

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**The effect of feeding and management on faecal pH of
the New Zealand Thoroughbred racehorse**

**A thesis presented in partial fulfilment of
the requirement for the degree Master of
Applied Science in Equine Nutrition at
Massey University, Palmerston North, New
Zealand.**

Anita Williamson

2006

Abstract

Quantifying the risk factors for hindgut acidosis is the first step in understanding the problems of poor management and feeding practices of horses in race training. A non-invasive measure of hindgut acidosis can be obtained by measuring faecal pH (Davie *et al.*, 2000; Eastwood, 2002; Rowe *et al.*, 1995; Zeyner *et al.*, 2004; Zeyner *et al.*, 1992; Zeyner, 1993). In this study fourteen 3-year-old Thoroughbreds in regular race training, ten Thoroughbred yearlings aged 13-15 months and 140 Thoroughbred horses of mixed aged in race training were surveyed. Approximately 200g±5g of faeces per horse was obtained from all faecal masses in the horse's stable or yard at the time of collection. Faecal pH was measured using a commercial pH meter.

The study was divided into three experiments; experiment one consisted of fourteen Thoroughbreds within the same racing stable and identified that subtle change in diet, management, and workload had no effect on mean faecal pH during an 83 day observation period. Experiment two, identified gender, between day or time of faecal collection and the amount of concentrate offered (kg), total feed weight and roughage to concentrate ratio of the diet had no significant effect on the faecal pH of ten Thoroughbred yearlings undergoing sales preparation. However there was considerable variation in faecal pH between horses.

Experiment three surveyed 140 Thoroughbred horses under the management of 16 racehorse trainers. Trainer age, number of years training horses, horse age, horse gender, weeks in race training or racing class had no effect on mean faecal pH. Acidic faecal pH (pH ≤6.32) was associated with small stables (1-12 horses). Trainers from small stables offered more concentrate feed than larger stables (13+ horses). Acidic pH was associated with trainers that offered grain as the only form of concentrated feed, or offered ≤2.25kg hay/day, and horses that were fast eaters. Horses that displayed stereotypic behaviours had more alkaline faecal pH than horses that never expresses stable vices (6.70± 0.35 vs. 6.43± 0.29). The total weight of concentrates offered, feed frequency, bedding type, exercise workload and the number of hour's horses were at pasture had no effect on mean faecal pH.

Acknowledgements

I would like to acknowledge my supervisors, Chris Rogers and Elwyn Firth for the opportunity to undertake this research project. The guidance, knowledge and suggestions they have put forward has helped considerably in the completion of this report.

I am most appreciative of the staff at Foxton Racecourse, especially Marty Johnston, for his contribution and commitment to those early morning faecal collections. I would like to thank all the Thoroughbred horse trainers and Sam Williams at Little Avondale Stud to allow me to question their management, feed practice and obtain horse faecal samples

Finally I would like to take this opportunity to acknowledge my family and friends for their kind support and encouragement, with a special thanks going out to Lindy, Gwyn, Sarah, Nikki, Fraser, Clem and Olivia for their constant support and commitment to listen.

Anita Williamson

Table of Contents

ABSTRACT	I
ACKNOWLEDGEMENTS	II
TABLE OF CONTENTS	III
LIST OF FIGURES	IV
LIST OF TABLES	V
LIST OF ABBREVIATIONS	VI
REVIEW OF LITERATURE	1
INTRODUCTION	1
THE NEW ZEALAND THOROUGHBRED INDUSTRY	3
ADAPTATION FROM NATURAL TO SPECIALISED DIET	5
THE STRUCTURE AND FUNCTION OF THE GASTROINTESTINAL TRACT	7
ROLE OF MICROBIAL FERMENTATION	11
WASTAGE IN THE THOROUGHBRED INDUSTRY	15
FEED REQUIREMENTS OF HORSES	19
MANAGEMENT AND TRAINING METHODS	30
FAECAL PH.....	36
FAECAL PH AS A TOOL TO DETERMINE HINDGUT ACIDOSIS	37
AIM OF THE STUDY	38
HYPOTHESES	38
MATERIALS AND METHODS	39
RESULTS	45
DISCUSSION	58
CONCLUSION	65
TERMINOLOGY	66
REFERENCES	70
APPENDIX	85

List of Figures

FIGURE 1. MEAN FAECAL PH OF 14 THOROUGHbred RACEHORSES OVER AN 84 DAYS OBSERVATION PERIOD.	45
FIGURE 2. MEAN FAECAL PH OF 14 THOROUGHbred RACEHORSES IN TRAINING OVER AN 84 DAY OBSERVATION PERIOD.	46
FIGURE 3. MEAN FAECAL PH OF 14 RACEHORSES IN TRAINING FOR 84 DAY (12 WEEKS) OBSERVATION PERIOD.	46
FIGURE 4. THE EFFECT OF EXERCISE INTENSITY ON MEAN FAECAL PH FOR 14 THOROUGHbred RACEHORSES FOR A 78 DAY OBSERVATION PERIOD.	48
FIGURE 5. THE EFFECT OF HORSE AGE ON MEAN FAECAL PH FOR 140 THOROUGHbred RACEHORSES SAMPLED FROM 16 TRAINING STABLES.	50
FIGURE 6. THE NUMBER OF CONCENTRATED MEALS PER DAY ON MEAN FAECAL PH OF 140 HORSES.	52
FIGURE 7. BOX AND WHISKER PLOT OF THE MEAN FAECAL PH AND THE DIFFERENT QUANTITIES OF CONCENTRATE OFFERED PER DAY.	53
FIGURE 8. BOX AND WHISKER PLOT OF THE MEAN FAECAL PH AND THE NUMBER OF WEEKS 140 RACEHORSES HAD BEEN IN RACE TRAINING.	56

List of Tables

TABLE 1. ENERGY AND CRUDE PROTEIN CONTENT OF COMMON NEW ZEALAND PASTURES ADOPTED FROM HUNT (1994).	6
TABLE 2. ENERGY REQUIREMENTS OF HORSES (NRC 1989).	23
TABLE 3. COMPARISON OF DIFFERENT MAINTENANCE ENERGY EQUATIONS FOR HORSES.	25
TABLE 4. COMPARISON BETWEEN KOHNKE <i>ET AL</i> (1999) AND NRC (1989) FOR ENERGY REQUIREMENTS FOR HORSES AT DIFFERENT WORK LOADS.	26
TABLE 5. COMPARISON OF DIFFERENT MAINTENANCE PROTEIN REQUIREMENTS.	28
TABLE 6. DESCRIPTION OF RACEHORSE GAITS AND VELOCITY (M/SEC).	31
TABLE 7 NEW ZEALAND GAIT DESCRIPTIONS IN VELOCITY (M/S)*	40
TABLE 8. NUTRIENT ANALYSIS OF DIET, NUMBER OF DAYS 14 HORSES WERE ON A DIFFERENT FEED PROGRAMME AND MEAN FAECAL pH A 84 DAY OBSERVATION PERIOD.	47
TABLE 9. SUMMARY DATA OF FEED OFFERED AND MEAN FAECAL pH FOR 10 HORSES WITH INDEPENDENT DIETS, SAME MANAGEMENT BUT NO EXERCISE.	49
TABLE 10. DESCRIPTIVE DATA OF THE RACING GRADES OF THE 140 THOROUGHBRED RACEHORSES SURVEYED.	50
TABLE 11. THE NUMBER OF HORSES AND NUMBER OF HORSES SAMPLED WITHIN THE SURVEYED TRAINING STABLES.	51
TABLE 12. MEAN FAECAL pH AND TOTAL NUMBER OF HORSES IN STABLES GROUPED INTO FOUR CATEGORIES.	51
TABLE 13. THE AMOUNT OF TIME 140 RACEHORSES WERE TURN OUT TO PASTURE ON MEAN FAECAL pH.	52
TABLE 14. A MATRIX OF SIGNIFICANT DIFFERENCE IS PRESENTED BELOW. *= (P<0.05)	53
TABLE 15. MEAN AMOUNT OF CONCENTRATE OFFERED TO HORSES IN RELATION TO CATEGORIZED STABLE NUMBER.	54
TABLE 16. THE EFFECT OF AMOUNT OF HAY OFFERED TO 140 HORSES ON MEAN FAECAL pH.	54
TABLE 17. TIME OF DAY HAY WAS OFFERED TO 140 THOROUGHBRED RACEHORSES.	55

List of Abbreviations

ADF – Acid-detergent fibre
ATP– Adenosine triphosphate
BW – Body weight in kg
Cal – calories
CP – Crude protein
DCP – Digestible crude protein
DE – Digestible energy
DM – Dry matter
FFA – Free fatty acids
GE – Gross energy
GDP– Gross Domestic Product
HCl – Hydrochloric acid
J – Joules
KJ – Kilojoule
Mcal – Megacalories
ME – Metabolisable energy
MJ – Megajoule
NZRB– New Zealand Racing Board
Net – Net energy
NZ – New Zealand
NSC – Non-structural carbohydrates
NDF – Neutral detergent fibre
NRC – National Research Council
R: C– Roughage to concentrate ratio
TAB– Totalisator agency board
TAGs– Triglycerides
VFA–Volatile fatty acids