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Abbreviation	Elaboration
Min	Minimum
Max	Maximum
n	Number
%	Percentage
SE	Standard error

ABSTRACT

The study was conducted to distinguish the phenotypic and reproductive characteristics of common pigeon breeds available in Noakhali, Bangladesh. Total 22 households, which have at least 3 pair of pigeon were selected for this study. These data were collected from 15 February. 2022 to 30 April, 2022. A total of 150 pigeons of 13 breeds were selected and the data were collected by using a questionnaire and analyses with Microsoft Excel, 2010.The objective of the study were to measure the phenotypic and reproductive characteristics of pigeon. Close observation of each pigeon was done to record the phenotypic characteristics and digital balance machine and measuring tape were used to measuring the quantitative data. In this study, the plumage color, beak shape and beak color were the main phenotypic features observed. About 33% of total pigeons head feather colour was of black and 27-33% was of white. White was the most prominent colour in neck, almost 36% in male and 33% in female birds; although greenish colour feather at neck with other colour was seen frequently. White wing feather were seen in 50-53% of total pigeons, rest were of black and brown colour. Short straight pink coloured beak was found in more than half of the total pigeon. Some other measurable phenotypic characteristics were also recorded and analyzed. The mean body weight, body length, wing length and wing span found were 358.05±4.98gm, 32.18±0.17cm, 29.12±0.24cm and 62.99±0.63cm in male respectively; which is relatively higher than that of female. The values found in female were 356.61±3.23gm, 32.12±0.20cm, 29.09±0.13cm,and 62.86±0.47cm respectively. The average egg weight found was 16.06 ± 0.21gm. The mean length and width of the egg were listed as 3.82±0.08cm and 2.86±0.78cm respectively. The correlation between body weight and body length was 0.794, which shows these two body parameters correlate significantly. The other parameters were also tested, but these do not correlate significantly. The findings of this study can function as a baseline for anyone interested in pigeon farming or research in pigeon hereafter.

Keywords*: Pigeon, phenotypic characteristics, reproductive characteristics.*

CHAPTER-1

INTRODUCTION

Wild animal domestication was a major milestone in the course of human civilization. Approximately, 40 species of animals have been domesticated by humans in different geographical areas (Scherf & Pilling, 2015).It is believed that birds were domesticated in 6000 BC, in Southeast Asia and the purpose was to use it to proclaim the hour of dawn, for cock-fighting; later as food. The current population of birds in the world is not easy to count or assume, but some new papers established a plausible range, that is 50 billion to 428 billion. The pigeon was started reared by humans all over the world possibly about 10,000 years ago (W. M. Levi, 1945).

The Rock pigeon is believed to be the world's oldest domesticated bird. The pigeon was used as an object of a symbol of peace, a good nutrition source, a messenger and also a source of recreation. It is a sociable monogamous bird by nature, which lay 2 eggs per period on average(W. M. Levi, 1945); both cock and hen hatch the egg, the female incubates at night and the male does so in the daytime; also both suck the squab.351 species of the family Columbidae (which include pigeons and dove) are listed by The International Ornithological Committee (IOC) till now, which are distributed among 50 genera and also include 13 extinct species.

Bangladesh also has a long history of pigeon rearing. Pigeon keeping was a popular pastime of the Mughals. Emperor Akbar had almost 500 types of pigeons, which were 2000 in number; most of these were of the fancy breed. Nowadays, many local and fancy breeds seem to be reared in both rural and urban areas. The characteristics of the locally available pigeons are a stout body, short neck, small head, short slender beak, thick and heavy plumage, long wing, powerful flight muscle and elongated body shape. The average life span is 6 years and 7-8 months age is the time of sexual maturity. The common farming style was semi-intensive, some intensive farm was also found. There are very few commercially available feeds for pigeons in Bangladesh. Some layers of poultry feed and whole grains like wheat, chickpea, corn, grit, rice grain etc are used as

feed. They can also ingest fruit, insects and other worms and use their beak as straws for drinking water.

About 10 million pigeons are present in Bangladesh (Hossain *et al*., 2016). Victoria crown is the most expensive one among the available breeds. There are more than 2000 pigeon breeders in Dhaka city and more than 20,000 scattered across the country. The climate, spacious crop field area, and available grains as feed are the reasons why pigeons have such popularity as pet birds in Bangladesh. The National Pigeon Association of Bangladesh organized an international pigeon fair in Dhaka in 2020, where the aim was to enhance the bond among the pigeon rearer around the world which can benefit them commercially. In Begumganj Upazila, almost every house keep a few pigeons, maybe 2-3 pairs just to meet their requirement. Most of these are of common local breeds. Despite having such popularity, there is very little information available about the phenotypic and reproductive characteristics of pigeons in the southern part of Bangladesh. So the objectives of the study were two, the first one was to observe the phenotypic characteristics and the second one was to record the reproductive characteristics of common pigeon breeds of Bangladesh.

CHAPTER-2

MATERIALS AND METHODS

2.1. Study area and duration:

This study was carried out at Begumganj Upazila in the Noakhali district for over 2.5 months (from 15th February 2022 to 30 April 2022). Begumganj is located in the southern part of the country. The availability of the pigeon was the criterion to select the study area.

2.2. Selection of sample:

A total of 22 households were selected for the study, where each household have at least 3 pairs of pigeons reared under intensive or semi-intensive conditions. Total 13 pigeon breeds were observed, for example- Ghiyachulli, Kalshira, Siraji, Sobujgola, Safchila, Jhak, Gora, Kaji, Lalgora etc. Therefore, a total of 150 pigeons were selected to execute the study. The data were collected by following a simple random sampling technique. The most common pigeon breeds available in Bangladesh were observed for this study.

2.3. Data Collection:

A pre-designed questionnaire that was relevant to the study objective was prepared to collect the data. Face-to-face interviews and on-the-spot data computing were commended on pigeon population, genetic status, housing, feeding, production, reproductive performance, the phenotypic characteristics such as eye colour, head feather colour, neck feather colour, breast feather colour, wing feather colour, tail feather colour, disease outbreak status and other management practices. For the phenotypic characteristics, each individual was observed and listed on spot. A digital balance machine and measuring tape were used to measure the quantitative data like live weight, neck length, body length, shank length, wing length, wingspan, and egg weight. A total of 150 pigeons' information were collected and studied.

2.4. Data analysis

The data collected during this period were entered in a Microsoft Excel worksheet, organized and processed for further analysis. Descriptive statistics of frequency, percentage, mean and standard error were done. The plumage colour frequency was expressed in percentage. The body and egg parameters were manifested as mean. Standard error of mean was also calculated to see how representative the sample is for the population and also to make valid conclusions. These data were analyzed in Microsoft excel version 2010.

2.5 Ethical consideration

The study was conducted considering the ethical principle and oral consent were taken from each respondent after explaining the purpose of the study.

Fig: Different Pigeon breeds and its housing.

CHAPTER 3

RESULTS

1. Phenotypic Characteristics (qualitative):

Table 1: Phenotypic features and their frequencies in common pigeons of Bangladesh

The pigeons have numerous colour in their plumage and it may vary from breed to breed. The head feather colour is mostly black and white, nearly 33% in white, 33% in black and 7-8% in black and white. Variation is found commonly in neck feather colour, and greenish to brown colour is found in some breeds. White seems to be prominent in wing feather colour, as good as 50% of total birds have white wing feathers.

Phenotype		**Sex**	**n**	**Characteristic features**	**Frequency**
Plumage colour	Head feather colour	Male	77	Black	33%
				White	33%
				Brown	27%
				Black and white	7%
		Female	73	Black	33%
				White	29%
				Brown	30%
				Black and white	8%
	Neck feather colour	Male	77	White	33%
				Black	19%
				Brown	22%
				Greenish	26%
		Female	73	White	36%
				Black	4%
				Brown	33%
				Greenish	27%
	Breast colour	Male	77	Black	24%
				White	39%
				Brown	37%

		Female	73	Black	25%
				White	35%
				Brown	40%
	Back colour	Male	77	Black	35%
				White	38%
				Brown	27%
		Female	73	Black	29%
				White	42%
				Brown	29%
	Wing colour	Male	77	Black	28%
				White	53%
				Brown	19%
		Female	73	Black	29%
				White	50%
				Brown	21%
	Tail colour	Male	77	Black	40%
				White	34%
				Brown	26%
		Female	73	Black	41%
				White	34%
				Brown	25%
Beak colour		Male	77	Pink	51%
				White	31%
				Black	18%
		Female	73	Pink	49%
				White	25%
				Black	26%
Shank colour		Male	77	Red	42%
				Pink	58%
		Female	73	Red	42%
				Pink	58%
Beak shape		Male	77	Short curved	12%
				Short straight	88%
		Female	73	Short curved	17%
				Short straight	83%

The beak colour has variations in it and white, black, and red colour appear more common in the common breeds available in Bangladesh. The shank colour was found pink in more than half of the total population of pigeons.

Phenotypic Characteristics (quantitative):

The body weight and length increase with age for a certain period, and the increase rate may vary from breed to breed. Normally, the male birds are heavier than the female ones, especially if compared to birds of the same age. The average weight found in males was 358.05±4.98gm, whereas the average weight of female birds was, 356.6±3.231gm.

Table 2: Phenotypic characteristics (quantitative) of common pigeons of Bangladesh

Trait	Male				Female			
	n	Min	Max	Mean±SE	n	Min	Max	Mean±SE
Body weight(gm)	77	258	416	358.05±4.98	73	256	411	356.61±3.23
Body length(cm)	77	23	34	32.18±0.17	73	22	34	32.12±0.20
Neck length(cm)	77	5.5	8.5	7.27±0.14	73	5	8.5	7.27±0.06
Shank length(cm)	77	6	10	8.28±0.05	73	7	10	8.28±0.05
Wing length(cm)	77	25.5	33	29.12±0.24	73	26	32	29.09±0.13
Wing span(cm)	77	55	69	62.99±0.63	73	55	68	62.86±0.47

Body length is also an important body parameter, which again is seen to be slightly higher in males than that in females. The other parameters were found almost the same in male and female birds.

2. Productive and reproductive performance of pigeons:

Pigeons normally give two eggs monthly, male and female bird hatch the egg in turns. The incubation period is normally 18 days, although it may slightly differ due to breed variation.

Table 3: Productive and reproductive performance of the pigeons

Traits	**Mean±SE**
Egg weight(gm) (n=40)	16.06 ±0.21
Egg length(cm) (n=40)	3.82±0.08
Egg width(cm) (n=40)	2.86±0.78
Average incubation period(n= 15)	18.05±0.67

The average egg weight found was 16.06±0.21gm and the mean length and width found were 3.82±0.08cm and 2.86±0.78cm respectively. The productive parameters can vary according to breed, nutrition and management.

3. Correlation among different body parameters:

The significant and positive correlation shows that the change in any body parameter would cause a direct change in body weight. The correlation between body weight and body length is 0.7941, which is significant and it means that any change in body length would positively change the body weight.

Table 4: Correlation among different body parameters

Traits	Body weight	Body length	Neck length	Shank length	Wing length
Body length	0.7941**				
Neck length	0.1299**	0.0432**			
Shank length	0.0045**	0.0006**	0.0051**		
Wing length	0.059**	0.0265**	0.0259**	0.2514**	
Wing span	0.0553**	0.0386**	0.0451**	0.1155**	0.1299**

**Correlation is significant at the level of 0.001

The positive relations show the change in one parameter would cause a positive change in other parameters.

CHAPTER-04

DISCUSSION

1. Phenotypic characteristics (qualitative):

The phenotypic features and their frequency in the pigeons are listed in table number 1They have multiple colour in their body feathers, and also have differences in eye, beak, shank colour, beak shape etc. Head colour is normally found in black, white, brown and a mixture of black and white. White head colour was noticed in 33% cock and 29% hens, whereas brown colour was found on 27% cock and 30% hens. Neck feather colour also varies from breed to breed; black, white, brown and greenish were the most common colours found. Brown with white colour feathers in the head with brownish (33%) or whitish neck (36%) was seen in (30%) hen and black (33%), black and white (7%) colour head with white (33%), brown (22%) neck was observed in cocks. The greenish colour neck was also a common feature in both hen (27%) and cock (26%). Breast and back colour was mainly observed as black, white and brown colour with various percentages**.**

Wing colour was mainly a mixture of different colours with a base colour of black, white and brown both in males and females. Black (28%), white (53%) and brown (19%) with greenish or ash colour were observed in cocks, while black (29%), white (50%), and brown (21%) with other coloured feathers were seen in hens. The tail colour was predominantly black, white and brown with almost the same percentage in males as females. Almost half of the total counted pigeons have pink colour beaks, 51% in male and 49% in female birds. The rest of the birds have white or black coloured beaks, that is 31%, 18% in males and 25%, 26% in females respectively. Black colour eye in both sex and white color egg in cock was noticed (100%). All of these phenotypic observations were similar to the findings of (Parvez *et al*., 2020), but there were some dissimilarities with the findings of (Bhowmik *et al*., 2014), (Hossain *et al*., 2016).

2. Phenotypic characteristics (quantitative):

The phenotypic characteristics (quantitative) of the common pigeon breeds of Bangladesh are presented in table 2. The average body weight of cock and hen were 358.05±4.98g and 356.61±3.23g respectively, which were similar to the findings of (Parvez *et al*., 2020), (Hossain *et al*., 2016). Little variation was seen with the findings of (Bhowmik *et al*., 2014), where the body weight was relatively lower. This variation may cause due to the sampling variation, or the age, feed, management and breed variation. The breed can be a major factor for different weights of the birds even of the same age, which was shown in (Parvez *et al*., 2020); where the birds were different in body weight though they were of the same age.

Body length was 32.18±0.17cm and 32.12±0.20cm respectively in cock and hen. This finding is supported by the study by (Bhowmik *et al*., 2014). The observation found in (Parvez *et al*., 2020) was different as they calculated each breed's length separately. Average neck and shank lengths were recorded 7.27±0.14 cm and 8.28±0.05 cm in males and 7.27±0.06 cm and 8.28±0.05 cm in females respectively.

Mean wing length and wing span were filed 29.12±0.24cm and 62.99±0.63cm in males; 29.09±0.13cm and 62.86±0.47cm in females respectively. However, a relatively higher wing span was recorded in (Parvez *et al*., 2020), which reported values of 64.60±0.63cm; also in (Hossain *et al*., 2016), that was 64.75±0.18cm. The variation may appear due to nutrition, breed or proper management of the farm.

3. Productive and reproductive performance of pigeons:

The productive and reproductive achievements of the local pigeons in the study are illustrated in Table 3. About 40 eggs were weighted among which 12% eggs were 12-14g, 74% eggs were 15-17g and 14% were more than 18 g. The average egg weight was estimated 16.06 ± 0.21g in the present study. This result was following the result of (Bhowmik *et al*., 2014), which was 16.18± 0.08g. In addition to that, the findings were also relevant with the results of (Hossain *et al*., 2016), the result found there was 16.29±0.08. However, the findings of (Kabir, 2012) were different from this study, the mean weight was 11.17±1.07. This could be due to breed and age variation.

Egg weight was recorded to increase with the age, though it was not significant to measure. Relatively small eggs were recorded in Giribaj, Mookee, and Lakkha; that could be due to breed variation or breed characteristics. Also, management practices can be a reason for such differences.

The mean length and width were found 3.82±0.08cm and 2.86±0.78cm respectively, which supports the findings of (Bhowmik *et al*., 2014), (Parvez *et al*., 2020). These findings are also following the findings of (Hossain *et al*., 2016).

The mean incubation period was found18.05±0.67days; which confirms the findings of (Bhowmik *et al*., 2014); where the average incubation period was 18±0.09 days. The result obtain in (Hossain *et al*., 2016) was almost similar,18.25±0.09 days. This consistency could be due to the fact that incubation period is a genetic trait. Fertility and hatchability were also measured and found almost 100% at younger age. A little deviation was observed in case of old birds.

4. Correlation among different body parameters:

The correlation among the body parameters were positive and high; which means that changes in one parameter can positively change the other one.(Mancha, 2004)also found positive relation among different body parameters. The positive relationship confirms that body length, neck length, shank length, wing length and wing span can cause direct improvement in body weight. Similar result were found in (Parvez *et al*., 2020), (Bhowmik *et al*., 2014), (Mbap & Zakar, 2000) and (Okpeku *et al*., 2003). Bokhari (2002) said shank length is a reliable index of body weight, especially in case of younger ones.

CHAPTER 5

CONCLUSION

The principle phenotypic results found exhibits that the main plumage colour is white and black and the colour of the beak and shank is primarily pink. Also, the findings also shows the body parameters are relatively higher in male birds, than that of in female birds. The productive and reproductive parameters were also measured and listed in this study. The result of the study indicates the productive and reproductive performances of the pigeons are good with a little amount of food and care. Also, external parameters records can help choose breeds to rear if anyone is willing to start a pigeon farm. More information needs to be listed and published to improve their utilization. In addition, Further work can be done to compare the productive and reproductive parameters within breeds.

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ACKNOWLEDGEMENTS

The author wishes to concede her heartfelt gratitude to the ALMIGHTY for immeasurable propitiousness without it she would never have been able to complete the work successfully.

The author would like to acknowledge with a deep sense of reverence and immense graciousness to her respectful internship supervisor, **Dr. Omar Faruk Miazi**, Professor of Department of Genetics and Animal Breeding, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University for his intellectual supervision, valuable guidance and constant encouragement throughout the period which shaped the present work as its show.

The author would also like to express her sincere gratitude and thank you to Professor **Dr. Gautam Buddha Das**, honourable vice chancellor of Chattogram Veterinary and Animal Sciences University.

The author is paying her respect to Professor, **Dr. Mohammad Alamgir Hossain**, Dean of FVM and Prof. **Dr. AKM Saifuddin**, Director, External Affairs for the provision of this unique internship program and research exposure.

The author would also extend her appreciation to her family, friends, well-wishers, and staff who helped at the time of the questionnaire survey for their kind cooperation in the completion of this work.

BIOGRAPHY

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Bangladesh is a developing country in South Asia where livestock plays a very important role in our economy as well as the food chain. I expect to be a future researcher of life science to address the present challenges we have in this field.