Age related changes in the morphometric parameters of the Heart, Kidneys and Adrenal glands of Nili-Ravi buffalo (*Bubalus bubalis*)

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**ABSTRACT:** Forty clinically healthy Nili-Ravi buffaloes (*Bubalus bubalis*) were divided into two age groups of 20 animals each viz., young (12-48 months of age) and adult (49-96 months) of each sex. These studies revealed that the absolute heart weight, absolute kidney’s weight, the absolute adrenal gland’s weight, mean values of width of heart, circumference, thickness of wall of right and left atria, thickness of wall of right and left ventricles, mean values of length of right and left kidneys, width, circumference, mean values of length of the adrenal glands were significantly (P<0.05) higher in adult buffaloes than young ones. The average relative heart weight, relative kidneys weight and the relative weight of adrenal glands was significantly (P<0.01) higher in young buffaloes as compared to the adult ones. While the relationship of the width of right adrenal glands between young and adult buffaloes were recorded as non-significant. The results of the present study are the first report on the age related morphological changes in the heart, kidneys and adrenal glands of buffalo. These age induced anatomical changes may affect the rennin-angiotensin-aldosterone system (RAAS) and hence blood pressure of an individual.

**Key words:** Macromorphometry, Heart, Kidneys, Adrenal glands.

**INTRODUCTION** - Nili-Ravi Buffalo (*Bubalus bubalis*) is ranked as best among the dairy breeds of the world. There are about 24 million total buffaloes in Pakistan producing 22.5 millions tons milk per annum. In Asia, buffalo played a pivotal role in overall social development through contributions to milk, meat, hides and draft power for agricultural operations (Nanda and Nakao, 2003). The etiology and pathogenesis of different diseases related to cardiovascular system are not fully understood, so extensive research work has been carried out to improve the basic information on the morphology and histology of blood pressure related organs (heart, kidneys and adrenal glands), during past few decades in different animal species (Nagra et al., 1989; Morovati and Alboghobeish, 2002;Yilmaz and Girgin, 2005).The heart, kidneys and adrenal glands are interconnected through renin-angiotensin - aldosterone system and play an important role in the blood pressure regulation (Saavedra and Trimmermans, 1994). The present work was carried out to study the morphometry of these organs in young and adult Nili-Ravi buffaloes (*Bubalus bubalis*). Moreover, influence of age on these parameters has also been described.
MATERIAL AND METHODS - Forty clinically healthy Nili-Ravi buffaloes (*Bubalus bubalis*) of either sex were divided into two age groups with equal numbers viz., young (12-48 months) and adult (49-96 months). The samples of the heart, the left and right kidneys and the left and right adrenal glands along with fat tissue were collected from each animal immediately after slaughter from the Faisalabad abattoir. Following collection, parameters including absolute weight, relative weight, length, width, circumference, thickness of wall of right and left atria and ventricles of heart were recorded. The absolute and relative weight of kidneys, length, width, and circumference of the left and right kidneys and the left and right adrenal glands were also recorded. The samples were weighed with the help of electrical weighing balance. The Vernier’s Calipers was used for the measurement of thickness of the right and left atrial and ventricular walls of heart. The means, standard error of mean (SEM) and ranges for each parameter studied were computed using Microsoft Excel software. Group means of young and adult animals were compared by Student’s t-test. All computations were done with the statistical software MSTAT.

RESULTS AND CONCLUSIONS

It is concluded, on the basis of present comparative investigations, that absolute weight, width, circumference and length of heart, kidneys and the adrenal glands increases, while relative weight of these organs decreases with advancing age. To the best of our knowledge, these are the first ever reported anatomical findings on the organs (interrelated through RAAS) in the nili-ravi buffalo of Pakistan. Authors suggest further studies to correlate the

Plate 1. Section of heart of adult buffalo (49 months) showing the conformation. Conical and pointed Ventricular part and thick left ventricular wall are visible. A=Aorta, Rv=Right ventricle, Ct=Chordea tendinae, Pm=Papillary muscle, Lv=Left ventricle, Lvw=Left ventricular wall.

Plate 2. Section of left kidney of a young buffalo (36 months of age) showing its internal structure. Pelvis is absent, renal papillae project into calyx minor, renal columns are very prominent. H=Hilus, Rp=Renal papilla, M=Medulla, C=Cortex.

Plate 3. Dorsal views of right and left adrenal glands of an adult buffalo (49 months of age). La=Left adrenal gland (flattened, V-shaped), Ra=Right adrenal gland (C- Shaped, convex lateral surface).
anatomical changes and physiological response of these organs in experimental and domestic animals, which would be helpful for inclusive understanding of the mechanism of blood pressure regulation and hence heart related problems.

Table 1. Mean values ± SEM of anatomical parameters of heart, kidneys and adrenal glands in young (12-48 months) and adult (49-96 months) buffaloes.

| Parameters                                | Young       | Adult       |
|-------------------------------------------|-------------|-------------|
| Absolute heart weight (g)                 | 1606 ± 53.86| 2561 ± 71.57** |
| Relative heart weight (%)                 | 0.4322 ± 0.0047 | 0.42 ± 0.04*   |
| Length (cm)                               | 17.57 ± 0.524 | 24.34 ± 0.54** |
| Width (cm)                                | 15.188 ± 0.413 | 19.85 ± 0.34** |
| Circumference (cm)                        | 30.87 ± 0.922 | 39.10 ± 0.79** |
| Thickness of wall of right atrium (cm)    | 1.33 ± 0.051  | 1.65 ± 0.03** |
| Thickness of wall of left atrium (cm)     | 1.74 ± 0.04   | 1.86 ± 0.04*  |
| Thickness of wall of right ventricle (cm) | 1.49 ± 0.03   | 2.76 ± 0.12** |
| Thickness of wall of left ventricle (cm)  | 1.9 ± 0.03    | 3.17 ± 0.14** |
| Abs. Weight (g) of both kidneys           | 937 ± 41.55  | 1285 ± 22.55** |
| Relative weight (%) of both kidneys       | 0.250 ± 0.003 | 0.21 ± 0.004** |
| Length (cm) of right kidney               | 18.61 ± 0.32  | 19.56 ± 0.32** |
| Length (cm) of left kidney                | 18.598 ± 0.45 | 21.96 ± 24.05* |
| Width (cm) of right kidney                | 12.22 ± 0.148 | 13.46 ± 0.26*  |
| Width of left kidney                      | 12.45 ± 0.21  | 13.58 ± 0.25** |
| Circumference (cm) of right kidney        | 23.76 ± 0.310 | 26.73 ± 0.54** |
| Circumference (cm) of left kidney         | 24.46 ± 0.40  | 26.60 ± 0.41** |
| Absolute weight (g) of both adrenal glands| 23.70±1.12    | 33.85±1.17**   |
| Relative weight (%) of both adrenal glands| 0.06±0.001    | 0.05±0.001**   |
| Length (cm) of right adrenal gland        | 5.03±0.05     | 6.69±0.09**    |
| Length (cm) of left adrenal               | 5.17±0.08     | 6.85±0.100**   |
| Width (cm) of right adrenal gland         | 3.84±0.06     | 4.13±0.015NS   |
| Width (cm) of left adrenal gland          | 2.85±0.05     | 4.82±0.22**    |
| Circumference (cm) of right adrenal gland | 7.40±0.19     | 8.17±0.34**    |
| Circumference (cm) of left adrenal gland  | 5.75±0.35     | 9.30±0.47**    |

* = Significant at P<0.05; ** = Significant at P<0.01; NS = Non-Significant.
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