
**UNIVERSITI PUTRA MALAYSIA**

# *EX VIVO CORRELATION OF ULTRASONOGRAPHIC APPEARANCE OF GASTRIC SUBMUCOSAL FAT WITH HISTOLOGY IN CATS*

**TEOH YONG BIN**

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# EX VIVO CORRELATION OF ULTRASONOGRAPHIC APPEARANCE OF GASTRIC SUBMUCOSAL FAT WITH HISTOLOGY IN CATS

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**FACULTY OF VETERINARY MEDICINE**

**UNIVERSITI PUTRA MALAYSIA**

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# EX VIVO CORRELATION OF ULTRASONOGRAPHIC APPEARANCE OF GASTRIC SUBMUCOSAL FAT WITH HISTOLOGY IN CATS

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A project paper submitted to the

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In partial fulfillment of requirement for the

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## CERTIFICATION

It is hereby certified that we have read this project paper entitled “Ex Vivo Correlation of the ultrasonographic appearance of gastric submucosal fat with histology in cats”, by Teoh Yong Bin and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999 - Project

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## DEDICATIONS

*To The Triple Gems,*

*The Buddha, the holy one, the fully enlightened one,*

*The Dhamma, His teachings which have guided my path,*

*The Sangha, the Order of monks which have pointed me to the Eight-Fold Path.*

To my family,

Teoh Jin Eng,

Tan Phaik Hong,

Teoh Mei Xian,

Teoh Yong Jun,

Teoh Mei Xing,

Ng Jia Chen,

Jessica Ng You Rou

And to all sentient beings perfecting their minds to be free from Samsara.

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## ABSTRACT

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**EX VIVO CORRELATION OF ULTRASONOGRAPHIC APPEARANCE OF GASTRIC SUBMUCOSAL FAT WITH HISTOLOGY IN CATS**

**By**

**Teoh Yong Bin**

**2017**

**Supervisor: Dr. Lim Sue Yee**

**Co-Supervisor: Dr. Mazlina Mazlan**

**Background**: Ultrasonographic assessment of the stomach and its layers are performed routinely in companion animals. Varying submucosal thicknesses are seen in cats ultrasonographically, however their attribution to fat deposition, anatomical variation or disease processes remain unknown.

**Hypothesis/Objective**: To correlate appearance of gastric submucosa on ultrasound with its histology in cats.

**Animals:** 25 cats from animal shelters and pounds.

**Methods**: Following humane euthanasia for various reasons, the stomach was resected and ex-vivo ultrasonography was performed at the fundus, body and pylorus. Ultrasound measurements include thickness of gastric wall ($GW_{US}$) and submucosa ($GSM_{US}$). Gastric rugae fold (RF) presence was also recorded. Thereafter, histology of the stomach section measured at ultrasound was performed. Histological measurements include thickness of gastric wall ($GW_{H}$) and submucosa ($GSM_{H}$) and submucosa fat score ($GSM_{FAT}$).

**Results**: Fat was present in the gastric submucosa in 96% of cats. However, no association was found between $GSM_{US}$ and $GSM_{FAT}$ in all regions. $GSM_{US}$ was correlated to $GSM_{H}$ (r=0.459; *P* =0.021) in the body. RF was associated to $GSM_{US}$ in fundus and body.

**Conclusion:** Gastric submucosal thickness is not associated to fat deposition on histology. Nevertheless, ultrasonographic thickness in gastric submucosa corresponds to histology and was also associated to presence of rugae fold.

**Keywords:** Cat, Histology, Stomach, Submucosa, Ultrasound

## ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek.

**KORELASI EX VIVO ANTARA KEMUNCULAN LEMAK SUBMUKOSA GASTRIK DI ULTRASOUND DENGAN HISTOLOGI DALAM KUCING**

**Oleh**

**Teoh Yong Bin**

**Penyelia: Dr. Lim Sue Yee**

**Penyelia bersama: Dr. Mazlina Mazlan**

**Latar belakang:** Taksiran ultrasound perut serta lapisannya sudah digunakan secara rutin dalam haiwan kesayangan. Ketebalan submukosa yang berbeza telah dijumpai dalam ultrasound, namun atribusi kepada perbezaan ini dari segi pengendapan lemak, variasi anatomi ataupun proses penyakit masih tidak diketahui.

**Hipotesis/Objektif:** Untuk mengkorelasikan penemuan submukosa gastrik melalui ultrasound dengan histologi dalam kucing.

**Haiwan:** 25 ekor kucing dari pusat perlindungan dan pusat pengurungan haiwan.

**Kaedah:** Selepas euthanasia secara berperikemanusiaan dibuat atas pelbagai sebab, perut telah diresek dan penskanan ultrasound secara ex vivo telah dibuat pada bahagian fundus, badan dan pilorus. Ukuran ultrasound yang diperolehi termasuk ketebalan dinding gastrik ($GW_{US}$) dan submukosa ($GSM_{US}$). Kehadiran lipatan ruga gaster (RF) turut direkodkan. Seterusnya, histologi pada keratan perut yang telah diukur melalui ultrasound dibuat. Ukuran histologi yang

diambil termasuklah ketebalan dinding gastrik ($GW_H$) dan submukosa ($GSM_H$) serta skor lemak submukosa ($GSM_{FAT}$).

**Keputusan:** Kajian mendapati lemak hadir dalam submukosa gastrik dalam 96% daripada sampel kucing yang dikaji. Namun, tiada perkaitan dijumpai antara $GSM_{US}$ dengan $GSM_{FAT}$ dalam kesemua kawasan perut. Terdapat korelasi antara $GSM_{US}$ dan $GSM_H$ ($r=0.459$; $P=0.021$) hanya pada sampel daripada bahagian badan perut. RF juga mempunyai korelasi dengan $GSM_{US}$ pada bahagian fundus dan badan perut.

**Kesimpulan:** Penemuan menunjukkan tiada kaitan antara ketebalan submukosa gastrik dengan pengendapan lemak dalam histologi. Walaubagaimanapun, ketebalan submukosa gastrik melalui penskanan ultrasound berpadanan dengan histologi dan turut dipengaruhi oleh kehadiran lipatan ruga.

**Kata kunci:** Kucing, Histologi, Perut, Submukosa, Ultrasound

## 1.0 INTRODUCTION

Gastric wall assessment is routinely performed using ultrasonography. Ultrasonographically established layers include hyperechoic lumen/mucosal surface, hypoechoic mucosa, hyperechoic submucosa, hypoechoic muscularis propria and lastly hyperechoic serosa (Pennick *et al*., 1989). Some ultrasonographic changes in gastrointestinal tract layer thickness and echogenicity have been reported as related to pathology, i.e. increased muscularis layer thickness have been reported in cats with inflammatory bowel diseases (Larson *et al.*, 2009). Imaging studies in people have reported presence of gastric fat halo sign observed in computed tomography (CT) and have associated this finding with inflammatory bowel diseases such as Crohn Disease and Ulcerative Colitis (Ahuali, 2008). However, another study described this finding as gastric wall fatty infiltration that may be a normal finding (Gervaise, 2016).

In cats, these gastric radiolucent bands on radiography and gastric hypoattenuating layer on CT scans seen in cats with no overt gastrointestinal signs of disease are associated to gastric wall fatty infiltration as confirmed with histology (Heng *et al.*, 2005 and 2008). This finding corresponds to the gastric fat halo sign as seen in human studies.

On ultrasound, the gastric submucosal layer is hyperechoic (Anderson, 2011). Variations in submucosal thickness are seen ultrasonographically in cats. It is unknown if this variation is anatomical or attributed to disease process. Therefore, there remains a need to correlate ultrasonographic appearance of the gastric submucosal layer with disease process or with anatomical variation using histology as gold standard.

The objectives of this studies are:-

1) To correlate the appearance of gastric submucosal fat with ultrasonography and histology in terms of thickness

2) To determine the association between the gastric submucosal thickness in ultrasonography to gastric submucosa fat deposition in terms of fat score

3) To determine the association between the presence of rugae fold in ultrasonography to gastric submucosal thickness in ultrasonography

4) To determine the association between the serum lipid parameters to gastric submucosal fat deposition in terms of fat score.

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