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**THE EFFECT OF EARLY CONDITIONING
EXERCISE ON THE CROSS SECTIONAL
AREA OF THE SUPERFICIAL DIGITAL
FLEXOR TENDON OF YOUNG
THOROUGHBRED HORSES.**

**A thesis presented in partial fulfilment of the
requirements for the degree of Master of
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**Trish Moffat
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ABBREVIATIONS

ADG	Average daily gain
AL-DDFT	Accessory ligament of deep digital flexor tendon (distal check ligament)
AL-SDFT	Accessory ligament of superficial digital flexor tendon
BAPN-F	Beta-aminopropionitrile fumarate
BCS	Body condition score
CDET	Common digital extensor tendon
COMP	Cartilage oligometric matrix protein
CSA	Cross sectional area
CV	Coefficient of variation
DACB	Distal to accessory carpal bone
DDFT	Deep digital flexor tendon
GERA	Global equine research alliance
GEXA	GERA exercise trial A
GRF	Ground reaction force
HA	Hyaluronic acid
IGF-1	Insulin-like growth factor
MAD	Mass average diameter
MCPJ	Metacarpophalangeal joint
MSCs	Mesenchymal stem cells
NSAIDS	Non-steroidal anti-inflammatory drugs
PIP	Proximal interphalangeal joint
PMMA	Polymethylmethacrylate
P1	Proximal phalanx
P2	Second phalanx
PQCT	Peripheral quantitative computed tomography
PSGAG	Polysulphated glycosaminoglycans
rEGH	Recombinant equine growth hormone
SDFT	Superficial digital flexor tendon
SL	Suspensory ligament
TIOM	The inter-osseous muscle (suspensory ligament)

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ABSTRACT

The effect of conditioning exercise on the ultrasonographic cross sectional area (CSA) of the superficial digital flexor tendon (SDFT) of young Thoroughbred horses was investigated. Two groups of pasture-reared foals were matched for age and sex, and allocated into conditioned (n=18, 6 colts, 12 fillies) and control groups (n=15, 4 colts, 11 fillies). The conditioned group were exercised over 1030m on a purpose-built 515m oval grass track, for five days per week, from ten days of age until completion of the study (eighteen months of age). Conditioning exercise was in both a clockwise and counter-clockwise direction, with the initial velocity being 4.20 ms^{-1} , which was increased to 5.56 ms^{-1} at five months of age, and to 6.66 ms^{-1} at eight months of age, with the addition of a 250m sprint at 12 ms^{-1} .

All foals underwent a thorough clinical examination and conformation assessment at four days of age, which was repeated monthly throughout the study period. The SDFT at the mid-metacarpal level of both left and right forelimbs were examined clinically and ultrasonographically in all animals at five, eight, twelve, fifteen and eighteen months of age. All ultrasonographic images were obtained using a Sonosite® 180 ultrasound machine with a linear 10-5 MHz transducer and a LA5 HRS acoustic stand-off. Captured images were exported to a Pentium computer and the CSA measured with Scion image, using the average of three measurements for statistical analysis. Twelve animals were euthanased at eighteen months of age (6 conditioned, 6 control), and CSA measurement from digital images of transected SDFT at mid-metacarpal level were used to validate ultrasonographic CSA measurements.

At no time during the course of the study were palpable tendon abnormalities detected in either conditioned or control groups, nor was there any ultrasonographic evidence of tendonitis in the SDFT at the mid-metacarpal level in any of the animals. There was no statistically significant difference in mean CSA between conditioned and control animals at any age, nor between colts and fillies. No relationship between mean CSA, bodyweight or body condition score could be established. There was a good linear correlation between *in-vivo* ultrasonographic CSA obtained prior to post-mortem and *in-vitro* CSA obtained at post-mortem ($R^2 = 0.8881$), with the *in-vitro* CSA being 10% larger.

In this novel conditioning programme, early conditioning exercise did not induce a change in the ultrasonographic CSA of the SDFT of the conditioned group, when compared to that of the control animals. When measured ultrasonographically, the ability of the immature SDFT to undergo an adaptive response to conditioning exercise appears to be limited. With the sensitivity of current *in-vivo* measurement techniques, if there are any subtle changes in SDFT CSA in response to conditioning exercise, such changes are likely to remain undetected. Histological and biochemical assessment of harvested tissue was not performed for the purpose of this thesis (these are currently being analysed for another study) and may reveal changes in the SDFT induced by conditioning exercise, at a cellular or molecular level.

1. INTRODUCTION

1.1 Background

1.1.1 Superficial digital flexor tendonitis - its significance in the racing Thoroughbred

The wastage of Thoroughbred racehorses on training tracks and racecourses is a feature of racing worldwide. For example, it is estimated that over one third of the Victorian racehorse population in Australia is replaced annually (Bailey *et al*, 1998). A high level of this wastage occurs at the end of the first or second seasons of racing. While "poor performance" contributes to this, a significant number of horses are retired due to injury or disease associated with training or racing (Bailey *et al*, 1997). Jeffcott *et al* (1982) found that 53% of horses experienced some period of lameness during the racing season, and in 20% of cases the lameness was sufficient to prevent the horse racing again. Similarly Rossdale *et al* (1983) showed 23.3 - 62.2% of individuals had some degree of lameness during the racing season.

Superficial digital flexor tendonitis is a common injury in horses that are required to work at speed and is therefore a significant cause of lameness in racing horses. Of the training days lost due to diagnosed causes of lameness, SDFT tendonitis has been estimated to be responsible for between 9% and 5.7% days (Jeffcott *et al*, 1982); Rossdale *et al*, 1983). The incidence of flexor tendon injury is higher in horses competing over fences or hurdles, compared with those competing in flat races (Marr *et al*, 1993a). The risk of SDFT injury is higher in older horses, particularly horses aged five years and older compared to two year olds (Perkins *et al*, 2004a).