Biospectra : ISSN: 0973-7057, Vol. 19(1), March, 2024, pp. 61-64
An International Biannual Refereed Journal of Life Sciences

Animal Science

ISSN : 0973-7057

Study of seasonal variation in the renin content and zona glomerulosa of *Rana tigrina*

Dharmesh Kumar[a]* & Faiyaz Ahmad[b]
[a]Department of Zoology, B.R.A.Bihar University, Muzaffarpur, Bihar, India.
[b]Department of Zoology, L.S.College, Muzaffarpur, Bihar, India.

Received : 20th December, 2023 ; Revised : 20th January, 2024
DOI:-https://doi.org/10.5281/zenodo.14323078

Abstract- The present study reveals that both renin content and zona glomerulosa exhibit cyclical changes which can be correlated with the season. As the size of the cell increases, zona glomerulosa becomes more active. It is just reversed in the onset of rainy season and during the winter season, the reverse situation is due to the zona glomerulosa cells appear to be regressed.

Key words: Renin, zona-glomerulosa, Rainy Season, Winter season

INTRODUCTION

The present study aims to investigate the seasonal variation in the renin contents and zona glomerulosa of frog. The normal Juxtaglomerular apparatus in frog consists of four components and three special cell types. The four components are afferent arterioles and arterioles of the glomerulus, the extraglomerular mesangium (EGM) and the macula densa (MD). The granular and agranular cells are the cells of macula densa (MD).

A space is form, due to afferent and efferent arterioles and some portion of distal tuble, which is called, lacis cells or extraglomerular mesangial region.

Granular cells are present in the walls of the afferent arterioles. They are sometimes present in arteriolar walls and the mesangial region. They are called epitheloid, myoepitheloiid or Juxtaglomerular cells. Agramular cell mass is mainly located in the masangial region. These cells are called pseudo-meissnerian, afibrillar or lacis cells. They constitute the extra glomerular mesangium (EGM).

In the portion of the distal tubule attached to the vascular pole of the glomerulus, the tubular cells on the side of the glomerulus become longer, and the nuclei are located closer to each other than those of the cells on the opposite side. This cell group is called the macula densa (MD).

Kidney and hypertension were confirmed by Tigerstedt and Bergman (1898)[1], who reported the creation of hypertension in rabbit with injection of homogenized kidney extract and termed this active factor renin. Juxtaglomerular cells play an important role in the seasonal variation of renin contents and zona-glomerulosa of frog.

It has been known that juxtaglomerular apparatus is functional unit of renin control which is located at the hilus of the glomerulus and consists of tubular and vascular

*Corresponding author :
Phone : 8002673788
E-mail : dharmeshkumar647@gmail.com

elements. A frequently employed method for light microscopic visualization of the Juxtaglomerular granules is the staining procedure according to Bowie (1936)[2], which was later modified by Hartroft (1968)[3]. All animals, including humans, can be shown to have granules using this method. Granulated cells have already been seen in kidney material from foetuses and embryos.

Investigations of Simpson (1965)[4] and Hartroft (1968)[3] have shown that the granularity of JG cells can vary in experimental settings including adrenalectomy and renal artery constriction. A number of workers like Fisher (1966)[5] & Matsuhashi *et al.* (1977)[6] have used histochemical techniques to demonstrate acid phosphatase activity in the Juxtaglomerular granules. Several workers like Pitcock *et al.*, (1959)[7]; Tobian *et al.*, (1959)[8,9]; Fisher (1961)[10]; Hartroft *et al.*, (1966)[11] are of the opinion that renin in mammal kidney is localized to the half of the vascular pole. Hartroft and Newark (1961)[12]; Latta and Maunsbach (1962)[13] are of the same view that due to the endocrine nature of the Juxtaglomerular cells they secrete renin. They believe that the macula densa, part of the distal tubule of the nephron touching the afferent arteriole, is the actively secreting region. But the literature regarding renin location and secretion is very scanty in frog.

MATERIAL & METHOD

The tissues were fixed in Helly's fluid and left of 24-36 hrs. The tissues were washed thereafter in tap water and then dehydrated in ethanol. Later they were cleared by acetone-acetobenzene-benzene method.

The slides were stained in with Haematoxylin, Eosin, and periodic acid. Juxtaglomerular cells of kidney stained with Bowle's stain because slides gave the best results which demonstrated the renin containing granules in the Juxtaglomerular cells.

RESULTS & DISCUSSION

The present study reveals that both renin content and Zona glomerulosa exhibit cyclical changes which can be correlated with the season.

During summer, the zona glomerulosa becomes very active as the size of the cells increases, resulting an increase in total width of this zone. The cells not only increase in size but the cytoplasm also assumes opacity indicating the synthesis of the product. In winter, the zona glomerulosa regresses not only in width but cells also get reduced in size and become more inactive.

In Juxtaglomerular cells, also during summer, conspicuous changes take place. The renin granules disappear gradually and Juxtaglomerular cell gives faint response to Bowie's stain indicating spent condition, while during rainy and winter season the Juxtaglomerular cells assume granularity in their cytoplasm indicating the storage state of the renin.

It can be concluded that in summer the Juxta glomerular cells contain very few granules whereas in winter the Juxtaglomerular cells are packed with granules. During rainy season the granularity is of intermediate type. The study believes that as the availability of water during summer season is very much reduced in nature the entire mechanism to retain sodium (Na) is activated. As the main site of exertion of sodium (Na) is through kidney and the hormone which is responsible for it is aldosterone, hence they get influenced due to the scarcity of water. In order to conserve the sodium (Na) which is not is plenty due to water scarcity has to be retained. Hence, the renin from Juxtaglomerular cells is released making the cells devoid of Bowie's positive stain. The released granules of renin then activate and go to various components of RAS and finally converted into angiotensin II which in turn stimulates zona glomerulosa.

The zona glomerulosa in summer under the influence of RAS system secrete aldosterone for the retention of sodium (Na) from the Kidney. In this process the zona glomerulosa cells under the enhanced requirement of aldosterone not only release the content but also increases in size. The present investigators have noticed large sized cells during the summer with dense granular cytoplasm.

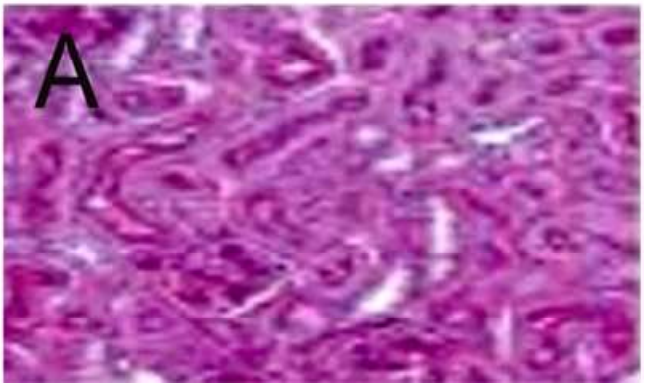

Figure A : T.S. of Kidney of Frog Stained by PAS showing low renin during winter season.

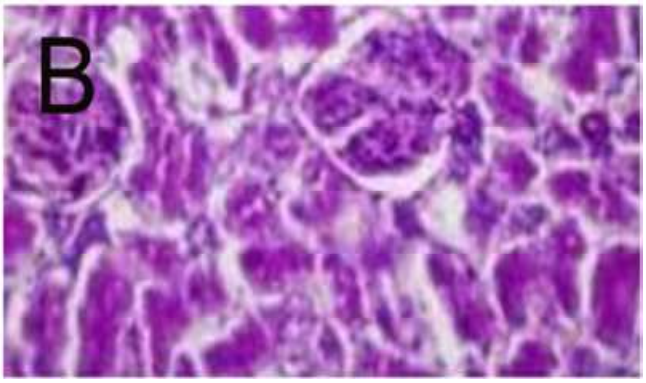

Figure B : T.S. Kidney of frog stained by PAS showing high renin during rainy season

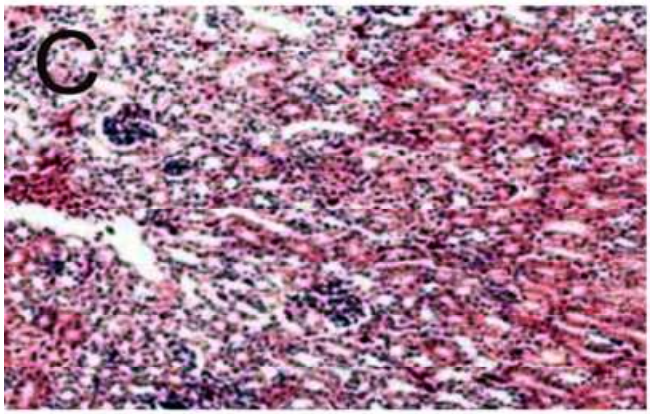

Figure C : T.S. Kidney of frog stained by PAS showing reduction of renin during summer

Similarly, on the onset of rainy season and during winter the situation is just reversed. The water is available in plenty, hence the availability of Sodium (Na) is also increased. As a result the intake of sodium (Na) via water and food is greater in winter and in rainy seasons hence, the body does not require so much need for retention of sodium.

The investigator believes that the RAS and Zona glomerulosa are not in as active state as there were during summer. This view of author gets support from the fact that during winter and rainy seasons the zona glomerulosa cells appear to be in regressed state and Juxtaglomerular cells are packed with Bowie's positive renin granules.

REFERENCES

1. **Tigerstedt R., Bergman P. G. 1898.** The kidneys and the circulation Niere und Kreislauf. *Skand Arch Physiol*. **8:** 223–271.
2. **Bowie D. J. 1936.** A method for staining the pepsinogen granules in Gastric glands. *Anat. Rec*. **61:** 357-368
3. **Hartroft P. M. 1968.** The Juxtaglomerular complex as an endocrine gland, Ins Blood Worth, JBB (ed.) Endocrine Pathology, Williams and Willkins, Balti more, pp.641-677
4. **Simpson F.O., 1965.** The Fine sequence of changes in Juxtaglomerular ell granulation in rats with induced narrowing of one renal artery, *Lab. invest*. **14:**173-177
5. **Fisher E.R. 1966.** Lysosomal nature of Juxta glomerular granules. *Science.* **152:** 1752-1753
6. **Matsuhashi H., Nishida T. & Mochizuki K. 1977.** Enzyme activity of Juxtaglomerular cell granules of the mouse, *Jap. J. Vet. Sci*. **39:**657-659
7. **Pit cock J.A., Hartroft P.M. & Newmark L.N. 1959.** Increased renal pressor activity (renin) i sodium deficient rats and correlation with Juxtaglomerular cell granulation. *Proc. Sco., Exp. Biol Med*. **100:**868-869
8. **Tobian L., Janecek J. and Tomboulian A. 1959.** Correlation between granulation of Juxtalomerular cells and extractable renin in rats with experimental hypertension. *Proc. Soc. Expt. Biol. Med*. **100:**94-96
9. **Tobian L., Tomboulian A. and Janecek J. 1959.** The effect of high perfusion pressure on the granulation of Juxtaglomerular cells in an isolated kidney. *J. Clin. Invest.* **38:**605-610
10. **Fisher E. R. 1961.** Correlation of Juxtaglomerular granulation, pressor activity and enzyme of macula densa in experimental hypertension. *Lab. Invest.* **10:**707-718
11. **Hartroft P. M. 1966.** Juxtaglomerular (JG) cells of the American bull frog as seen by light and electron microscopy. *Fed. Proc*. **25:** 238
12. **Hartroft P. & New Mark L. N. 1961.** Electron Microscopy of renal Juxtaglomerular cells. *Anat, Rec.* **133:**185-199
13. **Latta H. and Maunsbach A. B. 1962.** Relations of the Centro lobular region of the glomerular apparatus, *J. Ultrastructure, Res.* **6:**562-578

ADDITIONAL REFERENCES

14. **Ahmad M. F. 1983.** On the presence of renin granules in the in the kidney of Toad. Bufomelanostictus. *Current Science*. **52(19):** 931-932

15. **Beyenbach K. W. 2004.** Kidneys sans glomeruli, *Am. J. Physiol. Renal Physiol*, 286(5):F 811-F827, *DOI : 101152/ajprenal.00351, 2003*

16. **Colvin S., Malvin G. M., Katz S. & Malvin K. 1984.** Temperature sensitivity of the renin-angiotensin system in Ambystomatigrinum. *Am J. Physiol*. **246:R.**510-515

17. **Davis J. O. 1962.** The control of aldosterone secretion. *Physiologist.* **5:** 65-86

18. **Davis J. O. 1971.** The renin angiotensin system the control of aldosterone secretion. In J.M. Fisher (ed.) Kidney hormones. Academic press, New York. 173-205

19. **Hartroft W. S. 1953.** Studies on renal Juxtaglomerular cell, I variation produced by Sodium chloride and desoxycorticosteroneacetale. *J. Exp. Med*. **97:** 415-428

20. **Louis Tobian. 1967.** Renin release and its role in renal function and the control of salt balance and arterial pressure. Symposium on "Renin", *AM Soc. Exp. Biol.* **26:** 48-53

***