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Evaluation of Carcass Traits and Meat Composition of Triple Cross Progenies of Hansli, CSML and CSFL Chickens

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ABSTRACT

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A study was conducted to compare the carcass characteristics and meat composition of a triple cross progeny involving (Hansli × CSML) ♂ and CSFL ♀ chicken, taken as the treatment group, with that of a cross of coloured synthetic broiler parent lines (CSML ♂ × CSFL ♀) chicken, taken as the control group, raised under intensive management system. Six healthy birds of 8 weeks of age from each group were sacrificed for this purpose. The pre-slaughtered live weight, eviscerated weight and dressed weight were 1256.67±110.67g, 826.33±74.54g and 905.00±78.54g in the treatment group whereas the corresponding weights were 1531.33±177.39g, 972.33±141.99g and 1063.00±152.51g in the control group. The dressing percentage was 72.03% in treatment group and 69.01% in control group. There was no significant difference between the groups among cut-up part yields such as neck, wing, back, breast, thigh and drumstick. The yields of edible offals such as heart, liver, gizzard were also similar between the groups. The yields of lymphoid organs such as spleen and bursa of fabricius were also found to be similar between the groups. There was no significant (p≥0.05) difference in chemical composition of breast and thigh muscles between the groups. However, the protein% in the treatment group was numerically higher and the fat% was lower than that of the control group.

Introduction

Poultry farming in India is an integral part of the agricultural industry. The Indian poultry industry has come a long way from a backyard enterprise to an organized commercial industry (Bharambe and Garud 2012). Among the various aspects in poultry science,

improvement in genetic makeup by various breeding methods, such as crossbreeding to improve the carcass characteristics and meat quality is an important aspect. Crossbreeding has been a major tool for the development of present-day commercial breeds of chickens (Sheridan 1981) and could likewise be used to improve the rural chicken. Comparatively, little research and development work has been

carried out on rural poultry, despite the fact that they are usually more numerous than the commercial chickens in most developing countries (Cumming 1992). Crossbred poultry have higher feed efficiency and lower mortality as compared to purebreds and these two factors play a very important role in increasing profits in poultry production (Dwivedi et al., 1986). Poultry has adapted to most areas of the world and has a high economic value as well as rapid regeneration time (Smith, 1990). The rapid growth of the human population in India has led to a relatively high demand for protein. Meat and eggs are among the most important forms of animal protein in economically developed and developing areas of the world. Poultry meat is the cheapest source of protein compared to other animal protein forms and, probably, the most consumed. Medical research also indicates that poultry meat has lower cholesterol content in contrast to red meat (Khatun, 2012). However, local chickens are insufficient to provide sufficient meat to the people in a highly populated country. So there is a growing demand from the farmers for the exotic hybrids suitable to family production system. Hence, efforts have been diverted to production of dual purpose breeds and hybrids with improved production profiles. Utilization of native chicken breeds for the development of suitable scavenging chicken has resulted in great success in our country. These hybrids are readily accepted by the rural farmers owing to their similarity to the typical appearance of the local birds and low operational cost with significant returns under the existing methods of rearing in the rural areas. Hence, the commercial hybrid cross between a native breed and an exotic bird would be a good proposition for the ideal replacement of native scavenging chicken in the backyard poultry keeping. 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.

With these views it is therefore necessary to identify potential poultry crossbreds suitable for backyard farming as well as commercial farming in different regions of India. The present study has been conducted to evaluate the crosses of native and coloured broiler parent line with the objectives to study their carcass traits and meat composition.

Materials and Methods

The study was carried out at PG Department of Poultry Science, College of Veterinary Science and Animal Husbandry, Orissa University of Agriculture and Technology, Bhubaneswar. The genotypes were; (i) Control: coloured synthetic broiler crosses (CSML ♂ × CSFL ♀ crosses) (ii) Treatment: (Hansli × CSML) ♂ × CSFL ♀ crosses. Adult coloured synthetic male line (CSML) males and coloured synthetic female line (CSFL) females at 40 weeks of age 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. The chicks were weighed, numbered by wing band and randomly distributed in separate pens according to treatments.

Identical care and management were provided to chicks of both groups throughout the experimental period and were vaccinated against various diseases. Ad libitum feeding was practiced. A standard broiler starter ration containing 22% crude protein (CP) and 3150 kcal/ kg metabolizable energy (ME) for four weeks followed by a finisher diet containing 20% CP and 3150 kcal/kg ME from 5th week till 8th week were fed to the experimental chickens. Clean and fresh water was made

available at all times. All procedures were approved by the Local Ethics Committee at the University.

Slaughtering procedure

At the end of eight weeks, six healthy birds from each group were sacrificed. Before slaughter, the selected birds were deprived of feed but not water for 12 hours to facilitate proper bleeding and also to know their actual pre-slaughter weights.

The birds were sacrificed by improved Kosher method by severing the jugular vein and carotid artery below the left ear lobe by a single incision and allowed to bleed for five minutes. After complete bleeding and cessation of movement, the carcass weight was recorded. The carcass was then scalded at 55-58⁰ C for 1 minute 30 seconds and defeathered manually starting from the tail, wing sides, legs, back and neck region of the scalded bird. Left over pin feathers were removed with pinning knife. The oil gland from the tail region, the head from the occipital joint and the feet from the hock joint were severed and removed. Evisceration was performed by giving a transverse incision at the abdomen between the keel and vent and then a circular incision around the vent to cut open the abdominal cavity. The entire visceral organs were pulled out through the opening made.

The inedible organs like wind pipe, oesophagus, crop and all other portions of the intestinal tract, vent, spleen, lungs, epicardium, testes, ovaries and gall bladder were removed. The eviscerated carcass along with the edible offals were weighed and recorded as edible carcass yield. The total meat yield was calculated by subtracting the giblet weight (the weight of the heart without pericardium, liver without gall bladder and gizzard without the serous lining) from the

weight of the edible carcass. All the above weights of the carcasses as well as the cut-up parts were further expressed in terms of percentage yield.

$$\text{Dressing yield (\%)} = \frac{\text{Dressed Weight}}{\text{Live Weight}} \times 100$$

$$\text{Eviscerated yield (\%)} = \frac{\text{Eviscerated Weight}}{\text{Live Weight}} \times 100$$

$$\text{Giblet yield (\%)} = \frac{\text{Giblet Weight}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Neck yield (\%)} = \frac{\text{Weight of the neck}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Wing yield (\%)} = \frac{\text{Weight of the wings}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Back yield (\%)} = \frac{\text{Weight of the back}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Breast yield (\%)} = \frac{\text{Breast Weight}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Thigh yield (\%)} = \frac{\text{Weight of the thighs}}{\text{Eviscerated Weight}} \times 100$$

$$\text{Drumstick yield (\%)} = \frac{\text{Weight of the drumsticks}}{\text{Eviscerated Weight}} \times 100$$

Proximate composition of meat

The proximate composition such as moisture, crude protein, ether extract and total ash content of the chicken meat from the breast and thigh muscles were made according to the procedure of AOAC (1995). Moisture content was determined by drying 20 g of minced meat placed in aluminum moisture cups and dried in a hot air oven for 18 h at 100±5⁰C. Crude protein content was measured by the Kjeldahl method. The amount of nitrogen obtained was multiplied by 6.25 to calculate the crude protein content. The ether extract or crude fat content was measured by the Soxhlet

extraction system. Total ash content was measured by burning 2 g of sample overnight in a muffle furnace at 600°C.

Statistical analysis

The data obtained from the study were statistically analyzed according to Snedecor and Cochran (1994). The data were analyzed for t-test to find the difference between the means wherever necessary.

Results and Discussion

Carcass traits

The mean carcass traits and cut-up parts% of the chicks in the two groups are presented in Table 1 and 2 respectively. The pre-slaughtered live weight, eviscerated weight and dressed weight were 1256.67±110.67 g, 826.33±74.54 g and 905.00±78.54 g in treatment group whereas the corresponding weights were 1531.33±177.39 g, 972.33±141.99 g and 1063.00±152.51 g in control group. Higher carcass values were exhibited by the control group, though the differences were not statistically significant. This was because of higher pre-slaughtered live weight of the chicks in the control group.

The dressing percentage of the treatment group (72.03%) was higher than the control group (69.01%) though the values did not differ significantly ($p \geq 0.05$). Considering the economic importance of the dressing percentage and a relatively higher value in the treatment group than the control group, it could be considered as a favourable trait for the crosses under study. Higher dressing % in different groups than the present finding was reported by Ekka et al. (2017) at 8 weeks of age in Hansli, CSML and its cross. There was no significant difference between the groups

among cut-up part yields such as neck, wing, back, breast, thigh and drumstick when expressed as the percentage yield of eviscerated weight. The yields of edible offals (percentage yield of eviscerated weight) such as heart, liver, gizzard were also similar between the groups.

The giblet % was 9.72±0.50 in treatment group and 9.42±0.68 in control group. The yields of lymphoid organs such as spleen and bursa of fabricius (percentage yield of live weight) were also found to be similar between the groups. Arora et al. (2011) reported that there was no difference in the percentages of abdominal fat, gizzard, liver, heart, breast, legs and back among various skin colour groups of F2 chicken involving Kadaknath and White Plymouth Rock. They also reported that melatonic and non-melatonic carcasses did not show any significant difference for meat texture and fatness traits.

Meat composition

The proximate compositions of meat from thigh and breast muscle of the chicks in the two groups are presented in Tables 3 and 4 respectively. Nutritional value of meat can be assessed on the basis of parameters such as protein and fat contents. Steinhauser (2000) claimed that proteins are the most important components of meat from nutritional and technological aspects. Proteins are the major components of dry matter of meat.

The protein content in muscles is variable and depends on the function of a particular tissue (Ingr, 1996). Fat is very important from a sensory aspect since it is a source of many aromatic substances affecting the meat taste. The content and quality of fat are considered to be important quality features of meat (Steinhauser et al., 2000).

Table.1 Carcass traits of experimental groups at 8 weeks of age

| Traits | Control | Treatment | T value | P value |
|---------------------------------|----------------|----------------|---------|---------|
| Pre-slaughtered live weight (g) | 1531.33±177.39 | 1256.67±110.67 | -1.015 | 0.417 |
| Eviscerated weight (g) | 972.33±141.99 | 826.33±74.54 | -0.724 | 0.544 |
| Dressed weight (g) | 1063 ± 152.51 | 905±78.54 | -0.730 | 0.541 |
| Heart (g) | 6.67±1.66 | 5.33±0.88 | -0.555 | 0.635 |
| Liver (g) | 39.67±9.67 | 31.33±1.66 | -0.735 | 0.539 |
| Gizzard (g) | 47±2.64 | 40.67±3.93 | -1.992 | 0.185 |
| Giblet (g) | 93.33±9.49 | 77.33±6.17 | -1.024 | 0.414 |
| Neck (g) | 92.33±17.38 | 79.67±5.36 | -0.563 | 0.630 |
| Back (g) | 225.67±36.44 | 181.67±17.46 | -0.843 | 0.488 |
| Wing (g) | 122±12.66 | 114±8.73 | -0.421 | 0.715 |
| Breast (g) | 222±33.42 | 190±21.12 | -0.751 | 0.531 |
| Thigh (g) | 173±28.58 | 130±12.77 | -1.076 | 0.394 |
| Drumstick (g) | 132.33±17.13 | 125.67±13.48 | -0.241 | 0.832 |
| Spleen (g) | 2±0.00 | 2±0.00 | - | - |
| Bursa of fabricius (g) | 2±0.00 | 2±0.00 | - | - |

Table.2 Dressing and cut up parts% of experimental groups at 8 weeks of age

| Traits | Control | Treatment | T value | P value |
|----------------------|--------------|---------------|---------|---------|
| Dressing % | 69.01 ± 1.76 | 72.034 ± 0.19 | 1.912 | 0.196 |
| Giblet % | 9.72 ± 0.50 | 9.42 ± 0.68 | -0.322 | 0.778 |
| Neck % | 9.40 ± 0.55 | 9.72 ± 0.69 | 0.663 | 0.576 |
| Back % | 23.12 ± 0.77 | 21.96 ± 0.24 | -1.383 | 0.301 |
| Wing % | 12.70 ± 0.61 | 13.83 ± 0.18 | 1.453 | 0.283 |
| Breast % | 22.85 ± 1.12 | 22.94 ± 0.91 | 0.172 | 0.879 |
| Thigh % | 17.72 ± 0.83 | 15.71 ± 0.12 | -2.138 | 0.166 |
| Drumstick % | 13.68 ± 0.55 | 15.16 ± 0.35 | 2.985 | 0.096 |
| Spleen % | 0.21 ± 0.03 | 0.24 ± 0.02 | 0.711 | 0.551 |
| Bursa of fabricius % | 0.21 ± 0.03 | 0.25 ± 0.02 | 0.711 | 0.551 |

Table.3 Proximate composition of thigh muscle (%) on DM basis

| Parameters | Thigh muscle | | P value |
|--------------------|-----------------|----------------|---------|
| | Control | Treatment | |
| Moisture | 65.71± 4.95 | 72.415 ± 0.725 | 0.447 |
| Crude protein | 50.965 ±16.845 | 64.69 ± 0.45 | 0.573 |
| Ether extract | 40.765 ± 11.645 | 26.595 ± 3.415 | 0.519 |
| Total ash | 4.2 ± 1.71 | 4.055 ± 0.525 | 0.959 |
| Acid insoluble ash | 0.04 ± 0.02 | 0.09 ± 0.01 | 0.344 |

Table.4 Proximate composition of breast muscle (%) on DM basis

| Parameters | Breast muscle | | P value |
|--------------------|----------------|----------------|---------|
| | Control | Treatment | |
| Moisture | 73.96 ± 1.2 | 73.99 ± 0.07 | 0.985 |
| Crude protein | 74.735 ± 6.615 | 79.405 ± 1.535 | 0.669 |
| Ether extract | 11.54 ± 6.86 | 5.995 ± 3.015 | 0.674 |
| Total ash | 4.95 ± 0.95 | 5.95 ± 0.13 | 0.524 |
| Acid insoluble ash | 0.065 ± 0.045 | 0.26 ± 0.25 | 0.516 |

According to Matusovicova (1986), a statistically significant negative correlation exists between fat and protein contents in muscles, i.e. the fatter the muscles, the lower the portion of lean meat they contain, which makes them less suitable in respect to human nutrition. In the present experiment, no significant difference ($p \geq 0.05$) in the breast and thigh meat composition was observed among the two genotypes. However, the protein% in the treatment group was higher and the fat% was lower than that of the control group which is a good trait from human health point of view. There was high content of crude protein and low content of crude fat in breast meat than that of thigh meat. These differences in protein contents between breast and thigh muscles are in agreement with findings of Ingr (1996), who reported that muscles differ in the content of proteins, which could result from different functions of particular muscle tissues. The contents of proteins in breast and thigh muscles we determined are in agreement with the findings of Simeonovova (1999). Matusovicova (1986) reported that individual cuts of poultry meat differ in contents of fat. Furthermore, our results are also supported by the findings of other authors (Matusovicova, 1986; Suchý et al., 2002; Ekka et al., 2017) who found differences between breast and thigh muscles. Similar observations were recorded by Fujimura et al. (1996) in case of different broiler strains.

The (Hansli × CSML) ♂ and CSFL ♀ chickens have an advantage over (CSML ♂ × CSFL ♀) chickens in terms of dressing% and superior meat quality traits such as high protein and low fat content.

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