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Macroscopic study of digestive system of house sparrows (*Passer domesticus*)

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House sparrow is a small passerine bird that lives in urban and rural areas. Generally they are non-migratory, socially monogamous birds. Their alimentary tract is similar to that of other birds in terms of anatomical adaptations. Their diet consists of mostly cereal grains, seeds with a minor proportion of natural grasses and a negligible number of insects. This study was planned to determine the macroscopic and microscopic components of the house sparrow digestive tract. For this purpose 20 adult sparrows of both sexes were taken and randomly divided into two groups: group A (ten males) and group B (ten females). Live weight of each sparrow was recorded and after slaughtering carcass weight was recorded. Careful evisceration of digestive organs was done. Each part was examined comprehensively as anatomically and histologically. The length, width and weight of digestive tract organs such as tongue, esophagus, crop, proventriculus, gizzard, liver, small intestine and large intestine were measured. Average body length and weight of male house sparrow ranged between 13.9±0.23cm and 21.30±0.54g respectively and for female house sparrows average length and weight was 13.74±0.23cm and 21.30±0.54g. The results indicated that appearance feature between them presented significant differences ($p<0.05$) due to their staple feeding habits to improve their predation rate and to adapt different environments but there was no significant ($p>0.05$) difference in the digestive parameters of male and female house sparrows.

Keywords: House sparrow, Digestive system, Gross Anatomy, Gizzard.

INTRODUCTION

Birds have distinct anatomical structures than mammals. Birds digestive systems differ from mammals and other vertebrates in a variety of ways. They have no teeth, a soft palate, and a unique feeding method that allows them to consume a large amount of food in a short amount of time (Wasilewski *et al*., 2015).

The House sparrow is a member of the Passeridae family with a wingspan of 210-255 mm and a total length of 160-165 mm. In the nineteenth century house sparrow is first introduced to Southern Africa (López, 2008). The house sparrow (*Passer domesticus*) is a little passerine bird that weighs between 24 and 36 grams. They are a socially monogamous, non-migratory species with great site fidelity (Parn *et al*., 2009).

Changes in agricultural management have been proposed as one reason for the demise of this species (Wretenberg *et al*., 2006). House sparrows prefer to eat cereal crops then wild seeds. The house sparrows diet is said to consist of about 70% cereal grain seeds, with a minor proportion of natural grasses and sedge, seeds and a negligible number of insects. Around the world people have reported eating habits of house sparrow that are generally similar (Perkins *et al*., 2007).

In contrast to mammals birds have small intestines although having large regular energy requirements. Body weight of bird is not significantly affected by their smaller short digestive tract. Therefore the bulk of dissolved material delivered must be significantly reduced due to the reduced small intestinal tract (Lavin *et al*., 2008). By allowing more time for absorption and digestion birds can compensate by keeping food particles for long period of time in their gut. (McWhorter *et al*., 2009).

Besides from the data on poultry farms, there is a deficiency of published data on descriptions of the structural anatomy and histology of the avian gastrointestinal tract from oesophagus to the cloaca (North *et al*., 2016).

MATERIALS AND METHODS

Study Sample

Total of 20 house sparrows were purchased from the local market. The birds were anaesthetized with chloroform according to University of Agriculture,

Faisalabad guidelines and then after separating the feathers from the ventral thoracic spine and cutting the cavity bone they were transferred to a large anatomy dish placed on their backs, with their ends attached with clips, and the abdomen opened from the center (Fig1, Fig 2). We used an electric balance to weigh the birds. The live weight of each sparrow was recorded in grams. After slaughtering carcass weight of each bird was recorded The width, length and diameter of each dissected organ was measured with the help of vernier caliper and measuring tape. The topographic position of all the digestive organs, such as the tongue, esophagus, gizzard, liver, small and large intestine, were investigated in situ after the house sparrow is dissected.

Fig 1: Length of Male House Sparrow

Fig 2: Length of Female House Sparrow

Statistical Analysis

Mean, standard error means and ranges were calculated for each parameter under study with the help of computer software Microsoft Excel. Data were statistically analyzed by applying on-way analysis of variance ANOVA (Steel *et al*., 1997).

RESULTS

Average body length of male and female sparrow ranged between 13.9 ±0.23 cm and 13.74±0.23 cm respectively. The total body weight of male house sparrow observed was 21.30±0.54 g and by removing digestive organs carcass weight was 10.6 g. While the mean of female total weight observed was be18.6±0.54 g and by removing gastrointestinal tract carcass weight observed was 7.6 which shows the weight of male sparrow is higher than that of female sparrow (Table 1, Fig 3). The result shown that length and weight of tongue in both sexes were nearly same. Average length of male and female sparrow esophagus ranged between 3.60±0.07cm and 3.63±0.04 cm respectively The weight of esophagus of male and female house sparrow observed was 0.08±0.01g and 0.08±0.02g respectively. Average body length of crop in male and female was 1.80±0.06 cm and is1.72±0.02. Width of male house sparrow crop was 0.50±0.02 cm meanwhile width of female house sparrow was 0.50±0.03 cm (Table 2).

The length, width and weight of Proventriculus in male and female are presented in the table1. Average length of male and female house sparrow proventriculus was 0.91±0.02 1.00±0.80 cm respectively.The weight of crop of male and female house sparrow was 0.06±0.003 g and 0.06±0.002g respectively. Width proventriculus of male and female house sparrow was 0.32±0.03 cm 0.36±0.03 cm respectively. The mean length of male and female sparrow gizzard was 0.86±0.02 cm and 0.83±0.03 cm respectively. The weight of gizzard of male house sparrow observed was0.84±0.03 g accounting for 4.12 % of the total weight of gastrointestinal tract. While the mean of female gizzard was observed to be 0.76±0.03 g accounting for 3.97 % of the total weight of gastrointestinal tract. Width of male house sparrow gizzard was 0.69±0.05 cm meanwhile width of female house sparrow was 0.67±0.05 cm. The mean length and width of small intestine was shown in table 2.

Table 1: (Mean ± SEM) of total body length and weight in adult male and female house sparrows (*Passer domesticus*).

Group	Body Length (cm) Mean±SEM	Body Weight (g) Mean±SEM
Male	13.9±0.23	21.30±0.54
Female	13.74±0.23	18.6±0.54

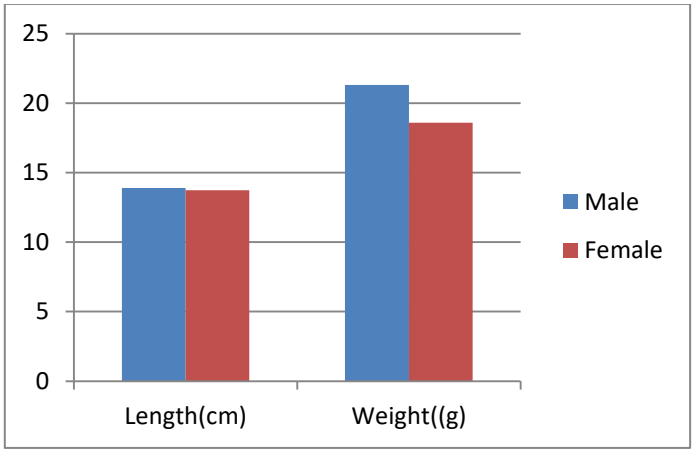

Fig 3: Total body length and total weight of male and female house sparrows (*Passer domesticus*).

Table 2: Overall means (±SEM) of Length, width and weight of large digestive organs in adult male and female house sparrows (*Passer domesticus)*

Parameters	Length (cm) Mean ± SEM		Weight (g) Mean ± SEM		Width (cm)	
	Male	Female	Male	Female	Male	Female
Tongue	0.90±0.04	0.91±0.03	0.06±0.01	0.05±0.02	-	-
esophagus	3.60±0.07	3.63±0.04	0.08±0.01	0.08±0.02	-	-
Crop	1.80±0.06	1.72±0.02	0.25±0.02	0.25±0.01	0.50±0.02	0.50±0.03
Proventriculus	0.91±0.02	1.00± 0.80	0.07±0.00	0.05±0.002	0.32 ± 0.03	0.36 ±0.01
Gizzard	0.86±0.02	0.83±0.03	0.84±0.03	0.76±0.03	0.69±0.05	0.67±0.05
Small intestine	1.90±0.28	13.20±0.29	-	-	0.34±0.03	0.36±0.02
Large Intestine	1.53±0.03	1.70±0.03	-	-	0.36±0.01	0.37±0.01

DISCUSSION

The house sparrow (*Passer domesticus*) is a little passerine bird that weighs between 24 and 36 grams. Tiny passerine birds like the house sparrow (*Passer domesticus*) that weighs between 24 and 36 grams. They are socially monogamous, non-migratory species with great site fidelity (Parn *et al*., 2009). House sparrow males typically weigh more and are heavier than females. Male house sparrows tend to be heavier and larger than females. Plumages of females are closely similar to youngsters and females of other Passer species. Female plumage resembles juveniles and females from other Passer species so much that distinguishing them visually is often difficult (Parn *et al*., 2009).

Tongue of the white tailed eagle is elongated with a sharp-ended apex and its length is 6 cm. House sparrow tongue is virtually modified to underneath beak in form but it does not extend beyond the bottom beak limit (Abumandour, 2018; Jackowiak, 2005).

The anatomical studies of gastrointestinal tract shows that length of esophagus in adult house sparrows was 3.60±0.07 cm in male and3.63±0.04 cm in female house sparrows. No significant difference exist between both species. Rossi *et al*. (2005) studied average length in males and females is 3.65 cm and 3.20 cm in adult partridges correspondingly. Results shown by Rossi also have similarity to the findings of Bailey *et al*. (1997) who observed that length of esophagus was significantly shorter in female then male bustards. House sparrows esophagus weigh ranged between 0.08±0.01 to 0.08±0.02 g and length of proventriculus ranged between 0.91±0.02 to 1.00± 0.80 cm. Baohua *et al*. (2010) the oesophagus supplied about 0.30 and 0.06 percent of the total body weight and had a weight that ranged from 15 to 2.5 g and proventriculus weigh is between 745-43cm correspondingly. Dearth of literature available on house sparrows morphology and histology.

Male sparrow proventriculus length was 0.91±0.02 cm and 1.00 ± 0.80 cm in female house sparrows. There was significant difference between the length of gizzard 0.86±0.02 cm in male sparrows and 0.83±0.03 cm in female sparrows while weight was 0.84±0.03 in male sparrow and 0.76±0.03 g of gizzard which shows that both length and weight were significantly higher in male house sparrow. Baohua *et al*. (2010) studied the total weight of the gizzards contents was as much as 16.5:43 g, and it is situated in between proventriculus and the duodenum size of 60.0±4.4× 49.2±5.5 mm, the gizzard was a rich purple-red. With an average wet weight of 35.9–4.7 g, this tissue provided 4.6–0.5% of the body surface area.

Small intestine length in male and female house sparrows was 10.90±0.28 ×13.20±0.29 cm and large intestine was 1.53± 0.03×1.70± 0.03 cm. Getty 1975 identified the length of small intestine and large intestine were 23-34 and 84-122 cm in chicken.

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CONCLUSION

The results indicated that appearance feature between male and female house sparrow presented significant differences ($p<0.05$) due to their staple feeding habits to improve their predation rate and to adapt different environments but there was no significant ($p>0.05$) difference in the digestive parameters of male and female house sparrows.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

RK designed and supervise the study. All authors contributed in writing, revision and finalization of manuscript. The author read and approved the final version.

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