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### Growth performance of white, black and bronze color heritage turkeys under semi-intensive system

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## Abstract

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The present study was conducted to compare the growth performance of White, Black and Bronze color type of turkeys, which have been currently introduced in Bangladesh. The birds were reared under semi-intensive system at BAU Poultry Farm with supplementation of commercial broiler grower and layer feeds. Key objectives were to investigate the growth performance of locally found turkeys (known as heritage turkeys) under semi-intensive rearing system and to recommend turkey as a supplementary part of existing poultry business in the country. A total of 46 poult of White, Black and Bronze color type unsexed birds of 5 weeks age were housed. Birds were reared under similar management conditions and feeds were purchased from local market. No significant difference ( $p>0.05$ ) in live weight for three color types were found. At the end of 21 weeks rearing, Bronze type turkeys attained highest live body weight (3720.71g/bird) while White type turkeys attained lowest (3282.29g/bird). The Black type turkeys however, attained 3552.86g/bird body weight. The live weight gain was increased gradually but decreased again after 18 weeks of age. Weekly weight gains were highest in all color types at 18 weeks of age where white type male turkey attained the highest (440.71g/bird) and black type showed the lowest weight gain (345.00g/bird). No significant difference ( $p>0.05$ ) in FCR among the three color types were found. Survivability under semi intensive system of three different color types, White, Black and Bronze were 100%, 88.46% and 91.67% respectively. Taken together, the growth performance of Bronze type turkey was superior to other color types used in this experiment. Therefore, it can be concluded that turkey farming will be viable in Bangladesh with available local varieties under semi-intensive system through feeding of commercial broiler and layer feeds.

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### Introduction

Deficiency of poultry meat and eggs in the country are 78.91% and 65.38 % respectively per person per year (FAO/APHCA, 2012; Saleque, 2010; Das *et al.* 2008). The commercial poultry sector has got an industrial shape within the period of 3 decades and becomes one of the leading enterprises contributing lot in national economic growth, followed by garments. Among 11 poultry species, only few are available in Bangladesh, of which the chicken is dominant over others and comprises almost 90% of the total poultry population (Das *et al.*, 2008). In Bangladesh the average number of chickens per household was recorded as 7.0 and the national sharing of commercial poultry to its indigenous counterpart in terms of egg production almost equal i.e., 50:50 and that of meat production is 60:40 (Islam *et al.*, 2015).

Commercial broiler and layer farming have emerged during the last quarter of 20th century and then flourishes within short period. Expansion of poultry farming, both at commercial and domestic levels, is meant absolutely the expansion of modern chicken strains of layer and broiler. In addition to chicken, the other poultry species that traditionally rearing and kept by our rural poultry keepers are quail, geese, pigeon and guinea fowl. The growth, development and expansion of

above mentioned species of specialized fowls are remained unchanged for decade after decade as because of a little or no attention has been paid to them.

In such a situation, it may be pertinent to focus on the rearing of alternative poultry species. One of the best choices may be the turkey (*Meleagris gallopavo*), which has been recently introduced in Bangladesh and slowly expanding in small scale throughout the country. Turkey (*Meleagris gallopavo*) is a large gallinaceous bird of the family *Meleagridae* and occupies an important global position next to chicken and duck approximately 5% of world poultry population (Besbes, 2009). Turkey meat consumption in USA 7.36 kg/person/year (Statista, 2018). Turkey has been contributing as the most evolving sector in western countries, Europe and America in particular, where it plays a pivotal role in supplying animal protein. The birds are reared for meat purpose only and, as reported, its meat is the leanest among all domestic avian species. Turkey meat has been considered as luxury meat by many consumers. Apart from the role in protein supply, the birds also have an aesthetic value due to their beauty (Ogundipe and Dafwang, 1980). More importantly, turkeys have unique and remarkable phenomena in adaptability to wide range of climatic conditions and can be raised successfully almost everywhere in the world if they are well fed and

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protected against diseases, predators and adverse weather conditions (Bhanja and Majumdar, 2001).

First instance for the domestication of turkeys was probably in Mexico, from the Mexican sub-species *Meleagris gallopavo* and was used as a domestic fowl by Indian communities, which is now known as the South-Western USA (Ahmed, 2009). The history of turkey production in Bangladesh is very new, and most probably this is the first scientific documentation regarding turkey production in the country. Thus, there is no specific information on how, when and from where turkey production has been started in the country however it can be assumed that the birds entered in Bangladesh through cross-bordering from the neighboring countries. As farmers reported, the birds came to Bangladesh and started to rear in northern and southern parts approximately 7-8 years back. Initially, only handful of farmers who were enthusiastic in rearing specialized fowls kept few pairs of birds as part of their hobby. Later, the birds could quickly be adjusted with local environment and thrive well under very ordinary foods, housing and management. Rearing turkey was not much popular to the general farmers, primarily may be because the birds were not well known to poultry keepers. It is however interesting to note that in recent days good number of farmers became familiar with the birds, rearing 50-200 birds at the home premises and getting benefit by selling poult with high market price. Currently market price of poult is approximately 100 BDT/poult, which is much higher than the commercial layer (25 BDT/chick), broiler (35 BDT/chick), sonali (15 BDT/chick) and duck (30 BDT/duckling). Since the birds are newly introduced in Bangladesh, the farmers are not well aware about various aspects of rearing such as feeding, housing, prevention and disease management, standard growth pattern, feed efficiency, copulation system, incubation of hatching eggs etc (Asaduzzaman *et al.* 2017). In present study, few of the above-mentioned issues such as feed consumption, feed efficiency, growth, disease prevention, general management of birds were focused. As reported elsewhere, there are many varieties of turkeys in all around the globe however principal varieties that have attained commercial importance in many parts of the world are, Broad Breasted, Large White and Broad Breasted Bronze. Other varieties are White Holland, Beltsville, Small White, Black, Bourbon Red and Narrangansett (Ogundipe and Dafwang, 1980). In Bangladesh, more than three color of turkeys are available, which may be termed as heritage turkeys.

To our concern, no comprehensive research works have yet been conducted on the characterization of turkey varieties available in Bangladesh, their production status, disease management and extension work. As the consequence, information on most of the production performances are yet unknown. Under the prevailing conditions, current study was designed to investigate the growth performance of locally available three plumage

color type turkeys namely white, black and bronze under semi-intensive rearing system.

## **Materials and Methods**

### **Birds, house management and experimental plan**

The present research was conducted at Bangladesh Agricultural University (BAU) Poultry Farm, Mymensingh. A total of 46 poult having 5 weeks of age were brought from a farmer in Bogra. All the poult were leg banded soon after arrival and data of the individual bird was recorded. Brooding of poult was completed at farmer's house and then the poult were brought to BAU Poultry Farm at 5 weeks of age to observe their growth performance. One experimental room having the area of 400 square feet was partitioned into two parts and half of the area i.e. 200 square feet (20' × 10') was allotted for 46 birds. Therefore, floor space for each bird was 4.35 square feet. Room was properly washed and cleaned by using tap water. Ceiling, walls and floor were thoroughly cleaned. The whole room area was sanitized with Vircon, a common but effective disinfectant. Before arrival the poult, rice husk was provided as bedding material. Drinkers and feeders were also provided prior to arrival the poult. To acclimatize with the environment, young turkeys were allowed for a short period during day time at outside of the room.

### **Feeding, watering and immunization of the birds**

All the poult were kept together and fed commercial broiler starter feed (ME-3000 kcal/kg, CP-23%) up to 8 weeks of age. Then, the layer grower feed (ME-2800 kcal/kg, CP-20%) was provided up to 21 weeks of age. Feed was supplied twice daily, once in the morning and another at afternoon. Fresh and clean drinking water was made available at all the times. Poult were vaccinated with BCRDV at 3 days of age and booster dose was performed at 18 days of age in the farmer's house against Newcastle disease. Fowl pox vaccine was administered at 5 wks of age through the puncturing of wing web (w/w). Then, Nobilis<sup>®</sup> ND Lasota prepared from the Lasota strain was vaccinated at 2 months of age through drinking water and repeated every two months. The birds were always exposed to natural lighting in day times. No artificial light was provided during the night.

### **Litter management, sanitation and biosecurity**

Rice husk with the thickness of 2 inches was used as litter materials. As compared to chicken, litter used in turkey became damper quickly, might be because of voluminous droppings. Because of aggressive attitude and fighting movement inside the house, waterers are fall down on the floor and caused wet litter problem, especially around the waterers. Thus, damp and wet litter was changed partially when necessary to maintain litter dry and clean. Strict sanitary and biosecurity measures were taken particularly in and around the experimental unit.

### Records keeping and data analysis

Data on weekly body weight of individual tagged birds, weekly body weight gain, bird's survivability, vaccination and medication records were kept. Records on feed consumption were maintained on weekly basis up to the end of experiment and the feed conversion ratio was calculated by dividing total feed consumption

by average body weight gain. The recorded data were analyzed using General Linear Model (GLM) procedures using one-way ANOVA through SPSS software. All data were analyzed for the completely randomized design. The significance differences were tested using *Tukey's* test.



(a) Turkey poults at one month of age



(b) Growing birds at BAU Poultry Farm



(c) Growing turkeys at 16 weeks of age



(d) Adult turkeys scavenging at BAU Poultry Farm

Photo: Experimental turkey birds at different ages rearing at BAU Poultry Farm

## Results and Discussion

### Production performance of the experimental birds

The results of weekly growth performances such as live weight, live weight gain, feed consumption and feed conversion ratio of the turkeys having distinct plumage color namely Black, White and Bronze are discussed. In Bangladesh, generally the turkey farmers who have parent breeders hatch the eggs using home type electric incubator and sell the poults after completion of brooding. Few farmers also hatch turkey eggs by natural incubation method setting eggs under indigenous broody chicken hen. It's an understanding of parent owners that the small-scale farmers who starts farming with newborn turkeys would be faced challenges in management at early stage. Therefore, the parent owners sell the young poults after completion of brooding period usually 30 days of age so that the new farmers can handle the birds smoothly.

### Live weight

The weekly live weight of three color types namely White, Black and Bronze reared under semi-intensive system with a supplementation of same diet and identical management is shown in Table 1 (male) and Table 2 (female). There were significant differences in weekly live weight among three different color types of male turkey at 20 and 21 weeks of age. Remaining other week of ages showed no significant differences among three color groups but an increasing trend was observed in the body weight of Bronze colored birds compared to others. At 21 weeks of age, Bronze type male turkeys was attained the highest live body weight ( $3720.71 \pm 64.96$  g/bird) followed by Black ( $3552.86 \pm 112.47$  g/bird) and the lowest ( $3282.29 \pm 20.87$  g/bird) was recorded in White color turkeys.

**Table 1. Weekly live weight (g/bird) of White, Black and Bronze color types of male Turkey**

Age (weeks)	White	Black	Bronze	P-value	Level of significance
5	379 <sup>c</sup> ± 1.445	386 <sup>a</sup> ± 2.492	381 <sup>bc</sup> ± 1.782	0.046	NS
6	417 <sup>b</sup> ± 2.417	445 <sup>a</sup> ± 12.865	426 <sup>ab</sup> ± 2.781	0.060	NS
7	653 ± 11.813	614 ± 7.156	610 ± 27.299	0.154	NS
8	704 ± 15.469	709 ± 16.064	738 ± 35.747	0.563	NS
9	804 ± 15.608	798 ± 31.295	821 ± 30.889	0.828	NS
10	947 ± 28.442	913 ± 45.953	1017 ± 40.873	0.186	NS
11	1016 ± 35.851	1072 ± 40.123	1153 ± 43.933	0.380	NS
12	1309 ± 44.327	1274 ± 47.313	1322 ± 51.903	0.768	NS
13	1526 ± 52.282	1495 ± 63.214	1580 ± 57.076	0.580	NS
14	1710 ± 45.862	1741 ± 83.193	1842 ± 52.597	0.368	NS
15	1909 ± 79.616	1984 ± 94.361	2087 ± 59.460	0.301	NS
16	2205 <sup>c</sup> ± 17.930	2237 <sup>bc</sup> ± 75.749	2389 <sup>a</sup> ± 48.359	0.054	NS
17	2605 <sup>b</sup> ± 24.967	2617 <sup>b</sup> ± 81.517	2781 <sup>a</sup> ± 40.404	0.061	NS
18	3045 <sup>b</sup> ± 59.048	2962 <sup>ab</sup> ± 105.412	3201 <sup>a</sup> ± 51.671	0.105	NS
19	3120 <sup>b</sup> ± 33.296	3243 <sup>ab</sup> ± 105.778	3382 <sup>a</sup> ± 39.908	0.045	NS
20	3202 <sup>b</sup> ± 22.130	3379 <sup>a</sup> ± 106.743	3550 <sup>ab</sup> ± 50.827	0.009	**
21	3282 <sup>a</sup> ± 20.868	3552 <sup>a</sup> ± 112.477	3720 <sup>b</sup> ± 64.958	0.003	**

NS = Non-Significant, Values indicate mean ± Standard Error

**Table 2. Weekly live weight (g/bird) of White, Black and Bronze color types of female Turkey**

Age (weeks)	White	Black	Bronze	P-value	Level of significance
5	277 ± 4.530	283 ± 3.300	286 ± 2.212	0.219	NS
6	381 ± 4.235	384 ± 2.7373	388 ± 3.828	0.416	NS
7	432 ± 9.091	437 ± 13.683	444 ± 16.926	0.818	NS
8	652 ± 9.141	661 ± 16.010	606 ± 36.843	0.244	NS
9	718 ± 14.469	736 ± 28.026	664 ± 46.608	0.291	NS
10	843 ± 13.421	846 ± 45.953	884 ± 36.291	0.994	NS
11	982 ± 21.487	982 ± 52.283	950 ± 45.005	0.824	NS
12	1171 ± 40.357	1119 ± 74.147	1081 ± 53.862	0.552	NS
13	1278 ± 25.096	1309 ± 84.724	1238 ± 56.706	0.710	NS
14	1438 ± 24.511	1453 ± 101.070	1405 ± 64.077	0.886	NS
15	1586 ± 27.956	1650 ± 119.583	1625 ± 82.737	0.871	NS
16	1801 ± 20.555	1815 ± 128.208	1875 ± 90.865	0.833	NS
17	2021 ± 14.828	2025 ± 140.790	2126 ± 106.583	0.717	NS
18	2301 ± 67.793	2315 ± 127.967	2434 ± 126.103	0.653	NS
19	2388 ± 46.948	2339 ± 160.402	2447 ± 134.24	0.827	NS
20	2466 ± 52.444	2442 ± 124.67	2553 ± 137.937	0.764	NS
21	2539 ± 62.430	2561 ± 96.543	2645 ± 144.868	0.679	NS

NS = Non-Significant, Values indicate mean ± Standard Error

The body weight of White, Black and Bronze color type female turkeys at 21 weeks were 2539.71g, 2561.43g and 2645.43g respectively. Karki (2005) conducted an experiment to observe growth performance of turkeys and found an average body weight of 4.525 kg/bird for male and 3.3 kg/bird for female at 20 weeks of age, although he did not mention the type or variety or color of birds were used for the study. In present study, the results for body weight in all color types were little bit lower than the average body weight observed by Karki (2005). When the hybrid turkeys were used for observation of growth performance, their live weight recorded was much higher, as reported in many

published papers (Austic and Neshein, 1990; Waibel *et al.* 2000; Prasad, 2000). Hybrid converter poults exhibit fast-growing traits and showed as much as body weights of approximately 9.644 kg at 15 weeks of age (Yilmaz *et al.* 2011), which is much higher than the body weight found in present study with heritage turkeys. A large variety turkey such as Broad Breasted Bronze even could achieve a body weight of 10.90kg at 24 weeks of age (Austic and Neshein, 1990). Almost similar results were reported by Sampath *et al.* (2012). Marketing age of birds and target body weight of marking are the key factors must consider gaining maximum profit of turkey farming. In other study, Singh and Moore (1972)

mentioned that the slow growth and poor feed efficiency are the common phenomena for small variety turkey, which is also resembled to the body weight of White color turkey found in present study. Based on the research conducted at Haryana Agriculture University, India the most economical marketing age as mentioned is 16 weeks (Prasad, 2000), however, Singh and Moore (1972) suggested an optimum market age of 20 weeks to obtain maximum profit.

#### Live weight gain

Live weight gain of the birds of three different color types is given in Table 3 (male) and Table 4 (female).

There were significant differences among three color types male turkeys found in 7, 8, 10, 19, 20 and 21 weeks of ages (Table 3). On the other hand, three types of female turkeys showed significant differences only at 13 weeks of age (Table 4). Among the three color types, black type male turkeys showed highest weekly body weight gain (173.29 g/day) compared to bronze type (170.71 g/day), followed by white (80 g/day) at the 21 weeks of age (Table 3). Similar results also observed in case of female turkeys, where black type turkeys attained highest (118.57 g/day) weekly gain at 21 weeks of age compared to bronze (111.86 g/day), white (73.57 g/d) color types (Table 4).

**Table 3. Weekly live weight gain (g/bird) of White, Black and Bronze color types of male Turkey**

Age (weeks)	White	Black	Bronze	P-value	Level of significance
5	128±1.462	129± 2.109	125± 1.343	.185	NS
6	38± 1.883	58± 11.152	45±1.738	.116	NS
7	235 <sup>a</sup> ±2.966	169. <sup>c</sup> ± 16.977	183 <sup>b</sup> ±25.131	.039	**
8	51 <sup>c</sup> ±15.079	94 <sup>b</sup> ±13.133	128 <sup>a</sup> ±23.593	.022	**
9	100±2.213	89±30.343	82±10.987	.792	NS
10	142 <sup>b</sup> ±16.058	115 <sup>c</sup> ±24.941	196 <sup>a</sup> ±19.453	.034	**
11	169±9.973	159±26.341	135±12.674	.413	NS
12	192±11.173	201±25.459	168±18.160	.468	NS
13	217±11.066	220±34.358	258.±27.107	.482	NS
14	195±9.221	246±31.390	261±20.636	.122	NS
15	187±34.345	242±14.592	245±22.023	.203	NS
16	295±62.559	253±22.801	301±34.464	.699	NS
17	400±31.168	379±13.427	392±27.323	.842	NS
18	440±42.418	345±36.368	419±34.698	.202	NS
19	75 <sup>c</sup> ±25.820	281 <sup>a</sup> ±61.234	180 <sup>b</sup> ±38.829	.015	**
20	81 <sup>c</sup> ±13.527	136 <sup>b</sup> ±12.079	167 <sup>a</sup> ±13.222	.001	**
21	80 <sup>b</sup> ±14.475	173 <sup>a</sup> ±13.714	170 <sup>a</sup> ±14.286	.001	**

NS = Non-Significant, Values indicate mean ± Standard Error

**Table 4. Weekly live weight gain (g/bird) of White, Black and Bronze color types of female Turkey**

Age (weeks)	White	Black	Bronze	P-value	Level of significance
5	31±3.441	36± 2.213	34± 1.010	.397	NS
6	103± 1.063	100± 2.091	102±2.535	.520	NS
7	51±5.464	53± 11.041	56±13.248	.939	NS
8	219±13.671	224±17.749	161±30.128	.103	NS
9	66±13.605	75±31.640	58±21.132	.878	NS
10	124±24.158	110±29.665	184±17.227	.101	NS
11	138±30.095	136±19.500	101±9.999	.415	NS
12	188±19.989	137±31.581	130±10.228	.159	NS
13	106 <sup>c</sup> ±28.370	190 <sup>a</sup> ±21.861	157 <sup>b</sup> ±13.924	.049	**
14	160±15.887	143±23.414	167±11.488	.640	NS
15	148±14.214	196±24.887	220±22.467	.075	NS
16	214.±16.014	165±25.671	250±11.339	.017	NS
17	220±19.100	210±31.604	251±31.504	.565	NS
18	279±56.510	290±50.178	307±37.047	.916	NS
19	87±64.465	23±78.6587	13±39.758	.674	NS
20	77±16.506	103±37.469	105±12.038	.678	NS
21	73±15.951	118±34.481	111±13.780	.360	NS

NS = Non-Significant, Values indicate mean ± Standard Error

In recent published data showed an average weekly weight gain of 107.1 g/bird by providing *ad libitum* feed up to 36 weeks of age (Elizabeth *et al.*, 2013). Karki (2005) carried an experiment might be considering the locally available heritage turkeys in Nepal and observed an average weekly live weight gain of 194.5gm/bird at 20 weeks of age. An average weekly gain of 286.09g/bird was also stated by Erener *et al.* (2006). All these results are almost resembled to the weight gain found in present observation. However, Waibel *et al.* (2000) conducted experiment with male hybrid turkeys and found weekly average weight gain of 680g/bird. Almost similar weight gain was mentioned by Ersoy *et al.* (2006), who also used meat type hybrid turkeys in the study. Thus, it is likely that the hybrid turkeys gained almost 2-3 times higher weekly body weight as compared to local heritage type birds.

### Feed conversion ratio

The feed conversion ratio (FCR) of three color types of turkey receiving same diet has been shown in Fig. 1. No significant differences were found in FCR for the three color types. The bronze color showed numerically lowest FCR value (3.5) compared to black (4.0) and white (4.5) color types. Several published reports suggest the average FCR for turkeys raised upto 20 weeks of age is approximately 2.729 (Austic and Neshein, 1990; Waibel *et al.* 2000; Prasad, 2000), which is slightly lower value as compared to the FCR found in current study, suggesting that the birds considered in present study utilize feed less efficiently. It can be noted that the turkeys used in present study were not provided *ad libitum* feed, which might be one of the key factors that caused poor FCR. Results of a study conducted at the Southern part of India showed almost similar FCR value (3.40) as observed in present study (www.tamilnadu farms.com). As it has been mentioned earlier that the mixed color unsexed birds used in the study were collected from a local farmer in Bogra, probably introduced from neighboring country, thus the FCR values were almost close to the Indian observation. In a recent research report of Przywitowski *et al.* (2016), almost similar FCR value of 3.06 at 18 weeks of age was stated. In Bangladesh, since the turkey has been introduced recently, as the specialized species of fowl and is expanding quickly at small and medium scale farming, however specialized feed formulae based on the nutrients required of heritage turkeys yet has not been developed. Thus, broiler starter and grower feed at initial stage, and later they supplied layer grower during growing followed by layer- layer diet during laying period. It has been well reported that the nutrients requirements of heritage turkey, protein in particularly is much higher (approximately 28%) than the broiler diet (22%). Thus it's most likely that the FCR of experimental birds found in current study can be improved once a specific diet is formulated and supplied to the birds satisfying all required nutrients, specifically the diet ensuring high level of protein.

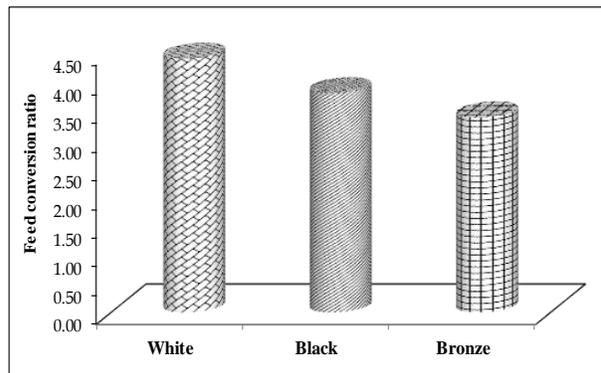


Fig. 1. FCR of White, Black and Bronze Turkeys under semi-intensive system

### Bird's survivability

Survivability and mortality of three color types of turkey under semi-intensive system is shown in Fig. 2. Overall mortality percentage was 8.70% which is within the range 5–30% reported by Sampath (2012). A total of 4 turkeys of which 3 were under the Black color group and rest 1 belong to Bronze were died during 21 weeks of experimental period indicating that the survivability under semi intensive system of three different color types, White, Black and Bronze were 100%, 88.46% and 91.67% respectively. Published data showed a mortality of 2.46% birds at 10-13 wk of age (Yilmaz *et al.* 2011). Among the dead birds, three died at 11<sup>th</sup> weeks of age and the rest one died at 14<sup>th</sup> weeks of age.

### Survivability percentage

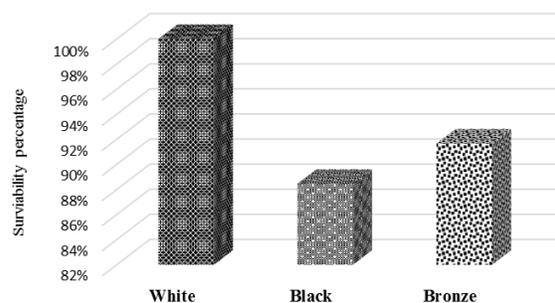


Fig. 2. Survivability of White, Black and Bronze color types of turkey under semi intensive system

All the 4 birds died during the experimental period were sent to the Department of Pathology, BAU, Mymensingh for post-mortem examinations. The birds were infected with Mycoplasma-E. Coli complex (M C Complex) however the problem could be overcome quickly with necessary treatment.

### Conclusion and future remarks

Based on the results of present study, it can be concluded that the live weight, live weight gain, feed intake and feed conversion ratio and survivability of White, Black and Bronze color type of heritage turkeys under semi intensive system were almost similar. Turkey is gaining popularity among farming community for its higher meat production potential, low production cost and creating option for self- employment opportunities

in Bangladesh. Since the birds have already proved their ability under semi-intensive rearing system in rural areas, further study should be undertaken with various levels of supplementations to increase the profit margin. Production of quality poult is the major challenges in Bangladesh. Small and medium scale farmers are producing poult indiscriminately, resulting unfair consequences. Thus, relevant sectors of the government, research and educational institutes, non-government organizations and enthusiastic investors should come forward and work together in a collaborative manner to ensure the production of quality poult.

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