UNIVERSITI PUTRA MALAYSIA

THE INFLUENCE OF THOROUGHBRED RACING ON SPECIFIC SERUM BIOCHEMISTRY PARAMETERS IN RACING HORSES IN SELANGOR

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THE INFLUENCE OF THOROUGHBRED RACING ON SPECIFIC SERUM BIOCHEMISTRY PARAMETERS IN RACING HORSES IN SELANGOR

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A project paper submitted to the

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CERTIFICATION

It is hereby certified that we have read this project paper entitled "The Influence of Thoroughbred Racing on Specific Serum Biochemistry Parameters in Racing Horses in Selangor", by Mohamad Hafizi bin Saidon and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course, VPD 4999 – Final Year Project.

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DEDICATION

Every challenging work needs self-efforts as well as guidance of elders especially those who were very close to our heart.

My humble effort I dedicate to my loving

FATHER & MOTHER,

Whose affection, love, encouragement and prays of day and night make me able to finish my task,

Along with all hard working and respected

SUPERVISORS

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ABSTRAK

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

PENGARUH PERLUMBAAN THOROUGHBRED KEPADA PARAMETER SERUM BIOKIMIA YANG KHUSUS DALAM KUDA LUMBA DI SELANGOR

Tahun

oleh

Mohamad Hafizi bin Saidon

Penyelia: Dr Nurul Hayah binti Khairuddin

Penyelia bersama: Dr. Sumita Sugnaseelan, Dr. Shri Kanth Kanaesalingam, Dr. Noraniza Mohd. Adzahan

Jangka pendek perlumbaan kuda berintensiti tinggi baka Thoroughbred menyebabkan ketinggian parameter serum biokimia seperti laktid, glukosa, creatine kinase (CK), transaminase aspartik (AST) dan alanine transaminase (ALT) dalam serum. Laktid dan glukosa adalah bahan metabolik bagi otot manakala CK, AST dan ALT adalah parameter bagi enzim otot. Kajian ini dijalankan untuk mengukur kecergasan terhadap parameter dan membandingkan kenaikan setiap kategori. Sampel darah kuda diambil daripada kuda yang memenangi tempat pertama dan ketiga melalui kaedah venipuncture leher sejurus selepas perlumbaan. 36 kuda telah disampel daripada 18 perlumbaan trek dalam lingkungan jarak 1100m, 1200m, 1300m, 1400m dan 1600m.

Berdasarkan kajian, nilai purata bagi laktid mempunyai peningkatan sebanyak 30 kali ganda. Kenaikan purata nilai untuk AST, ALT, dan tahap glukosa ialah dua kali ganda. Walaubagaimanapun, nilai purata bagi CK berada dalam julat normal. Peningkatan besar laktid boleh diterangkan dengan penglibatan otot dalam glikolisis anaerobik bagi mengimbangi permintaan tenaga yang tinggi semasa perlumbaan. CK kekal dalam julat normal dengan AST dan ALT meningkat sedikit menunjukkan enzim yang diperolehi adalah berasalkan daripada hati di mana ia adalah normal bagi kuda selepas melakukan aktiviti. Hiperglisemia adalah disebabkan oleh tindakan antagonistik insulin kepada catecholamines, glukocorticoids, hormon pertumbuhan dan glukagon. Analisis statistikal mencadangkan bahawa perubahan antara kuda menduduki tempat pertama dan ketiga itu tidak membawa perbezaan yang jelas antara kumpulan untuk semua parameter juga terhadap perbezaan jarak, jantina, dan tahap umur . Paras laktid menunjukkan kapasiti oksidatif otot kuda di mana ketinggian paras laktid boleh menunjukkan penglibatan awal glikolisis anaerobik.

Cadangan bagi kajian yang sama untuk masa hadapan ialah dengan mendapatkan pembolehubah yang lebih membezakan antara kuda. Contohnya seperti sampel antara kuda di tempat pertama dan di tempat ke-sepuluh. Tahap biokimia laktid mencerminkan glikolisis anaerobik perlumbaan kuda baka Thoroughbred mencadangkan tindak balas langsung kepada keletihan otot.

Kata kunci: serum biokimia, perlumbaan Thoroghbred, laktid, prestasi, glikolisis anaerobic

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 – Final Year Project

THE INFLUENCE OF THOROUGHBRED RACING ON SPECIFIC SERUM BIOCHEMISTRY PARAMETERS IN RACING HORSES IN SELANGOR

by

Mohamad Hafizi bin Saidon

2017

Supervisor: Dr. Nurul Hayah Khairuddin

Co-supervisor: Dr. Sumita Sugnaseelan, Dr. Shri Kanth Kanaesalingam, Dr. Noraniza Mohd Adzahan

Short duration high intensity thoroughbred racing causes the elevation of serum biochemistry parameters such as lactate, glucose, creatine kinase (CK), aspartate transaminase (AST)and alanine transaminase (ALT) in the serum. The lactate and glucoseare metabolic fuel of the muscles.CK, AST and ALT parameters are muscle-derived enzymes. This study was conducted to measure the influence of exercise to these parameters and to compare the increments of each categories. Blood was sampled from horses that won first and third placing.Method of blood collection was via jugular venipuncture shortly after the race. 36 horses were

sampled from 18 thoroughbred track races, which distances range from 1100m, 1200m, 1300m, 1400m, and 1600m.

Based on the study here, it was observed that the mean value for lactate had a substantial increase by approximately 30 folds. The mean value for AST, ALT, and glucose levels elevated two-folds. However, the mean value for CK is within normal range. The substantial increase of lactate could beexplained by muscles engaging in anaerobic glycolysis to compensate the high energy demand for high intensity racing in a short duration. CK remained within normal range with AST and ALT showing slight elevations indicating the enzymes were liver-derived which is normal for clinically fit horses post exercise. Physiologic hyperglycemia is caused by insulin-antagonistic actions of catecholamines, glucocorticoids, growth hormone, and glucagon. Statistical analysis suggested that changes between the first placing horse (Winning horse) and the third placing horse (Show horse) did not pose a significant difference between groups for all parameters so as the differences in distance, gender, and age. Lactate levels indicate the oxidative capacity of muscles in horses, so a higher level of lactate could indicate earlier engagement of anaerobic glycolysis.

Future recommendations for similar study, suggest obtaining variables that are more differentiated such as between the winning horse and horses placed tenth instead. Determination of biochemistry level of lactate would reflect the anaerobic glycolysis of racing thoroughbred horses hence suggest indirect response to muscle fatigue.

Keyword: Serum biochemistry, thoroughbred racing, lactate, performance, anaerobic glycolysis

1.0 INTRODUCTION

Thoroughbred racehorses run at high speeds of around 18 m/s or 64 km/h over distances of 800 to 5000 metres. A large number of physiological and anatomical features act in concert to endow the horse with extraordinary athletic capacity. Maximal athletic performance is dependent upon integrated functioning of these physiological and anatomical features (Hinchcliff and Geor, 2004; Evans, 2007). However, there are limits to maximal performance of horses, and there is evidence that these limits have been reached or will soon be so, particularly for thoroughbred racehorses (Denny, 2008; Pieramati et al., 2011). Fatigue is a complex chain of events, with central as well as peripheral contributions. Short-duration, high-intensity exercise such as is performed in thoroughbred racing is not limited by availability of substrates but, more likely, by failure of energy production associated with an increase in protons and a decrease in adenosine triphosphate (ATP). Current studies have focused on which parameters could be used to determine the future outcome of performing horses to which this information can be used to further optimise the sports industry of equine racing.

Lactate and glucose are metabolic fuels of the horse muscles which are used during any type of exercise. During short duration high intensity exercises, anaerobic glycolysis seems to be the most dominant pathway for energy production and glucose regeneration (Hodgson, 1985). Lactate is the product of anaerobic glycolysis and this is used for the further production of glucose which is required by the muscles. The self-limiting nature of anaerobic power output means the horse can only maintain maximal speed for about 600 to 800 m. After this distance, energy supply falls back to slower aerobic pathways, necessitating a reduction in speed of exercise (Hodgson et al., 1985; McMiken, 1983).

Creatine kinase is a muscle specific enzyme which increases usually due to skeletal muscle injury. The increase in this parameter after a track race would indicate that the horse is not fit for racing at

given intensity and would lead to injury. This enzyme however has a short half-life and thus must be interpreted with another muscle enzyme with longer half-life which for example is aspartate transaminase. Aspartate transaminase has a lower specificity to muscle tissue thus when interpreted in conjunction with creatine kinase could provide great information on the function and health of skeletal muscles. Alanine transaminase is categorised under a muscle-derived enzyme as well as a liver-derived enzyme. However in equine studies, the liver has only little influence on alanine transaminase levels when compared to muscles.

This study was conducted to observe the changes of all of the stated parameters and to compare the differences in elevations between the first and third placings. This information could then be used to evaluate these parameters more specifically and associate this information to determine the performance of the horse and potential victory. Differences in other factors such as gender, distance, and age are also compared to see if these independent variables could affect the horse's performance.

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