Journal of Applied Life Sciences International
6(1): 1-4, 2016; Article no.JALSI.26341
ISSN: 2394-1103

SCIENCEDOMAIN *international*
www.sciencedomain.org

Lungs of Bat (*Eidolon helvum*), RAT (*Rattus norvegicus*) and Pangolin (*Manis tricuspis*): A Comparative Histology

S. G. Ojuolape[1,2*], O. A. Muhammed[3] and M. M. Sanni[1]

[1]Department of Anatomy, College of Health Sciences, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria.
[2]Department of Anatomy, College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria.
[3]Department of Histopathology, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author SGO designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author OAM managed the literature searches, analyses of the study performed the spectroscopy analysis and author MMS managed the experimental process. All authors read and approved the final manuscript.

Article Information

DOI:10.9734/JALSI/2016/26341
Editor(s):
(1) Purnachandra Nagaraju Ganji, Department of Hematology and Medical Oncology, Emory University School of Medicine, USA.
(2) Hayet Hammami, Fungal and Parasitic Molecular Biology Laboratory, Sfax University, Tunisia.
Reviewers:
(1) Kenneth Nugent, Texas Tech University Health Sciences Center, USA.
(2) M. Roth, University Hospital Basel, Switzerland.
(3) Anonymous, Ulyanovsk State University, Russia.
(4) Renshan Sun, Daping Hospital of Third Military Medical University, Choqing City, China.
Complete Peer review History: http://sciencedomain.org/review-history/15063

Original Research Article

Received 12th April 2016
Accepted 7th June 2016
Published 18th June 2016

ABSTRACT

Aims: The histology of the lungs of three mammalian species were examined to explore how their histological differences may determine their functional features, which may be compared by differences in their life styles.
Study Design: The histological investigations of the lungs of occational flying specie, bat (*Eidolon helvum*); the slow or sluggish specie, pangolin (*Manis tricuspis*); and running or walking specie, wistar rat (*Rattus norvegicus*) were studied.
Methodology: Two (2) bats, two (2) rats and one (1) pangolin were acclimatized (in the animal holding of the University of Ilorin) and used for this research work, the animals were sacrificed using cervical dislocation under chloroform anaesthesia, after which the lungs were extracted and fixed in

**Corresponding author: E-mail: samsudeeng84@gmail.com;*

a 10% formalin for 24 hours, and prepared for histological examinations.
Results: The alveolar duct in bat is slightly thinner in bat compared to that of rat, and thinnest in pangolin. Also, the macrophages found in rat are larger than that in bat. More epithelial type I cells are found in rat compared to bat and scanty in the pangolin, and more of epithelial type II cells are found in bat compared to rat and very most in pangolin. The macrophages found in rat are larger than that in bat. The macrophages that are larger in the ground running animals may suggest that, the earth closer animal requires more antibodies for self defence compared to flying animals.
Conclusion: It can therefore be concluded that, the differences in the histological features may determine the respiratory functions of the animals involved.

Keywords: Lung; alveolar wall; alveolar diameter; bat; rat; pangolin.

1. INTRODUCTION

There are Studies on the Bat and rat as mammals, though bat is an arboreal, while rat is a terrestrial animal. But, there has not been any work on the histology of their lungs in relation to their respiratory functions. The lungs are vital organs of respiration; their main function is to oxygenate the blood by bringing the inspired air into close relating with the venous blood in the pulmonary capillaries [1]. The morphology and efficiency of respiratory organs correspond with the oxygen requirement of the animals.

The flying animals, such as bats and birds which have high aerobic capacities, appear to have the most efficient respiratory organs [2]. It should be clearly explained that bats are mammals and birds are aves, according to their phylogenetic and morphological differences, the strategies to accomplish this energetically expensive form of locomotion appear to be different [3]. Thus, bats appear to have a restricted number of factors operating close to their maximal levels of a narrow-based high-keyed strategy. The three animal species were selected for the study, because of their observing metabolic activities which may determine the structural integrity of the various lungs.

2. MATERIALS AND METHODS

2.1 Care of the Animals

Two (2) bats, two (2) rats and one (1) pangolin were used for this research work. The animals were acclimatized in the Animal holding of the University of Ilorin, Nigeria. The rats were fed with rat pellets and given water, while the bats were fed with ripe bananas and given water as well.

2.2 Excision of the Lungs

The animals were sacrificed by the cervical dislocation under chloroform anaesthesia, after which the lungs were extracted and fixed in 10% formalin for 24 hours.

2.3 Histological Procedure

Having carefully excised and set for tissue processing through; dehydrated in graded alcohols, cleared in xylene, impregnated in a liquid paraffin wax in an oven and finally embedded. Serial sections were obtained at 5µm thickness from a rotary microtome and stained using Haematoxylin and Eosin (H&E). The sections were examined with the light microscope and photomicrographs of the sections were taken for further analysis.

3. RESULTS

3.1 Morphological Analysis of the Lungs

3.1.1 Alveolar duct

The alveolar duct in bat is slightly thinner in bat compare to that of rat and thinnest in pangolin.

3.1.2 Macrophage

The macrophages found in rat are larger than that in bat.

3.1.3 Epithelial type I cell

More epithelial type I cell is found in rat compare to bat and more scanty in pangolin.

3.1.4 Epithelial type II cell

More of epithelial type II cell is found in bat compare to rat and very most in pangolin.

3.2 Histological Observations

The figure below presents the histology of lungs of three (3) mammalian species: Bat, Rat and Pangolin.

Table 1. Illustrates the average body and lung weights of bat and rat using a descriptive statistics for both bat and rat, and simple mean for pangolin

	Bat	Rat	Pangolin
Body weight (BW/g)	267.45±1.20	182.00±2.26	827.80
Lung weight (LW/g)	2.80±0.14	1.40±0.14	4.70
LW/BW	0.011±0.010	0.008±0.007	0.006

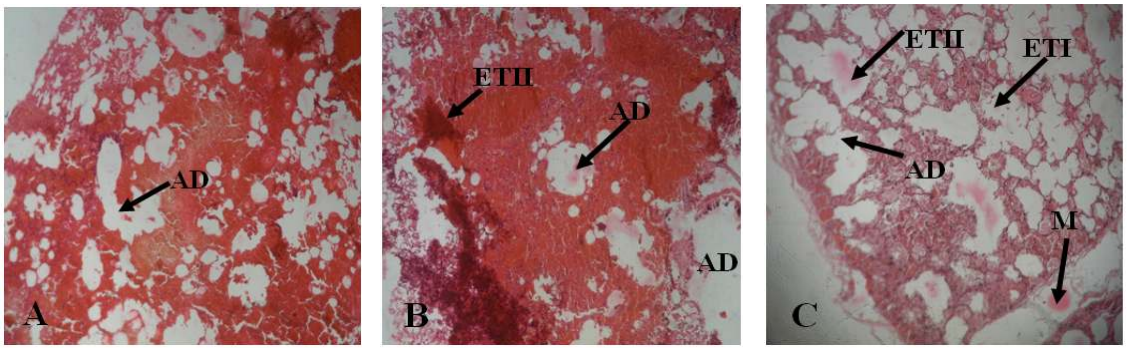

Fig. 1. Photomicrographs of the lungs of bat (A), rat (B) and pangolin (C) comparing their; alveolar ducts (AD), macrophages (M) and epithelial cells arrangements. H & E (X100)

4. DISCUSSION

The metabolic activity of bat is higher when compared to rat and pangolin as a result of their differences in their modes of locomotion, which appears to be the most responsive to the energetic requirements of the higher oxygen flows. Thus, the morphology and efficiency of respiratory organ corresponds with the oxygen requirements of the mammals [4].

From the microscopic observation, it was suggested that, the sizes of alveoli and alveolar duct are in conformity with the structural adaptation for the increased efficiency of gaseous exchange; the progressive thinning of the alveolar wall [5] and the concomitant decrease in alveolar diameter, which are determined by the alveolar duct [6] are observable in the photomicrographs above. The alveolar macrophages serves as a model of the alveolar-blood interface, it is found in the frontline of cellular defense against the respiratory pathogen [7]. In the photomicrographs above, rat was reported to have large microphages; this suggested that, rat as a running animal could need more cellular defense than flying animal (bat), especially, when animal is faced with larger number of infectious particle of more virulent microbes [8].

The epithelial type II cell is more in bat, and may be as a result of its occasional flying activity, which said to be responsible for the production of surfactant and also in host defense [9], when bat is inactive during the day with lower metabolic rates, and compensated for by an increase in epithelial type II cell.

5. CONCLUSION

In conclusion, the differences in the histological features may determine the respiratory functions of the animals involved. Thus, the morphology and efficiency of respiratory organs correspond with the oxygen requirements of animals. An occasional flying animal, such as bat with higher aerobic capacities, appears to have the most efficient respiratory features compared to others.

ETHICAL APPROVAL

All authors hereby declare that Principle of laboratory animal care (NH publication No. 85-23, revised 1985) was followed, as well as specific national laws where applicable. All experiments have been examined and approved by the appropriate ethic committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Moore KL, Dalley AF. Clinical oriented anatomy 4th ed. New York, Lippincott Williams & Wilkin; 2006.
2. Maina JN. What it takes to fly: The structural and functional respiratory refinement in birds and bats. J. Exp. Biol. 2000;203:3045-3064.
3. Maina JN. Fundamental structural aspect and features in the bioengineering of the gas exchangers. Comparative perspectives. Adv -AnatEmbryol-cell Biol. 2002;167:1-112.
4. Maina JN, King AS, King DZ. Amorphometric analysis of the lung of a species of bat. Respir. Physiol. 1982;50:1-11.
5. Meban C. Thickness of the air-blood barriers in vertebrate lungs. J Anat. 1980; 131(Pt 2):299-307.
6. Daniels CB, Orgeig S. Pulmonary surfactant the key to the evolution of air breathing news. Physiol. Sci. 2003;18:151-157.
7. Sibille Y, Reynolds HY. Macrophages and polymorphonuclear neutrophils in lung defense and injury. Am Rev Respir Dis. 1990;141:471-501.
8. Haslett C. Granulocyte apoptosis and its role in the resolution and control of lung inflammation. Am J Respir Crit Care Med. 1999;160:S5-S11.
9. Wright JR. Immunoregulator surfactant proteins. Nat. Rev. Immune; 2005.

© 2016 Ojuolape et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/15063