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The Pattern Comparison of Changes of Heart Macro-Structure in the Fowl

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Abstract: Understanding early heart tissue structure, especially the properties of heart morphology is of cardinal interest for varied biomedical disciplines. During the past few years, striking progress has been made in identifying morphology and anatomy of bird's heart; but an exhaustive study is not available about avian heart structure related to gender differences. The current study was designed to determine whether sex effects acutely to change heart tissue pattern. Hence selected 20 native adult fowl (to equal number of both sexes) of Shahrekord districts and then hearts were dissected. Heart weight, length and diameter and thickness of left and right ventricles were determined after preparation of tissue sections, myocardial and epicardial layers were measured by micrometer. With respect to the gender, gross and microscopic morphological aspects, indicated no difference between heart weight and length and right ventricle thickness as well as left and right epicardium in both sexes. However, thickness of the left ventricle and myocardium and heart diameter in males exceeds that of females.

Key words: Fowl · Heart structure · Micrometer · Thickness

INTRODUCTION

Among individuals dependent on avis groups, there is a great variety in the structure of particular systems that is the result of their adaptability to condition of different environments. Among special attention should be paid to the circulatory system and heart of birds [1]. Morphological examination of the heart of rare and valuable birds is difficult to do; Nevertheless in several avian species, included the fowl, primarily heart size, according to weight, was determined by Grubb [2], Hartmann [3] and Brush [4] and heart weights in some birds have summarized by Sturkie [5]. Das *et al*. [6] explained gross and biometrical components of the heart in indian duck [6] and a detailed description of gross microscopic anatomy of the heart from adult fowl was presented by lu *et al.* [7].

Numerous studies have been conducted on histomorphologic evaluations of the heart in the certain species of birds [8-12], but few studies have been done on histological structure and the morphologic changes of the heart in related to sex effect. Pannwitz and Berg [11] conducted a morphologic assessment of sex effect on heart weight as well as mass of the ventricular and auricular walls in strain of turkeys (Hybrid B-6). They show that was not differ between both sexes. Thaxton [10] measured heart weight, length, diameter and thickness of the right ventricular wall and left ventricular wall in broilers male and female and results indicated that males have greater heart weight, heart length and left ventricular wall thickness than females.

However, in birds especially in fowl, studies of sex effect on the heart structure were limited. Therefore, this study aims to investigate sex effect on the histomorphometric properties of heart of the native fowl in Shahrekord district.

MATERIALS AND METHODS

The study was conducted on 20 hearts of native adult fowl (10 males with weight 2225±298.6 g and 10 females with weight 2077±186.7 g). The birds were taken from farm of household bird's maintenance from districts of Shahrekord. The heart was removed by dissection of thoracic cavity and firstly the aorta then pulmonary vessels and common vena cava were removed near their points of attachment to the heart. The finding of gross anatomy such as heart and length weight from the anterior

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aspect of the atria and at the apex of the ventricles and heart diameter in the coronary groove were measured by making a cross section of the heart. Thickness of ventricles was measured by calipers for determination of the index of ventricles cardiac morphometry. The tissue samples were immediately fixed in 10% buffered formaldehyde solution and followed by alcohol dehydration and embedding in paraffin. Five-micrometer thick sections were stained with haematoxylin-eosin for study of histomorphometrical properties of heart and were interpreted under light microscope.

Results are exhibited as mean ± SD and the data were analyzed using one-sample t-test analysis of variance between two sexes, at significance level 0.05.

RESULTS

Mean morphometric and histometric measurements of the heart structure are presented in Table 1.

Analysis of obtained results indicated that mean gross of body and heart weights and heart length have not significantly different between males and females gender. In females fowl, heart diameter were significantly small and left ventricular thickness were larger in male fowls than those of females and this increased was statically significant. Results obtained from this study also revealed that mean of right ventricular thickness did not significant differ between two sexes.

The morphometry of the left and right epicardial layers and endocardial layers in male and female showed no significant statically differences .

Measurements of left myocardium layer was significantly larger in male fowl than those of females, but this measurement for right myocardium layer was not significant between both sexes.

DISCUSSION

In the international publications concerning the histomorphometric structure of fowl heart related to sex are few. Thaxton [10] studied the gross and histological properties of heart with emphasis on comparison between male and female heart in broilers. In other study, morphological evaluations of the heart were conducted by Rajpal *et al*. [12-13] and Das *et al*. [6] in the Indian duck (*Anas platyrhynchos*) and the single comb white Leghorn, respectively; but they were not measured differences attributable to sex. A comprehensive morphological study was performed by Aydinlioðlu *et al.* [9] in chick hearts [9]. They suggested that although chick heart has no the tricuspid valve similar to that of the human heart, it shows a great anatomical similarity with the human heart.

Heart morphometric measurements in the current study revealed that the differences were not statistically significant mainly for gross heart weight and length and body weight between males and females gender. Thaxton [10] at hatching, 20, 34 and 48th d of age, indicated that gross heart length in males and females did not differ at hatching and 20 d of age in broiler. This researcher represented that at both 34 and 48 days of age males possessed longer hearts than females and also gross heart weight were heavier in males, as compared to females, at 34 and 48 d of age, but did not differ from females at hatching and 20 d of age. However, these gross findings at 34 and 48 days of age in broiler are adverse with data of get the current study.

The present study indicated that left myocardial layer is significantly larger in male birds in contrast with those female. The increased thickness of the myocardial layer of heart could be theoretically related to testosterone receptors on the myocardium cells in male gender.

Table 1: Mean values of Mean histomorphometric features of the heart in both sexes in native fowl

	Sex			
	Male		Female	
Parameter	Mean±SD	CI	Mean±SD	CI
Heart length	3.45±0.2	3.11-3.78	3.3±0.18	3.0-3.5
Heart weight	25±1.8	22.09-27.9	22.25±1.7	19.53-24.96
Body weight	2225±298.6	1749.4-2700.1	2077±186.7	1780.2-2374.7
Heart diameter	3.2±0.21	2.85-3.54	2.7±0.18	2.4-2.99
Left ventricle thickness	5.27±0.17	5-5.5	4.47±0.26	4.0-4.8
Right ventricle thickness	1.88±0.15	1.64-2.13	1.83±0.05	1.74-1.91
Left epicard	108.25±10.6	91.24-125.2	106±8.16	93-118.9
Right epicard	56.27±2.85	47.18-65.36	55.6±4.91	47.7-63.4
Left myocard	3797.5±125.2	3598.1-3996.8	3072.5±95	2921.3-3223.6
Right myocard	1182.5±55.6	1094-1270.9	1051.2±84.7	977-1125.4

It seems that existence of sex hormones (testosterone) in male birds and presence of testosterone receptors in hart myocardial cells together cause that myocardial cells reacted and will be increase histological measurements of heart, included size and diameter and as a results of increased thickness of left and right ventricles in male than females. McGill *et al.* [14] indicted that atrial and ventricular myocardial cells of hearts in female rhesus monkeys and baboons contain androgen receptors. However, they suggested that sex steroid hormones may affect on the myocardial function and cells directly and may were generalize some of the peculiar differences in heart structure between men and women. Next, investigations revealed various aspects of the heart measured (included left ventricular dimensions, etc) using steroids affect the function, size, shape and activity of the heart [15] and Marsh *et al.* [16] showed the existence of testosterone receptor transcripts in isolated cardiac myocytes from animals and humans.

Results of the present study also showed that heart diameter in males was greater than that of females and these differences were statically significant. keeping in mind that testosterone hormone effect on the heart myocardial layer, the seems that heart diameter numerically increase parallel with increased gross thickness of left and right ventricles, although increased thickness of right ventricle (included gross and microscopic measurements) wasn't significant in male than female. Thaxton [10] revealed that gross heart diameter did not differ between sexes in broiler, but males have greater left ventricular wall thickness than females [10].

In conclusion, between both sexes there was no difference between right ventricle and right epicardium in both sexes in weight, length and thickness but left ventricle and myocardium thickness and heart diameter in males increased than females.

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