd	4 th	5 th	6 th
MLW×FLW	37.04± 0.48 ^a	96.90± 1.81 ^a	232.09± 4.59 ^a	383.04± 6.96 ^a	645.42± 12.15 ^a	831.19± 17.35 ^a	1078.86± 24.11 ^a
MLW×FLC	30.20± 0.40 ^b	71.66± 1.51 ^b	196.83± 3.84 ^b	343.33± 5.82 ^b	573.53± 10.16 ^b	748.26± 14.51 ^b	1042.03± 20.17 ^a
MLC×FLW	37.53± 0.39 ^a	60.31± 1.46 ^c	143.37± 3.72 ^c	235.53± 5.64 ^c	350.59± 9.84 ^c	471.18± 14.05 ^c	603.31± 19.53 ^b
MLC×FLC	30.66± 0.57 ^b	52.66± 2.14 ^d	122.73± 5.43 ^d	209.06± 8.24 ^d	316.20± 14.37 ^c	440.40± 20.53 ^c	552.87± 28.52 ^b
LS	***	***	***	***	***	***	***

Data are least squared mean ± SE. ***: $P < 0.001$; Values not connected by same superscript letter are significantly different. DOC: Day Old Chick, FLC: Female Line Color, MLC: Male Line Color, MLW: Male Line White, FLW: Female Line White, SE: Standard Error, LS: Level of significance

Table 4: Sex combined weight gain of different line crossed chicken up to 6 weeks of age

Genotypes	Body weight gain (Week)								
	0-1 week	1-2 week	2-3 week	3-4 Week	4-5 week	5-6 week	0-3 week	3-6 week	0-6 week
MLW×FLW	55.25± 1.23 ^a	133.37± 2.14 ^a	153.35± 3.4 ^a	278.67±5. 59 ^a	210.42± 5.80 ^a	296.46± 7.83 ^a	341.98± 4.47 ^a	785.57± 14.89 ^a	1127.55± 16.97 ^a
MLW×FLC	37.90± 1.24 ^b	130.27± 2.16 ^a	150.34± 3.4 ^a	247.78±5. 64 ^b	184.25± 5.86 ^b	318.87± 7.90 ^b	318.52± 4.51 ^b	750.90± 15.03 ^a	1069.44± 17.13 ^b
MLC×FLW	23.73± 1.23 ^c	85.44± 2.14 ^b	97.08± 3.41 ^b	128.71±5. 59 ^c	137.62± 5.80 ^c	151.21± 7.83 ^c	206.26± 4.47 ^c	417.55± 14.89 ^b	623.82± 16.97 ^c
MLC × FLC	22.07± 1.81 ^c	72.92± 3.14 ^c	92.42± 5.00 ^b	118.61±1 8.20 ^c	146.23± 8.52 ^c	142.50± 11.49 ^c	187.42± 6.56 ^d	407.34± 21.86 ^b	594.77± 24.91 ^c
LS	***	***	***	***	***	***	***	***	***

Data are least squared mean ± SE. ***: P<0.001; Values not connected by same superscript letter are significantly different. DOC: Day Old Chick, FLC: Female Line Color, MLC: Male Line Color, MLW: Male Line White, FLW: Female Line White, SE: Standard Error, LS: Level of significance

Table 5: Meat yield characteristics of different four line crossed chicken

Genotype	Sex	Weight (g)															Dress- ing %	Shrink age (%)	
		BF	AF	Difference	EM	Giblet	Carcass	BM	TM	TB	Thigh	DM	DB	Drum stick	WM	WB			Wing
MLC × FLC	M	963	950	13	659.0	60.0	719	89.5	45.2	8.7	53.9	33.1	15.2	48.3	26.1	19.2	45.3	75.6	1.3
MLC × FLC	F	865	850	15	598.5	38.5	637	54.3	39.4	7.6	47	37.1	11.3	48.4	22.5	18	40.5	74.9	1.7
MLC×FLW	M	1055	1019	36	720	69.5	789.5	65	51	8.4	59.4	35.9	14	49.9	26.3	18.1	44.4	77.4	3.4
MLC × FLW	F	873	852	21	568	50.5	618.5	49.2	40.6	6.6	47.2	26.6	9.8	36.4	16.3	15.9	32.2	72.5	2.4
MLW×FLW	M	1216	1200	16	860	66.0	926	90.2	55.1	10.6	65.7	42.1	16.2	58.3	28.2	19.5	47.7	77.1	1.3
MLW×FLW	F	1155	1019	136	757.5	71.0	828.5	86.7	36.4	9.1	45.5	41.2	12.7	53.9	28.4	17.5	45.9	81.3	11.7
MLW×FLC	M	1107	1090	17	757.5	66.8	824.3	73.2	52.4	8.9	61.3	39	15.1	54.1	32.1	15.4	47.5	75.6	1.5
MLW×FLC	F	1091	1080	11	758.5	62.0	820.5	81.4	47.5	8.6	56.1	37.5	11.3	48.8	23.1	17.6	40.7	75.9	1.0
Broiler	M	1200	1113	87	758.7	53.5	812.2	88.2	60.2	8.9	69.1	40.7	14.8	55.5	28.1	15.7	43.8	72.9	7.2
Broiler	F	1150	1011	139	672	51.8	723.8	60.6	55.2	9.2	64.4	33.5	15.6	49.1	26.7	15.4	42.1	71.5	12.0

M: Male, F: Female, BF: Before Fasting, AF: After Fasting, EM: Edible Meat, BM: Breast Meat, TM: Thigh Meat, TB: Thigh Bone, DM: Drumstick Meat, DB: Drumstick Bone, WM: Wing Meat, WB: Wing Bone, FLC: Female Line Color, MLC: Male Line Color, MLW: Male Line White, FLW: Female Line White

IV. DISCUSSION

The day old weight of MLC×FLC and MLW×FL crossbred chicken were intermediate with no significant difference which supports the study of Sharma *et al.* (1971) who reported that genotypes ultimately affect the day old weight of chicks that positively related with egg weight. The final weight was higher in MLW×FLW than that of MLW×FLC, MLC×FLC and MLC × FLW which strongly supports the findings of [5] who studied with 498 chicks of a colored synthetic broiler strain to evaluate the

inheritance of body weight from day old to 6 weeks of age and found positive significant correlation between the body weights at different ages. Body weights were also influenced by some set of genes and the weights at 6 weeks of age was improved as a correlated response [5]. The finding of the current study also matches with the findings of [1] who demonstrated that the growth of synthetic broiler in F2 generation is comparable to commercial broilers. The synthetic broiler attained 1459.25 gm body weight at 5 weeks of age which is higher than the present findings.

The results of different body weight of male and female chickens indicates effect of sex on body weight difference in broilers which supports the study of [6] who reported that body weight in female lines improved 504, 548 and 587g for strains PP (15), VV (10) and KK (8) respectively and body weight in male lines improved 758 and 408g for TT (10) and ZZ (3) respectively. High weight lines gained 26 and 20g per generation for males and females were reported by [7].

The results are consistent with [8] who found that dressing percentage of commercial broiler (Hybro) was 63.00% at 6 week of age. The dressing percentage of MLW × FLW was 75.48% at 6 wk of age, which is comparable with the observation of [9] who reported the dressing percentage of Synthetic broiler × White Rock (WR) was 74 percent. The highest breast meat yield was obtained from MLW × FLW. Significant difference in breast meat was observed in MLC × FLW. According to the findings of [10] percentage of breast muscle was 27.1 and 29.3 for male and female respectively, and this result contradicts with our findings that the highest breast meat percentage in our study was 12.44 for male and 10.34 for female.

Three different parameters were measured of thigh. They were thigh meat, thigh bone and thigh weight. All the parameters differed significantly among different strain and cross. All the parameters were highest in MLW × FLW (55.1, 10.6 and 65.7 g respectively) which was comparable with the experiment conducted by [11] on the carcass parts meat yields and bone of eight strains of broiler. There was no significant difference between the sexes but the differences between the strains were significant. These findings are in agreement with the results of the current research. In case of drumstick and wing measurement highest result was found in MLW × FLW and no significant difference was found between male and female performance which also supports the experiment of [11]. Giblet weight differed among the crosses. It is seen from the Table 5 that MLW × FLW had the highest giblet weight followed by MLC × FLW, MLW × FLC and MLC × FLC which supports the findings of [12].

V. CONCLUSION

It could be concluded from the present study that body weight, weekly weight gain and meat yield characteristics were significantly higher in MLW × FLW rather than other three crosses. The performance of MLW × FLC was almost similar compared with MLC × FLC and MLC × FLW. The performance of colored male line considering parameters used in the study was significantly lower in both cases i.e. when it was mated with colored female or white female line. Finally, it may be suggested from the result of this study that white male line is most suitable for superior performance than that of any kind of female line either white or colored.

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