Effects of Separate Sex Growing on Performance and Metabolic Disorders of Broilers

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ABSTRACT

A study was conducted at Sher-e-Bangla Agricultural University Poultry Farm in order to explore the effects of separate sex rearing of broiler on production performance and the occurrence of metabolic diseases. A total of 405 Cobb500 birds were divided in 3 treatments (male, female and unsexed) according to their sex with 3 replications in each treatment where each replication had 45 birds. They were provided the same feed and water *adlibitum* for 28 days. Initial body weight, temperature, humidity, feed intake, weekly body weight, death record, final live weight and dressing percent of broiler were recorded. Abdominal fat, liver, heart, kidney, spleen etc. were collected and weighed from the birds to correlate to the occurrence of metabolic disorders. The study revealed that male birds consumed more feed and produced higher body weight. The FCR (1.45) in male birds differed significantly than that (1.61) in female birds and also showed better dressing percentage (71.21%) than in female group (69.67%) or unsexed group (70.08%). Abdominal fat deposition was higher in female (20.35 ±1.94 gm) in comparison to those in male (16.45 ±1.50 gm) or unsexed (18.48 ±2.04 gm) birds. Abdominal fat deposition was highly correlated (*r = 0.83*) to fatty liver diseases in female birds in comparison to that of male (*r=0.42*). Mortality rate was higher in female birds (2.2%) than that in male (1.4%). All these findings together revealed that in separate sex growing male chicken showed better performance in terms of more production and less vulnerability to metabolic diseases.

Key words: Broiler production, separate sex growing, abdominal fat, fatty liver, metabolic diseases

INTRODUCTION

Now-a-days poultry farming has been recognized as a profitable enterprise. Broiler farming is a rapid income generating source for the rural women and un-employed youths. In connection with the possibility of new marketing channels for poultry meat, the present study was carried out to evaluate the feasibility of separate sex growing of broilers available in Bangladesh market. No sexing is practiced on the day-old broilers at the hatchery. Under similar management conditions, male broilers have a lower FCR, and produce heavier carcasses than females when slaughtered at the same age. Separate sex growing may increase average meat production. The more efficient male broilers can be used for cut-up and value-added products and the female broilers can be used to meet the whole carcass requirements. The economic implications of separate sex growing effects on the management and production systems are discussed in the present paper. Bangladesh is significantly deficit in meat production. Annual meat consumption is 8.65 kg per head per year (BBS, 2010) against the world average of 43.8 kg which indicates a huge demand for increasing the production of broiler meat and its related

industry. In this connection maximum production should be ensured by using appropriate rearing technology. Rearing of separate sex growing may increase profit margin of broiler business which is not practiced in Bangladesh. Total edible meat of a broiler chicken can be measured by evaluating its carcass parts like breast, thigh, drumstick, back, neck, giblet and abdominal fat weight. In developed countries dressing edible parts of broiler business is very popular. Here, customer can purchase broiler carcass parts as desires. It helps to produce safe chicken meat and prevents disease contamination. The composition of the broiler carcass is now the focus of the broiler industry with the major economic emphasis being put on further processing (Leeson & Summers, 1997). A review of limited data published on the separate sex growing of broilers indicates the economic advantages that can be obtained from the practice (North & Bell, 1996). Broiler processing helps to produce safe chicken meat and prevents disease contamination. It has also been reported that the male broilers have less abdominal fat compared to females (Nir, I., 1992), and therefore the cost of fat trimming is significantly reduced during further processing. The male broilers had a significantly higher meat yield in the choice cuts compared to the females (Leenstra and Cahaner, 1992). So, the present study was undertaken to know the effect of separate sex growing on the incidence of metabolic disorders and the production performances of broilers reared under separate sex growing.

MATERIALS AND METHODS

A total of four hundred five (405) day-old Cobb 500 chicks were used and fed on commercial feeds. The experiment was conducted at the SAU Poultry Farm, Dhaka, Bangladesh for a period of 28 days (from 6 June to 4 July 2014). The conditions and standards of care employed in this experiment were in accordance with standard guideline of poultry management. The broiler chicks were separated by sex. Males and females can be separated on visual observation of the feathers (Austic & Nesheim, 1990). Female broiler chicks are fast feathering and have longer primaries than coverts. Male broiler chicks are slow feathering, and the primaries are shorter (or are of the same length) than the coverts. The chicks were sexed at day-1 to establish separate male and female flocks. There were three treatments i.e male chicks, female chicks and control (unsexed group) 3 replications in each treatment. Forty five (45) chicks were allocated for each replication. Sexed and unsexed chicks were distributed randomly inside the pens. The size of each pen was $4m^2$ (2m x 2m). The broiler chicks were housed in the open sided south facing shed and kept disease away from the broiler farm maintaining all bio-security measures. During the experimental period the highest and lowest temperature of poultry house was recorded 38^0C and 27^0C and the highest and lowest humidity was recorded as 99% and 50%, receptively. Fresh, clean and sun dried rice husk was used as shallow litter (2 inch depth) on floor. There was provision of cross net wire ventilation in the broiler house to remove polluted air. Thick polythene sheet was used over the net to save the bird from rains and wind. Brooding temperature was adjusted (Below 35^0C) with house temperature. It was hot season. Electric fans were used as per necessity to save the birds from the heat stress. The starter ration was analyzed in the Nutrition laboratory, SAU, Dhaka. The ME Kcal/Kg & CP was 2950 & 22 % respectively. The grower ration had ME Kcal/Kg 3088 & CP 21%. Feed and drinking water were allowed *adlibitum*. Round plastic feeders and drinkers were used. For the first 2 weeks four 40-watt tube lights were used at night to facilitate eating and drinking of the birds. Rest of the weeks 1 hour dark was allowed at night in two times. The

initial body weight, temperature, humidity, feed intake, weekly body weight, death record, final live weight and dressing percent of broiler chicks were recorded. Abdominal fat, liver, heart, kidney, spleen etc. were collected from the experimental birds and weighted to correlate to the occurrence of metabolic disorders. Briefly, 10 birds from each replicates were randomly selected from each treatment; first they were weighed then marked with stamps on their wing and left without food for 12 hours. Subsequently, birds were weighed again, slaughtered following Halal method and frozen. During the dissection, the abdominal fat was extracted and weighed, as well as body weight and put in proportion to the body weight before slaughtering, and yield of cooled carcasses were obtained. Data were analyzed in factorial experiment with Randomized Completely Block Design (RCBD) for ANOVA table. MSTAT-C (Freed, et. al., 1992) computer package program was used for data analysis. Duncan Multiple Comparison Range Tests, Tukey–Kramer test were done at 5% level of significant. Excel Program was practiced for preliminary data calculation.

Formulae for Calculation

Following formula were used to find out different parameters-

$$1.\ \text{Feed consumption (g/bird)} = \frac{\text{Feed intake in a replication}}{\text{No. of live birds in a replication}}$$

$$2.\ \text{Live weight (g/bird)} = \frac{\text{Total live weight in a replication}}{\text{No. of live birds in a replication}}$$

$$3.\ \text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed intake (g)/bird in a replication}}{\text{Live weight (g)/bird in a replication}}$$

$$4.\ \text{Mortality (\%)} = \frac{\text{No. of death bird in a replication}}{\text{No. of initial birds in a replication}} \times 100$$

5. Dressing yield = Live weight- (blood + feathers + head + shank+ digestive system)

$$6.\ \text{Dressing \%} = \frac{\text{Dressing yield}}{\text{Live weight}} \times 100$$

RESULTS AND DISCUSSION

Production Performance

The average important production performance parameters such as feed consumption, live weight, feed conversion ratio (FCR), mortality and dressing rate of 28 days broiler chicken under three treatment is presented in Table 1. It indicates that the average feed consumption were significantly (P<0.05) higher in male (2286g) and female (2434g) group than control (2403g) group, but there was no significant (P>0.05) difference between male and female group in feed consumption. The control group consumed less feed and it might be agnostic behavior of chicken. It is revealed from Table 1 that the live weight at marketing age was not significantly (P>0.05) differ among the male (1567g), female (1504g) and control (1514g) groups. The live weight of broiler was not influenced by sex. Here the live weight of control group was not affected by their less feed intake. Table 1 shows that the feed conversion ratio (FCR) of female (1.61) and control group (1.58) were significantly (P<0.05) higher than male group (1.45), but no significant (P>0.05) difference was found between female and control group. Higher FCR indicates poorer feed efficiency and lower indicates better feed efficiency. In the experiment male group showed the best feed efficiency by consuming less feed. It is revealed from Table 1 that significant (P<0.05) difference was found among the treatments in dressing percent. Male broiler chicks showed highest dressing percent (71.21%) than unsexed (70.08%) and female (69.67%) broilers. In dressing yield male broiler chicken was superior to female. Similar finding reported by Leenstra and Cahaner (1992) that the male broilers had a significantly higher meat yield compared to the females. It is evident (Table 1) that the mortality percent was not significant (P>0.05) at different treatment groups of male (1.4%), female (2.22%) and control (2.22%), but male group showed less mortality than others. It was found that mortality was not affected (P>0.05) by male or female and unsexed groups.

Table 1: The average production performance parameters of broilers

Treatments (Broiler)	Production Performances				
	Feed Intake (g)	Live weight (g)	Feed Conversion Ratio (FCR)	Mortality (%)	Dressing%
Male chicks	2286^{a}	1567^{a}	1.45^{b}	1.40^{a}	71.21^{a}
Female chicks	2434^{a}	1504^{a}	1.61^{a}	2.22^{a}	69.67^{c}
Unsexed chicks (Control group)	2403^{b}	1514^{a}	1.58^{a}	2.22^{a}	70.08^{b}
Mean ± SE	2374.11±15.84	1528.33±25.11	1.55±0.018	1.94±0.683	70.31±0.075
LSD $_{(0.05)}$	62.18	98.59^{NS}	0.071	2.68^{NS}	0.29

Means with different superscripts are significantly different (P<0.05)
Means with same superscripts are not significantly different (P>0.05)
SE= Standard Error
LSD=Least Significant Difference

Propensity to metabolic disorders

In order to understand the influence of sex on the occurrence of metabolic disorder in broiler, the amount of abdominal fat, the size and consistency of liver and other internal organs were studied. Table 2 depicts the amount of abdominal fat and the size of other internal organs in male bird group, female bird group and the unsexed (control) bird group. This is obvious from the Table 2 that abdominal fat deposition was significantly higher in female birds than that in male. This is to be noted that fat load is an important problem of the modern broiler production. Intensive production system in poultry has induced increase of fat in broilers which nowadays amounts to more than 18% fat in their carcass.

Table 2: Amount of abdominal fat and sizes of other internal organs in different treatment groups of Broiler

Groups	Gross weight (g)					% of live weight				
	Abdominal Fat	Liver	Spleen	Heart	Gizzard	Abdominal Fat	Liver	Spleen	Heart	Gizzard
Male chicks (n-30)	16.45 ±1.50^{a}	32.01 ±1.33^{a}	1.5 ±0.32	5.1 ±0.33	62.7 ±1.12	1.1 ±0.1^{a}	2.04 ±0.08	0.1 ±0.2	0.33 ±0.02	4.0 ±0.08
Female chicks (n-30)	20.35 ±1.94^{b}	35.37 ±2.52^{b}	1.01 ±0.24	5.03 ±0.42	60.3 ±3.68	1.32 ±0.12^{ab}	2.32 ±0.11	0.07 ±0.02	0.33 ±0.03	4.0 ±0.24
Control chicks (n-30)	18.48 ±2.04^{ab}	32.77 ±2.15^{ab}	1.14 ±0.34	5.03 ±0.26	63.5 ±4.08	1.22 ±0.13^{ab}	2.16 ±0.14	0.08 ±0.02	0.33 ±0.02	4.2 ±0.27

Data are shown as Mean± Standard Error. Different lowercase letters indicate significant differences in groups (P <.05; Turkey–Kramer test).

Abdominal fat is a characteristic which is related to the total amount of fat in the body. Crawford (1992) has concluded that the differences in weight of abdominal fat in chicken of various races and genotypes are result of the differences in body weight, so that abdominal fat should be determined for the chicken with similar weight. Sex and age have great influence on fat. Female chicken tend to be fattened than male (Fig. 1a) and the older chicken have greater fat quantity than the younger ones.

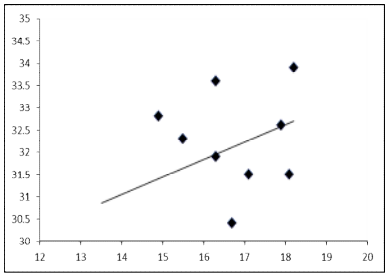

Fig. 1 (a): Correlation between abdominal fat deposition and weight of liver in male birds (*r = 0.42*)

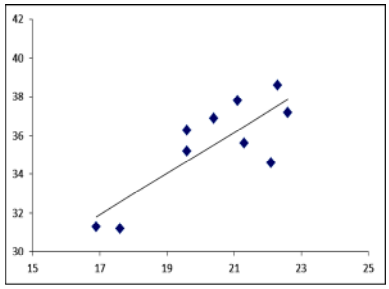

Fig. 1 (b): Correlation between abdominal fat deposition and weight of liver in female birds (*r = 0.83*)

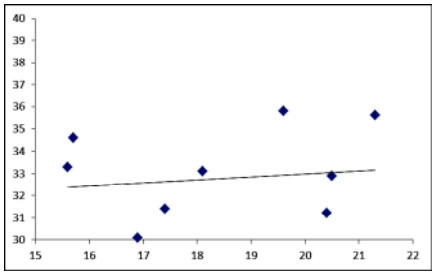

Fig. 1 (c): Correlation between abdominal fat deposition and weight of liver in unsexed birds (*r = 0.12*)

Sonaiya and Benyi (1983) conducted a research on the influence of the line, age and sex on the quantity and weight of abdominal fat in broiler chicken, from which they concluded that sex and age had significant influence, but not equally, sex had greater influence than age. Female chickens produced more abdominal fat than male chicken and therefore the cost of fat trimming is significantly reduced during further processing (Nir, I., 1992). This is well believed that fat deposition of the body significantly influences the occurrence of metabolic disorders like fatty liver diseases and sudden death in all animal types including chicken (Skřivan et. al., 2008). The findings of this study are also in accordance with the belief. We have recorded 1.40% sudden death in male birds in comparison to 2.22% of that in female and unsexed groups. On postmortem examination all of the sudden death revealed more or less fatty liver syndrome of which fatty liver was more prominent in female birds (Fig. 2b) than in male birds. The post mortem findings are also in agreement with the data shown in Table 2. The gross weight of liver of female birds was significantly higher than that in male birds (Fig. 2a).

Fig. 2 (a): Liver of male birds

Fig. 2 (b): Liver of female birds

This finding indicates the high correlation (r=0.83) between abdominal fat deposition and fatty liver syndrome (Fig. 1b). In addition, the percentage of abdominal fat in female birds were significantly higher than that in male (Fig. 1a) indicating the females to be more susceptible to metabolic syndromes. The correlation (r=0.12) between abdominal fat deposition and fatty liver syndrome is low (Fig. 1c) in unsexed birds. Moreover, increased gross weight of liver in female is also an indication of higher fat deposition that makes females more prone to develop metabolic disorders (Table 2). Thus, the study findings clearly reveal that female birds are prone to more fat accumulation and thereby producing metabolic disorders like fatty liver diseases and sudden death.

CONCLUSIONS

The study findings clearly revealed some interesting facts on commercial broiler production that seem to be worthy for practical implementation in Bangladesh. In Bangladesh, commercial broiler production usually follows raising of broilers as straight-run flocks. No sexing is practiced in case of broiler production in Bangladesh. But this study reveals the fact that using male chicks for broiler production would be more cost effective since the male birds showed higher feed efficiency, dressing percentage but lower abdominal fat accumulation and thus, lower vulnerability to metabolic disorders or sudden death. Although there is need for more studies on this issue, present study shows new dimension for commercial broiler production in Bangladesh.

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ABBREVIATIONS

FCR- Feed Conversion Ratio

SAU- Sher-e-Bangla Agricultural University

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