ABSTRACT

The performance and profitability of three commercial broiler strains reared under intensive farming system were investigated in this study at three different farms in Sariakandi Upazilla from 1st February to 7 march. Day-old broiler chicks (n=156) of three different commercial strains (Arbor acres, Cobb-500, and Lohman) were assigned to three treatment groups in a completely randomized block design. Each treatment replicated four times, 13 birds per replicate. The birds were reared from d1 to 35 days of age with similer housing, feeding and environmental management condition. Regarding to all parameters collected, live weight and body weight gain were higher in T2 (Cobb-500) group, while the birds of T3(Lohmann) group were the lowest. Birds of T2 (Cobb-500) group consumed higher feeds, while the birds of other two groups had the lowest feed intake. Cobb-500 broiler strain achieved superior FCR, while the birds of T3 (Lohman) strain group had poorer FCR. Livability of the broiler strains was unaffected by all the treatment groups. Higher net profit and lower production cost observed in T2 (Cobb-500) group than compared to other two strains, although the difference between the treatment groups was similar. The highly significant measurements of live body weight, weight gain and better FCR values were recorded for Cobb-500 broiler strain, followed by Arbor acres and Lohmann, respectively. In conclusion Cobb-500 broiler strain is appeared to be the most economic to rear amongst the three broiler strains investigated here in response to their performance records.

Key words: Strains, FCR, Performances, Sariakandi, Bogra.

Chapter 1

INTRODUCTION

The global livestock industry currently employs 13 billion people and accounts for 40% of agricultural GDP (Steinfeld *et al*., 2006), and this industry is supplying one third of humanity's protein intake across the world. Global meat production is projected to double by 2050 for its increasing demand and trade in livestock products (FAO, 2006). In addition to this, poultry industry as micro-livestock contributing meat, eggs and other food products, and is recognized as the most popular emerging industry in the world. The popularity of this industry is increasing day by day as it supplies nutritious and healthy food items is meat and eggs to the consumers. This industry provides the people health security by supplying them with premium quality of meats and eggs that can improve the nutrition of the people and huge protein gap of the country. As a result, it is emerging as a commercial venture in the world and is rapidly shaping up into an attractive enterprise in response to meet the increasing demand of animal proteins (meat and eggs) which are required for alleviating the malnutrition problem for the people. However, today's broiler industry has undergone a tremendous development and expansion during the last couple of decades around the world. The body weight gain of the broiler strains has been markedly increased, and the feed utilization has been strongly improved with the advancement of new technology applied in poultry nutrition as well as in genetics. This progress in breeding and nutrition has resulted in broiler strains having higher performances today than ever before (Bogdangnov *et al*., 1990). Despite the tremendous growth and development of modern broiler strains all over the world, the inadequate supply of quality animal proteins is still the main problem for the people of Bangladesh. This problem is being aggravated by the increasing trend of human population and thus creating a heavy pressure on every form of food supply in Bangladesh. The expansion of commercial broiler production in Bangladesh has a great potentials for the partial fulfillment of huge protein gap of the country. Broiler production is being raised by both large scale and small scale commercial entrepreneurs under farming condition for fulfilling the protein need of the country. Many people are now encouraged in this enterprise, as maximum return can be achieved shortly by investing minimum capital in broiler production (Sarker *et al*., 2001). However, the greatest scientific and technological development of poultry industry in the last years demanded the evaluation of different commercial broiler strains, as well as different management techniques in order to improve production efficiency, and help them in proper decision making at farming strategy for the commercial broiler strains. This assessment of the fast growing broiler strains is creating a constant force to increase the world scale meat and egg production for human consumption.

Owing to the above consequences, the continuous effort of the breeding companies towards producing high quality broiler strains with improved production traits necessitates continuing evaluation of the selected broiler lines. The broiler breeder strains commonly used by the broiler industry in Bangladesh are Arbor acres, Hub chicks, Ross, Starbro, Hubbard classic, Cobb-500, MPK, Lohman, Hybro G and Hybro N (Latif, 1999). Furthermore, the supply of the day old chicks in most of the farms of Bangladesh is mainly coming from ten international poultry breeding companies, either from imported parent stocks or from imported hatching eggs (Latif, 1998). However, various traits of these broiler strains such as production potentials, resistence to disease incidences, marketing age, meat quality, consumer demand, profitability, adaptability etc, may affect the farmer's preference adversely and profit margin of rearing these birds in the farming condition of Bangladesh.

However, Bangladesh is developing and tropical country where poultry industry is growing rapidly with raising a numerous broiler strains under the farming management. The productivity and adaptability of these strains may very significantly due to several environmental factors for example temperature, humidity and other incidences (diseases) which may put a great impact on the production potential and survivability of these fast-growing broiler strains. In addition, climatic stresses can affect the production performances and adaptability of these strains (Sarker *et al.*, 2001) to an extent. Fast-growing broiler strains may face extreme heat stress when they are exposed to higher temperature environmental condition and therefore, may be unsuitable for rearing them under tropical environmental management condition (Bohen *et al.*, 1982) profitably. Furthermore, adverse environmental impact on broiler performance is noticed by previous several researchers (Baghel and Pradhan, 1989; Islam, 2000), which is responsible to reduce the weight gains, feed consumption, feed efficiency, adaptability, and profitability of rearing these strains under hot- humid and dry seasons than any other cold climatic conditions. However, information on the probable performance and managing of these strains is typically obtained from the literatures made available by the breeder companies. This information does not necessarily apply to regional environmental effects (Farran *et al*., 2000) of any particular country. Therefore, lack of adequate information on the fast growing broiler strains retrieved from these breeder companies is still perceived a salient constraint to the speedy growth broiler industry in Bangladesh. In view of the above consideration, the present study was undertaken to compare the performance and economic suitability of three commercial broiler strains (Arbor acres, Cobb-500 and Lohman).

Chapter 2

MATERIALS AND METHODS

A total number of 156 day old broiler chicks of either sex of three different strains such as Arbor acres, Cobb-500 and Lohman were purchased from dealers . The chicks were randomly allocated into three treatment groups (T1, T2 and T3) having 52 chicks in each group. Each treatment had four replications of 13 birds. The birds were reared under intensive farming systems at the broiler farm in Sariakandi; Bogra, from1st February to 7 March upto 35 days of age.

A total of 12 floor pens of equal size were set up in an open-sided house to accommodate the birds from d1 to 35 days. Each pen contained a feeder and a drinker for proper feeding and drinking. Litter of rice husk materials to a depth of 2 cm was spread on the floor of each pen to maintain a comfortable environment for the birds. Feeders were cleaned daily before supplying diets and drinkers were washed weekly to maintain the hygienic condition for the birds. The birds were brooded with the temperature of 35˚ Celsius for the first two days only. Then this was reduced by 1 or 2˚ every 1 or 2 days until day 19 when the temperature was set at 24˚ and this temperature was maintained until the end of the trial period. Continuous lighting was provided throughout the trial period. Feeds were provided in pelleted form. Birds had free access to water and feed which were provided adlibitum throughout the trial period.

Commercial ready- made compound broiler feeds (pellet) were supplied to the birds adlibitum throughout the trial period. The feeds were collected from the purchasing outlets of the Aftab Bohumukhi feed mill company. Birds were fed the starter diets from 0 to 21 days and the finisher diets were used for the rest of the trial period (22 to 35 days). The nutrient composition of the experimental feed was shown in the table 1. The nutrient composition of the experimental feeds used in this study appeared to be a bit different from the recommended levels prescribed by the NRC(1994) for the broiler chickens. All the birds received the necessary vaccines against the Newcastle disease, Infectious Bursal Diseases and Infectious Bronchitis disease and medicines for disease protection. All dead birds were sent to the Sariakandi

Veterinary Hospital, Bogra, for post mortem examination to identify the causes of death.

Data collection:

Birds were weighed individually before allocating them into the pens, then in group wise on 15, 23, 28 and 35 days of age to the end of the trial. Live body weight (LBW) and feed intake were recorded on the same days. Mortality was recorded daily while the body weight and feed intake were recorded on 15, 23, 28 and 35 days of age for the calculation of body weight gain and FCR corrected for mortality. Mortality of birds was recorded daily as and when it was occurred, and finally livability of the birds was calculated from this by deduction. The experimental design followed for this experiment was a completely randomized block design.

Live weight gain, FCR and cost benefit ratio (CBR) were calculated by the following ways:

LWG= Achieved body weight of the birds (g) – Initial body weight (g) of the birds

$$\text{FCR} = \frac{\text{Amount of feed consumed(g)}}{\text{Body weight gain(g)}}$$

$$\text{CBR} = \frac{\text{Total cost of production per bird}}{\text{Net profit obtained by each bird}}$$

Statistical Analysis:

All recorded data were subjected to analysis using one-way ANOVA with strain as a factor. The significance of difference between means was determined by post hoc t test.

Table1: Nutrient composition of the feed

Nutrients	Starter (0 – 21 days)	Finisher (22-35 days)
ME (kcal/kg)	3200	3000
CP (%)	22	19.5
Crude Fat (%)	3.50	4.00
Ca (%)	.95	.95
p (%)	.44	.44

Chapter 3

RESULTS

Live weight:

Body weight differed significantly ($p<0.05$) between the strains. Cobb-500 birds recorded heavier body weight compared to Arbor acres and Lohman birds from 28 to 35 days of age. Final weight differed significantly ($p<0.05$) between the strains. Birds of Cobb-500 strain were the heaviest (1425.3g) at 35 days of age compared to Arbor acres (1375.3g) and Lohman (1314.6g) strains.

Body weight gain:

Live weight gains of all the strains differed significantly ($p<0.05$) showed in table 3. As the absolute differences between the strains greater than the critical range so there was differences for weight gain for each group and average live weight gains upto 28^{th} and 35^{th} days were significantly ($p<0.05$) greater for Cobb-500 strain compared to other two strains showed in table 3.1.

Feed intake:

Feed intake of all the strains differed significantly ($p<0.05$) showed in table 4.As the absolute differences between the strains greater than the critical range so there was differences for feed intake for each group and at 35^{th} days, bird of T1 group was the highest in feed intake, while birds of T3 group being the lowest in feed consumption. The feed intake of T1 group was similar to the Cobb-500, but differed significantly from the other strain (Lohman) during 35^{th} days of age showed in table 4.1.

Feed conversion ratio (FCR):

Feed conversion ratio of all the strains differed significantly ($p<0.05$) showed in the table 5. As the absolute differences between the strains greater than the critical range so there was differences for FCR for each group showed in table 5.1 and significantly lower FCR value was found in Cobb-500 strains compared to other two strains .

Livability(%):

In the present study, the livability (%) of three broiler strains during the experimental period (35^{th} day) were 94.23%, 98.08% and 94.23% in Arbor acres, Cobb-500 and Lohman respectively (Table 6). Livability of the three strains throughout the entire raising period (15^{th} to 35^{th}) did not show any significant ($p>0.05$) difference between the treatment groups showed in table 6.

Cost benefit analysis:

The data on cost of production of three broiler strains at 35^{th} days of age are shown in table 7. Higher live weight was found in T2 group, while T3 group of birds being the least. Apart from live weight, no other significant differences was found in the remaining data presented in this table 7. Despite insignificant effect, numerically higher feed cost was found in T1 and T3 groups, respectively. Total cost of production (108 tk / kg live bird) was less for T2 group and net profit (22 tk/ kg live bird) was found higher in this strain than the other strains (T1 and T3). Lowest cost benefit ratio (4.91) was found in T2 group.

Table 2: Performance of three broiler strains from 15th day to 35th day:

Parameters	Age (days)	T1	T2	T3
Average body weight gain (g/b)	15	190.5	185.7	179.9
	23	492.7	496.8	495.8
	28	786.7	860.3	695.4
	35	1335.3	1385.3	1274.6
Average Feed intake(g/b)	15	526.4	519.4	515.4
	23	675.2	980.8	985.9
	28	1560.4	1580.6	1475.5
	35	2955.4	2855.4	2783.0
FCR	15	2.80	2.79	2.90
	23	1.36	1.98	2.00
	28	1.98	1.84	2.12
	35	2.21	2.06	2.18
Livability (%)	15	98.08	100	100
	23	98.08	98.08	100
	28	96.15	98.08	96.15
	35	94.23	98.08	94.23

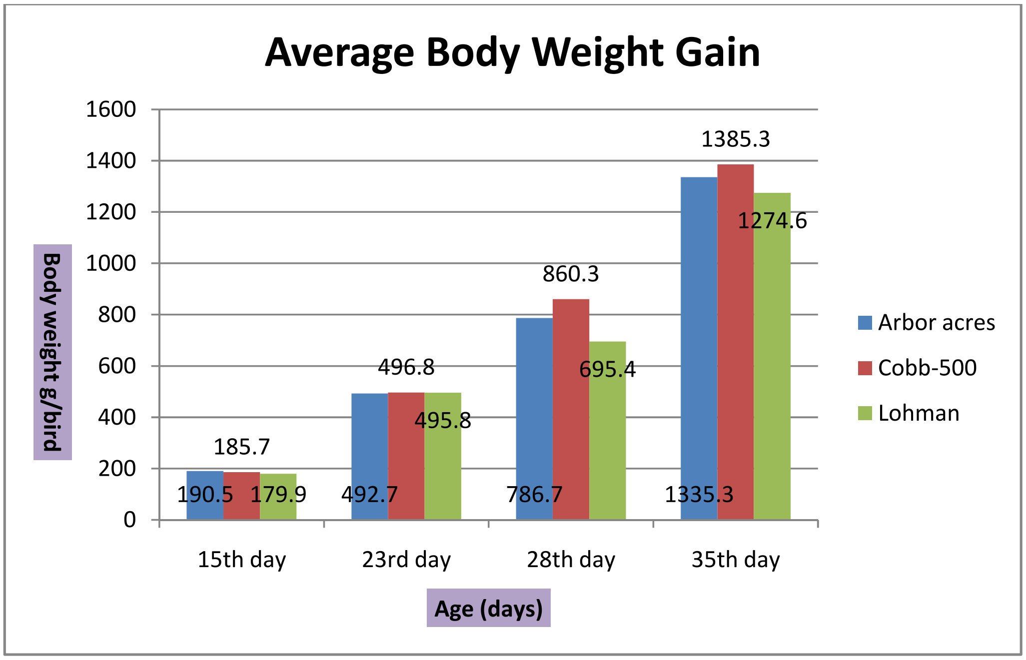

Figure 1: Average live weight gain (g) from day 1 to day 35

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2137305	3	712434.9	286.9823	0.0000000176	4.066181
Within Groups	19860.03	8	2482.504			
Total	2157165	11				

Table 3: overall statistical differences between and within strains for live weight gain (using one way ANOVA).

Comparison	Absolute differences	Critical range
T1 toT2	309.7333333	116.8273477
T2 toT3	285.7	116.8273477
T3 to T1	550.9333333	116.8273477

3.1. Actual mean differences between strain for live weight gain (post hoc t test)

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	9591942.283	3	3197314	302.39	0.0000000143	4.066181
Within Groups	84587.81333	8	10573.48			
Total	9676530.097	11				

Table 4: overall statistical differences between and within strains for feed intake (one way ANOVA)

Comparison	Absolute differences	critical range
T1 to T2	360.2333333	241.1062285
T2 to T3	658.2	241.1062285
T3 to T1	1325.766667	241.1062285

4.1: Actual mean differences between strains for feed intake (post hoc t test)

ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.400492	3	1.133497	104.5501	0.000001	4.066181
Within Groups	0.086733	8	0.010842			
Total	3.487225	11				

Table 5: overall statistical differences between and within strains for FCR

Comparison	Absolute differences	Critical range
T1 toT2	1.48	0.24414484
T2 toT3	0.606666667	0.24414484
T3 to T1	0.276666667	0.24414484

5.1: Actual mean differences between the strains for FCR (post hoc t test)

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.411267	2	3.705633	0.879052	0.448003	4.256495
Within Groups	37.9394	9	4.215489			
Total	45.35067	11				

Table 6: 0verall statistical differences between and within strains for livability (one way ANOVA)

Table 7: Cost benefit analysis at the end of the trial period (at 35th day):

Parameters	T1	T2	T3
Live weight(g/b)	1375.3	1425.3	1314.6
Feed cost (tk/ kg)	62.5	58.3	61.7
Chick cost (tk/ bird)	40.9	39.2	40.2
Other cost (tk/kg)	14.5	10.5	16.3
Market price (tk/kg live weight)	130	130	130
Total cost of production (tk/kg live weight)	117.9	108	118.2
Net profit (tk/ kg live weight)	12.1	22	11.8
Cost benefit ratio	9.74	4.91	10.01

Chapter 4

DISCUSSION

Growth performance (live weight and live weight gain):

Traditionally, the salient criteria for appraising the performance of the broiler strains have been growth rate and feed conversion efficiency, and less frequently, carcass composition (Cahaner *et al*., 1987; Rezaei *et al.*, 2004). But some strains may show higher mortalities and a great variation in final body weight than others due to several factors (strains, sex, feed, disease incidences, environmental condition and so on). Chicken growth is well described as a sigmoid curve with an initial exponential developmental phase, and a final phase of inhibited growth that consists of gradual reduction in growth rate following an asymptotic increase in the body weight (Aguiler *et al*., 1983). However, the duration of this study was only to complete the first phase of growth which is the initial exponential development phase, because the phases afterwards are not economic for broiler producers.

However, significant differences were observed in the live weight and average body weight gain among three broiler strains in this present study. Cobb-500 broiler strain achieved heavier body weight and higher weight gain compared to other two strains. This might be due to higher feed intake and several other factors involved here.The differences of the live weight and weight gain of the broiler strains may be explained by different factors, for example, genotype, feed, sex, strains, environmental conditions, climatic effects and so on. Goneals *et al.*, (1998) found strain effects among several strains of birds in live weight. Koner *et al.*, (2004) reported that genotype may affect the body weight of different broiler strains. Genetic variation of the strains amongst other factors might give rise to the body weight variation between two individual birds. So it is assumed that more weight gain of Cobb-500 broiler strain might arise from the genetic makeup during the embryonic stage, which can lead to having different growth potential, and it may be possible owing to the strain effect, and some other factors might be involved here.

Feed intake:

The ingestion of the optimal level of dietary nutrients, whether for birds involved in egg or meat production, is very much dependent on the level of feed intake. The complexities of the factors which determine nutrient intake and causative reasons and hypothesis for under or over consumption, have been reviewed extensively by many former researcher (Heide *et al.*,1999; Forbes,2006). Birds have a precise requirements for nutrients, both macro and micro, and energy-yielding components. Therefore, knowledge of their feed intake capacity is essential if dietary concentrations are to be appropriate. A bird's daily consumption of feed ultimately governs its health, development and potential for reproduction. Feed consumption of Cobb-500 broiler strain was found higher compared to other two strains in this study. The higher feed consumption of the strain might be resulted from the heavier body weight and individual body requirements of the birds. In addition, the reason for higher feed intake may be explained by several other factors including breed or strain, feed quality, palatability of feed, age, sex, individual body requirement, stage of production, climatic effect and other environmental conditions. Smith *et al.*,(1998)reported that strain and sex can affect feed intake and feed conversion ratio. However, in contrast, the poor performance and reduced feed intake of the broiler strain (Lohman) may be affected by the adverse environmental impact. This strain is supposed to be less heat-tolerant than others, which might affect their feed consumption capacity and other performanceas well. Baghel and Pradhan (1989)and Islam (2000)reported that broiler performance is reduced significantly when they are raised under hot-humid and dry seasons than the cold-climatic condition.

Feed Conversion Ratio (FCR):

Feed conversion ratio (FCR) of the Cobb-500 broiler strain was found superior compared to other two strains in this study. This performance might be partly due to the capacity of this strain (Cobb-500) to consume greater quantities of feed, resulting in higher intakes and hence greater live weight, weight gain and improved FCR than in other broiler strains. The improved FCR of Cobb-500birds indicates that this strain is more efficient in converting feed to meat more rapidly than other two strains. FCR values of this study indicated that improved feed efficiency showed by Cobb-500 broiler strains, then inferior trend of FCR values was followed by Arbor acres and Lohman strains subsequently at 35^{th} days of age.

LIVABILITY :

The livability (%) of the broiler strains was unaffected by all the treatment groups throughout the trial period (d1-35). Birds of Arbor acres and Lohman strains grew poorly than the Cobb-500 birds, although the livability (%) of these two group of birds were identical during the 35^{th} days of age. It may, therefore, be deduced that strains did not adversely affect the bird livability. So to say, the effect of strain on the livability (%) of broiler chickens is exiguous or nominal. Despite this non-significant effect, numerically higher livability was observed in Cobb-500 strain group followed by Arbor acres and Lohman respectively.

Cost benefit analysis:

Higher net profit and lower cost benefit ratio were observed in the Cobb-500 broiler strain than other two strains. The reason behind this is possibly due to attaining heavier body weight and lower production cost compared to other two strains. In addition, higher livability of this strain(Cobb-500) might influence higher net profit than other two strains. Higher profit margin was obtained by the farmers by selling these birds in the market on the live weight basis, as this strain(Cobb-500) attained heavier body weight compared to other strains in this study.

CONCLUSION

It can be concluded that Cobb-500 broiler strain has supported comparatively better growth responses in terms of body weight, feed efficiency, net profit and lower cost of production than those of Arbor acres and Lohman strains. So, Cobb-500 broiler strain may be recommended as economic and more suitable for rearing under the farming management in Sariakandi Upazilla.

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BIOGRAPHY

I am Md. Ariful islam, from Bogra. I have completed my Secondary School Certificate (SSC) examination in 2010 with GPA-5 from Sariakandi Govt. High School, Sariakandi, Bogra and Higher Secondary Certificate (HSC) examination in 2012 with GPA 5.00 from Govt. Azizul Haque college, Bogra. Currently I have been doing my internship programme which is the compulsory of DVM programme under the Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University. My favorite hobby is reading books. I feel much interest in exploring new techniques for contributing in development of veterinary field in Bangladesh.