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**Original Research Article**

# Gross Anatomical, Histological and Histochemical Studies of the Parathyroid Glands of the African Giant Rat (AGR) (*Cricetomys gambianus*-Waterhouse, 1840)

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**Abstract:** Twenty AGR (wild African giant pouched rat) comprising of ten males and ten females were used for this study. The average weight of twenty adult African giant rats was observed to be 1058.42 ± 37.79g. The average weight of male and female AGR were observed to be 1210.00 ± 56.70g and 911.11 ± 24.50g respectively. The weight showed sexual dimorphism with the male significantly higher than the female. Gross anatomy and morphological studies of the parathyroid glands of the African giant rat revealed that parathyroid glands were two pairs situated in the lateral and inferior in position to the thyroid gland. Histological studies showed that the parathyroid glands were richly supplied with blood and the chief cells were abundant and arranged in form of cords throughout the glands. The chief cells were positive when stained with periodic acid Schiff (PAS) stain which showed that glycoprotein was present. Oxyphil cells were also present and were observed to be bigger and fewer than the chief cells.

**Keywords:** Cricetomys gambianus, periodic acid Schiff (PAS), glycoprotein, Oxyphil cells.

## INTRODUCTION

The parathyroid gland is one of the endocrine glands which secrete parahormone [1]. The parathyroid gland cells secrete paratharmone hormone which plays a great role in the regulation of the calcium metabolism inside the body and keeping calcium level within normal inside the blood. In recent years, studies on the histological structure of the parathyroid glands in animals have been reported. [2] in buffalo, [3] in goats, [4] in dogs and [5] in camels. Paucity of literature on the anatomy, histology and histochemistry of parathyroid glands in wild African giant rat prompted us to undertake this research work with the view of establishing some baseline data.

## METHODOLOGY

### Study Design

In this research, twenty adult African giant pouched rats of both sexes were used. The animals were captured alive using local metal cage traps in the wild around Samaru and Bomo villages in Sabogari local government area of Kaduna state, Nigeria. They were transported to the laboratory of the Department of Human Anatomy, Ahmadu Bello University, Zaria and acclimatized for two weeks prior to the research. They were fed with groundnut pellets and water was allowed *ad libitum.* The care and handling of these animals conformed to the rules and guidelines issued by the Ahmadu Bello University, Zaria. Physical examination revealed that the animals were healthy and in good nutritional status before the research. The animals were anaesthetized using chloroform in a closed container [6]. Their body weights were recorded to the nearest gram, using a laboratory balance (Model P 1210). The animals were humanly sacrificed and an incision was made in its cervical region, the parathyroid glands were dissected. The parathyroid glands were inferior and lateral to the thyroid. Photograph of glands were taken before glands were dissected. The weight of glands was determined using the digital weighing balance while the lengths and widths were determined using ruler. The glands were fixed in Bouin's fluid for 24 hrs. The fixed tissues were then dehydrated in a series of ascending ethanol concentration (70 %. 80 %, 90 % and 100 %), cleared in xylene, impregnated in liquid paraffin wax and embedded in paraffin blocks. Sections of 6$\mu m$ thickness were cut using rotary microtome, dewaxed in xylene, hydrated in series of descending ethanol concentration, stained with haematoxylin and eosin and mounted on glass slides. For histochemical studies the parathyroid glands were stained with PAS for the demonstration of glycoprotein in the gland. Slides were studied on the binocular light microscope Olympus at different magnifications.

**Key words used**

Wild African giant pouched rat, Parathyroid glands, histological, histochenical

**Statistical Analysis**

Data on weights, lengths and widths were expressed as mean ± standard error of mean and statistical analysis of the data was analysed using the Student T-test for differences between males and females rats using student package for social sciences version 17.

**RESULTS**

The parathyroid glands were four in number and inferior and lateral to the thyroid (Fig-3). Each gland was separated from the architecture of the thyroid gland by thin connective tissue capsule that can be easily identified and distinguished from the thyroid capsule. Table 1 showed that the mean weight, width and length of the male parathyroid gland were significant in relation with the body weight. The same result was observed for the female AGR (Table 1). Parathyroid weight does not showed sexual dimorphism (Table 1). The length and width of Parathyroid glands of AGR does not showed sexual dimorphism ($P<0.05$).

Each gland was covered by thin connective tissue capsule. The glands were seen to be consisted of fibres extended into the substance of the glands divided them into incomplete compartments and consisted of densely packed cellular structures arranged basically in cords (Fig-1). The chief cells were abundant and widely distributed throughout the glands with cord like arrangement (Fig-1). Oxyphil cells were present in the glands (Fig-1).

Histochemical studies revealed that chief cells were PAS positive (Fig-2). The parathyroid glands were richly supplied with blood.

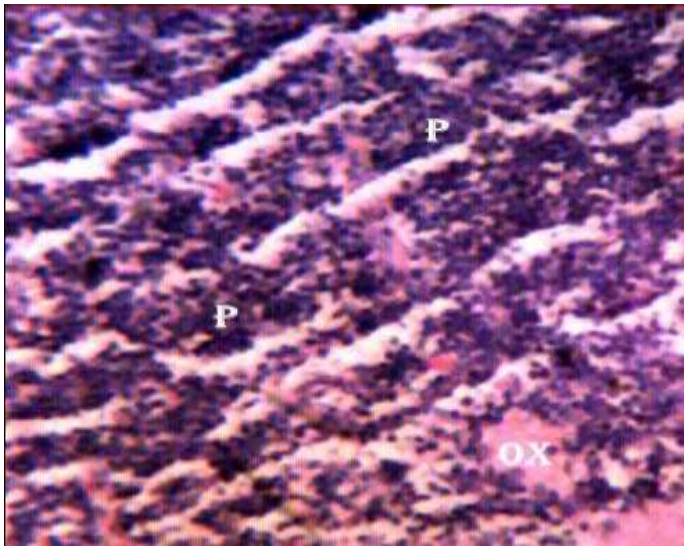


**Fig-1: Micrograph of the histology of the Parathyroid gland of the African giant rat showing the chief cells (P) and oxyphyils cells (OX). Note the cord like arrangement of the chief cells (H&E, 250)**

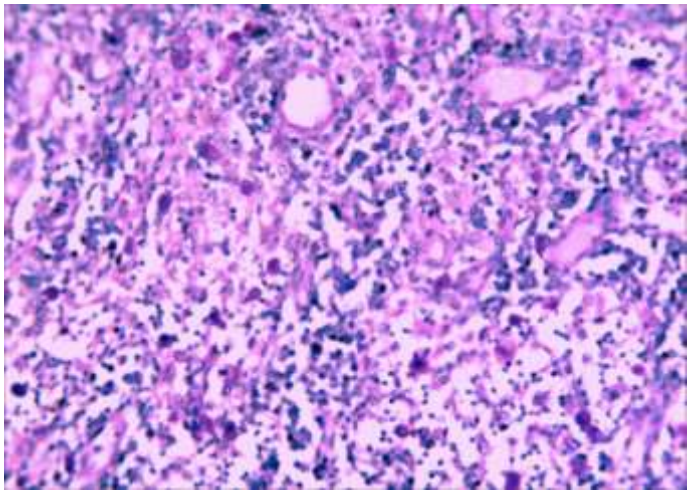

**Fig-2: Micrograph of Parathyroid histology of the African giant rat. Note that the chief cells (C) of the parathyroid gland stained positive with PAS (PAS stain 250)**


**Fig-3: The Parathyroid glands (P) of the African giant rat. Note the position of the glands Inferior and lateral to the two lobes of the thyroid glands (T)**

**Table 1: Morphometric studies on the parathyroid glands of the African giant rat**

| **AGR** | Body weight | Organ weight | Parathyroid index | Organ length | Organ width |
|---|---|---|---|---|---|
| **MALE** | 1210.00 ±56.67* | 0.04±0.002 | 0.003 ±0.01 | 0.28 ±0.01 | 0.11±0.01 |
| **FEMALE** | 911.11±24.45 | 0.02±0.001 | 0.002±0.01 | 0.021±0.01 | 0.021±0.01 |

## DISCUSSION

The parathyroid glands in most animal species consisted of two pairs of glands in the anterior cervical region [7]. Similar findings were made in the present study. There was no significant difference between the weight of male and female parathyroid glands of AGR. This does not agree with findings in mice and Wister rats where the female organs are significantly higher in weight than that of the males [8]. There was no significant difference between the width and the length of the parathyroid glands of male and female parathyroid gland of the AGR.

The AGR parathyroid gland was identical in histological structure to other mammals [9] in Camel, [10] in Buffalo, [11], in cow and [12] in goat, in hen [13], and [14] in hamster and in rodents [8]. The chief cells were arranged basically in forms of cords. This arrangement is different from that of humans were cells are arranged in various forms; cords, semi follicles and follicles [15], but agrees with findings in rodents [16]. The chief cells are responsible for the production of parathyroid hormone [17], hence chief cells were PAS positive. Chief cells were positive because the parathyroid hormone is basically a glycoprotein.

The oxyphilic cells were larger than the chief cells, fewer in number and mostly located as single cells in between the chief cells. The cells were characterized by darkly stained eosinophilic granular cytoplasm (Plate I). Nuclei were centrally located and heterochromatic. Similar results were observed [5] in Camel. [18]. Oxyphil cells do not have an active function in the biosynthesis of parathyroid hormone [19]. Whereas [20] and [13] had reported that Oxyphil cells were absent in parathyroid glands of the rat, chicken, and many species of lower animals.

## CONCLUSION

The gross, histological and histochemical studies of parathyroid glands of the African giant rat showed no sexual dimorphism and the cellular morphology which we saw could help in understanding the biology of the rodent.

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