



UNIVERSITI PUTRA MALAYSIA

THE NEPHRON OF SWIFTLET - AN ULTRASTRUCTURAL STUDY

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**THE NEPHRON OF SWIFTLET - AN ULTRASTRUCTURAL
STUDY**

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**A project paper submitted to the
Faculty of Veterinary Medicine, Universiti Putra Malaysia**

**In partial fulfilment of the requirement for the
DEGREE OF DOCTOR OF VETERINARY MEDICINE**

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CERTIFICATION

I hereby certify that I have read this project paper entitled “The Nephron of Swiftlet- An Ultrastructural Study”, by NurLiyanaBintiLokhman Hakim and in my opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999-Final Year Project.

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DEDICATION

I wish to dedicate this Final Year Project paper to

My father, Lokhman Hakim Bin Harun

My mother, NoorihanBinti Abdul Rahman

For their passion and compassion in nurturing

My supervisor

My family

My friends

Thank you for your continuous support.

May this will be your inspiration and motivation for your future endeavours

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATION

EBN	Edible bird nest
H&E	Hematoxylin and eosin
Cd	Collecting duct
Rc	Renal corpuscle



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ABSTRAK

Abstrakdaripadakertasprojek yang dikemukakankepadaFakultiPerubatanVeterinaruntukmemenuhisebahagiandaripadakeperluankursus VPD 4999-ProjekTahunAkhir.

NEFRON BURUNG WALIT- KAJIAN ULTRASTRUKTUR

Oleh:

NUR LIYANA BINTI LOKHMAN HAKIM

Supervisor: Dato' Dr.TengkuAzmi Bin Tengku Ibrahim

Telahdilaporkanbahawastrukturorganisasinefronburungwalitmenyerupainefronreptilia yangtidak “bergelung” denganketiadaananggotamenurundanmenaiklengkunganHenle. Tanpabergelungmenjadikankortekslebihluasdan penuhiolehtubulproksima.Hipotesiskajianiniadalahburungwalitmempunyainefron yang mudahdaripadasegistrukturtetapiefisientdarisegifungsi.Dengan demikiankajianinimenelitimorfologinefronburungwalit tahapultrastrukturdankearahtujuanisampelbuahpinggangburungwalityang diperolehitelahdiprosesuntukmikroskopi electron transmisi. Terdapatbanyakmikrovilusdalamsitoplasmaselepiteliumtubulproksima, insidensmitokondria yang tinggidisampingindentasidanlipatankedalam membrane besseltubulproksima yang luas yang menunjukkankecepatinggiseransemulafiltrat glomerulus

dan penyalurannya ke lumen kapilar peritubul.

Kecekapan nefron dipertingkatkan seterusnya oleh tubul segmen perantaraan yang juga mempunyai struktur yang sama seperti sel epitelium tubul proksima – mikrovili, mitokondria dan indentasi bes dan lipatan ke dalam membrane sel – yang menunjukkan masih lagi berlaku penyerapan filtrat glomerulus di bahagian tubul nefron ini. Tubul yang lebih distal dan tubul pengumpul juga menunjukkan buktidarisegi struktur penyerapan semuladan penyaluran filtrat glomerulus ke dalam kapilar peritubul. Cerapan menarik dalam kajian ini adalah terdapatnya dengan bekitubanyaktitisan lipid dalam lumen nefron. Mikrovilus mempunyai permukaan hujung yang luas berkemungkinan membentuk khas bagi penyerapan lipid dalam segmen perantaraan nefron. Dengan ini kesimpulan yang boleh diambil daripada kajian ini ialah nefron burung walit adalah mudah dari segi struktur kerana tidak mempunyai anggotamenurundan menaik lengkung. Henlet tetap mempunyai kecekapan yang tinggi mengambil kira penyerapan semulafiltrat glomerulus berlaku disepanjang nefron.

Kata kunci: *burung walit, ketiadaan lengkung, nefron reptilia, segmen perantaraan, titisan lipid*

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of the course VPD 4999- Final year Project.

THE NEPHRON OF SWIFTLETS - AN ULTRASTRUCTURAL STUDY

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Supervisor: Dato' Dr. Tengku Azmi Bin Tengku Ibrahim

It has been reported that the structural organization of the swiftlet nephron resembled that of the reptilian which was "loopless" – absence of the descending and ascending limbs of the loop of Henle. Being loopless and with a large cortex occupied mainly by the proximal tubules it is hypothesized that the swiftlet's nephron is structurally simple but functionally efficient. Accordingly the present study examined the morphology of the swiftlet's nephron at the ultrastructural level and towards this objective samples of the swiftlet's kidney collected were processed for transmission electron microscopy. Numerous microvilli, a high incidence of mitochondria and an extensive indentation and infolding of the basal epithelium of the proximal tubule indicated enhanced reabsorption of glomerular filtrate and its release into peritubular capillary. Efficiency of the nephron is further augmented by

the tubules of the intermediate segment which also showed similar structural evidences – microvilli, mitochondria and basal indentations and infoldings - indicating there was still considerable reabsorption of glomerular filtrate in this part of the nephric tubules. The distal convoluted tubules and collecting ducts also showed evidences of reabsorption and release of glomerular filtrate into peritubular capillary. An interesting observation in this study was the presence of many lipid droplets in the lumen of the nephron. Microvilli with dilated apical ends could be specially designed for the absorption of lipids in the intermediate segment. Thus the nephron of the swiftlet is simple as it is loopless but highly efficient as reabsorption take place throughout the entire length of the nephron.

Keywords: *swiftlet, loopless. Reptilian nephron, intermediate segment, lipid droplet*

1.0 INTRODUCTION

In Malaysia, the nests of *Aerodramus fuciphagus* (white-nest swiftlet) and *Aerodramus maximus* (black-nest swiftlet) are harvested for commercial purposes (Looi Qi Hao *et al.*, 2015). With a market price of about RM3000/kg the edible birdnest (EBN) is one of the most expensive animal products consumed by human (Rashid, 2015). Unlike other avian species, the swiftlet build their nests almost entirely from its salivary secretion (Ibrahim *et al.*, 2009).

EBN is claimed to have many therapeutic properties (Syed and Norazlin, 2014) as it consists of the highly valued glycoprotein rich in amino acids, carbohydrate, calcium, sodium and potassium (Norhayati *et al.*, 2010). It also helps to promote one's immune system and enhances body metabolism. More recently, bird nests have been used as a component in cosmetic products (Zainabet *et al.*, 2013). More importantly, EBN is also known to contain the immuno-competent and antiviral properties (Norhayati *et al.*, 2010).

The swiftlet, from the time it leaves its nest at dawn to forage on insects in the upper strata of the atmosphere, is always in constant flight until dusk when it returns to its nest. During flight, for duration of 12 hours, there is very likelihood that it has limited access to water. Hence, it must have a urinary system which is highly efficient to conserve its body fluids.

1.1 OBJECTIVE

In a previous study (Raihan and TengkuAzmi, 2015), it was reported that the nephron of the swiftlet is loopless – absence of ascending and descending limbs of the loop of Henle. An ultrastructural study of the nephron would provide comprehensive information on the efficiency of the swiftlet kidney.

1.2 JUSTIFICATION

The present study is aimed at providing an understanding on the structural and functional relationship of the tubular parts of the swiftlet's nephron focusing on (proximal and distal convoluted tubule, intermediate segment and collecting duct). The functional significance of these parts of the nephron could be better understood when their morphologies are examined at the ultrastructural level

1.2 HYPOTHESIS

From the above objective it is hypothesized that the swiftlet's nephron is structurally simple but highly efficient in its function.

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