UNIVERSITI PUTRA MALAYSIA

COMPARISON OF SKULL DIMENSIONS AND THEIR RESPECTIVE DENTITION IN RELATION TO ITS BITING FORCES IN ROTTWEILER, DOBERMANN, GERMAN SHEPHERD AND LOCAL DOGS IN MALAYSIA

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JESSIE BAY JI XI

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In partial fulfillment of the requirement for the

DEGREE OF DOCTOR OF VETERINARY MEDICINE

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CERTIFICATION

It is hereby certified that I have read this paper entitled, "Comparison of Skull Dimensions and their Respective Dentition in relation to their Biting Forces in Rottweiler, Dobermann, German Shepherd and local dogs in Malaysia" by Jessie Bay Ji Xi, 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 – Project.

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DEDICATION

TO MY DEAREST PARENTS, BROTHER AND FRIENDS.

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LIST OF ABBREVIATIONS

CBF	Canine Biting Force
MBF	Molar Biting Force
RI	Right Incisor
LI	Left Incisor
RC	Right Canine
LC	Left Canine
RPM	Right Premolar
LPM	Left Premolar
RM	Right Molar
LM	Left Molar

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial requirement of the course VPD 4999 – Project.

COMPARISON OF SKULL DIMENSIONS AND THEIR RESPECTIVE DENTITION IN RELATION TO THEIR BITING FORCES IN ROTTWEILER, DOBERMANN, GERMAN SHEPHERD AND LOCAL DOGS IN MALAYSIA

By

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2015

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Co-supervisor: Dr. Gayathri Thevi Selvarajah

Since the beginning of domestication, the craniofacial architectures of dogs (*Canis lupus familiaris*) have changed and modified of a result of human intervention in natural selection. Fatal attacks in humans by dogs have highlight the importance of studying comparative anatomy in forensic science to identify the specific dog breed involved in such an attack. Several studies described the biting forces for specific breeds, but thus far, no such investigation has been conducted in local dogs of Malaysia. Thus, the purpose of this study is to determine the skull dimensions and dentition to estimate and compare the biting forces in Rottweiler, Dobermann, German Shepherd and local dogs in Malaysia. Twenty skulls were obtained from

male dogs (five from each different breed) that were disposed at the Post-Mortem Laboratory at the Faculty of Veterinary Medicine, Universiti Putra Malaysia. Skull dimensions were measured using a pair of Vernier caliper on defleshed-dried skulls. Bite forces were estimated using the lever model adapted from Kiltie, 1984. Increasing zygomatic width has a stronger correlation ($p<0.01$) with biting forces compared to skull length. Rottweiler has the strongest biting forces, compared to Dobermann and German Shepherd. The local dogs have the smallest zygomatic widths, thus the canine and molar biting forces are the weakest. Local dogs are relatively smaller ($p<0.05$) compared to the other three breeds in terms of skull dimensions and dentition; therefore resulting in the lowest biting forces. The present study revealed that each breed has a distinct skull dimension, dentition and biting forces comparable to other published reports. Due to the high variation observed among local dog in terms of body and skull sizes and overall appearances; future studies should include higher number of local dogs to establish a database of skull dimensions and bite forces which can be valuable information for Malaysian local forensics and crime investigators.

Keywords: bite force, dogs, skull dimensions

ABSTRAK

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

PERBANDINGAN DIMENSI TENGKORAK DAN KEGIGIAN BERHUBUNG DENGAN DAYA GIGITAN ANTARA ROTTWEILER, DOBERMANN, GERMAN SHEPHERD DAN TEMPATAN DI MALAYSIA

Oleh

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2015

Penyelia: Prof. Madya Dr Shanthi Ganabadi

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Dengan bermulanya pembela jinakan, reka bentuk kraniofasial anjing mula berubah dan terubah suai akibat campur tangan manusia dalam pemilihan alam. Serangan maut anjing terhadap manusia telah menunjukkan betapa pentingnya kajian anatomi perbandingan dilakukan dalam bidang sains forensik untuk mengenal pasti baka anjing tertentu yang terlibat dalam sesuatu serangan maut tersebut. Walaupun ada beberapa kajian telah menghuraikan daya gigitan baka anjing tertentu, kajian seumpama belum pernah dijalankan terhadap anjing tempatan Malaysia. Oleh itu,

tujuan kajian ini adalah untuk menentukan dimensi tengkorak dan kegigian bagi tujuan penganggaran dan perbandingan daya gigitan antara anjing Rottweiler, Dobermann, German Shepherd dan tempatan di Malaysia. Dua puluh buah tengkorak anjing jantan (5 tengkorak daripada setiap baka) telah perolehi daripada Makmal Post-Mortem, Fakulti Perubatan Veterinar, Universiti Putra Malaysia. Dimensi tengkorak kering ternyah kulit dan daging diukur mengguna sepasang angkup Vernier. Daya gigitan dianggarkan menggunakan model lever Kiltie 1984. Lebar zigoma telah menunjukkan korelasi lebih tinggi ($p<0.01$) dengan daya gigitan daripada panjang tengkorak. Anjing Rottweiler mempunyai daya gigitan yang lebih kuat daripada anjing Dobermann atau German Shepherd. Lebar zigoma anjing tempatan adalah paling kecil; justeru daya gigitan taring dan molarnya juga paling lemah. Anjing tempatan mempunyai dimensi dan kegigian paling kecil ($p<0.05$) di kalangan anjing yang dikaji; ini juga membuatkan daya gigitannya paling lemah. Kajian ini menunjukkan bahawa setiap baka anjing ini mempunyai dimensi tengkorak, kegigian dan daya gigitan sama seperti yang telah dilapor. Oleh sebab ada banyak kelainan saiz badan dan tengkorak dan penampilan keseluruhan di kalangan anjing tempatan, maka kajian masa hadapan perlu melibatkan bilangan anjing yang banyak untuk penubuhan pangkalan data dimensi tengkorak dan daya gigitan anjing tempatan sebagai matlumat rujukan bagi penyiasat jenayah dan forensik Malaysia..

kata kunci : daya gigitan, anjing dimensi

1.0 INTRODUCTION

It is believed that people and wolves have had a long association, as the archeological remains which dated about 12,000 years, by the evidence of a puppy skeleton buried together with humans (Morey 1994). It is believed that domestication of dogs' progenitor, gray wolf and further human intervention in natural selection has created the domestic dogs that we recognized today.

Among land mammals, domestic dogs exhibit the most variation and diversity morphologically. We can appreciate the differences from their height, their body size, leg length etc. For instances, Great Dane can be more than fifty times greater in weight and height compared to a Chihuahua, Pug is known for its flat, shorten snout while Saluki has long snout. The difference in the morphology has leaded us to ponder whether there is any difference in the skull dimension, dentition as well as biting forces among these breeds.

Studies revealed that there are genes which control the craniofacial dimension development, for example the Bone Morphogenesis Protein 3 (BMP3) (Schoenebeck *et al*., 2012). BMP3 is the gene that determines the diversity of the phenotypes including body size, leg length (Rimbault & Ostrander, 2012). Therefore, based on the BMP3 genes studies, the differences on the craniofacial dimensions have lead to studies on how cranial dimension can affect the biting force.

In mammals, studies on biting force suggested relevant relationship between diet and feeding behavior (Christiansen & Wroe, 2007). Carnivores with bigger body size

were estimated to exert higher forces compared to herbivores and omnivores (Christiansen & Wroe, 2007) as carnivores' skull and mandible must be strong enough to hold their prey and prevent them from escaping the attack (Thomason, 1991).

According to Ellis and company in 2009, biting forces increase with the increase in skull size. Other than that, comparative anatomy in forensic anthropology plays an important role in determining whether the assault is from a human or a dog. Dogs have had involved in fatal attacks and death, hence by looking and comparing the available dentition may actually lead us to the potential offending dog. In medium and large skulls, it appears that brachycephalic dogs convey a greater biting force advantage, resulting a higher biting force values for these dogs (Ellis *et al.*,2009).

There is a lack of similar studies done on Malaysian local dogs and this study will provide a preliminary data on skull dimension, dentition and biting forces of local dogs in Malaysia. The purpose of this study is to measure skull dimensions, dentition and biting forces in Rottweiler, Dobermann, German Shepherd and local Malaysian dogs. The hypothesis are: each breed of dog has distinct dimensions for skull, dentition and biting forces and among the four breeds, Rottweiler has the highest biting force.

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