EQUINECTAR®

DIGESTIVE SUPPORT FOR HORSES IN TRAINING

EQUINECTAR

- A **digestive syrup** and natural source of energy and B vitamins from Barley Malt
- Live Enzymes – provision of amylase, glucanase and fructanase
- Source of Natural Sugars – contains glucose, sucrose and maltose
- Source of Natural B Vitamins – contains all B vitamins, most notably high in folate and niacin
- Easy to feed and highly palatable syrup

EQUINECTAR & DIGESTION

- The digestive system of the racehorse is restricted by the limited capability of the small intestine.
- As the main site for carbohydrate digestion, and so provision of fuel for muscles and other key organs, the ability to maximise efficiency of the small intestine is a key area of interest for performance.
- Carbohydrate digestion in the small intestine is enzyme dependent.
- The number of enzymes present is individual and fixed, the horse does not have the ability to increase or decrease enzyme levels subject to the type of feed given.
- **EQUINECTAR is a source of natural and effective enzymes.**

EQUINECTAR & DIGESTION

- The primary source of fuel for racehorses comes in the form of starch.
- Traditionally oats were the dominant grain and source of starch, typically providing 38% starch.
- Modern feeds with blends of grains and other materials offer a wide range of starch profiles from as low as 8% to feeds in excess of 35% starch.
- Even with lower starch feeding, the volume of feed required each day can still results in feeding periods where intake provides more starch than the small intestine can effectively digest.
- **EQUINECTAR is beneficial to all horses in training.**

TYPICAL STARCH INTAKE OF HORSES IN TRAINING

- The intake of starch for a horse in training is highly variable.
- The upper safe limit for starch is set at 2g/kg of bodyweight per meal. The safe limit refers to risks associated with ulceration and acidosis. The target intake for reduction of risk is 1g/kg of bodyweight or lower.
- A higher intake of starch overwhelms the small intestine and causes starch spill-over into the large intestine.
- Fermentation of starch in the large intestine is not as effective an energy pathway as when converted to glucose in the small intestine.
- Fermentation of starch in the large intestine lowers pH causing acidosis and associated disorders.

TYPICAL STARCH INTAKE OF HORSES IN TRAINING

20% Starch Racing Feed

	Intake kg	Intake lbs	Starch intake per meal (grams)
AM feed	1.7	3.7	340
Lunch feed	2.55	5.6	510
PM feed	3.4	7.5	680
Total intake/day	7.7	16.9	1530.0

- Examples of a 500kg horse in training based on 3 different feeds of differing starch levels
- For a 500kg horse the upper safe limit is 1000g of starch per meal with an ideal upper intake of 500g of starch per meal
- The high requirement for energy of a horse in training and volume of feed required to meet that need easily results in a starch intake that is above the ideal intake

27% Starch Racing Feed

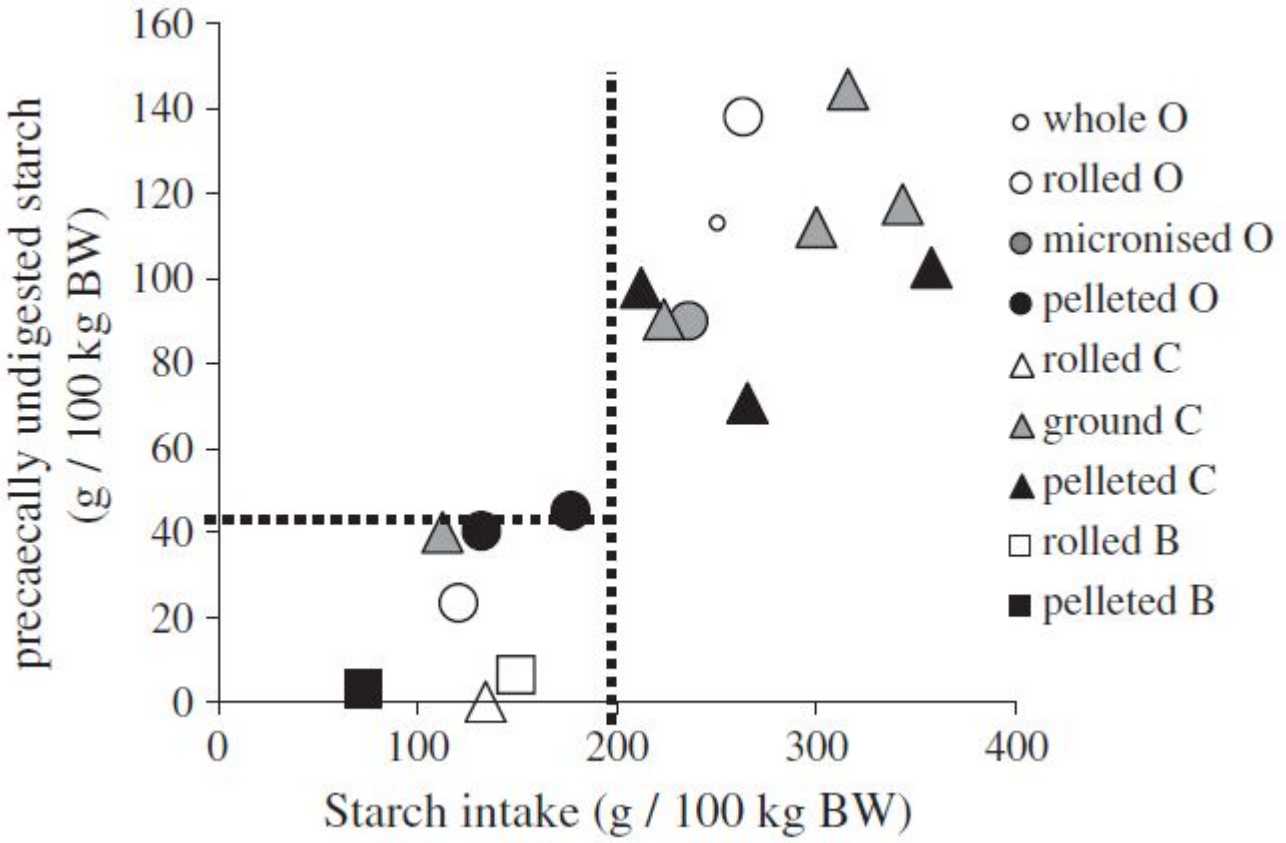
	Intake kg	Intake lbs	Starch intake per meal (grams)
AM feed	1.7	3.7	459
Lunch feed	2.55	5.6	688
PM feed	3.4	7.5	918
Total intake/day	7.7	16.9	2065.5

34% Starch Racing Feed

	Intake kg	Intake lbs	Starch intake per meal (grams)
AM feed	1.7	3.7	578
Lunch feed	2.55	5.6	867
PM feed	3.4	7.5	1156
Total intake/day	7.7	16.9	2601.0

FEED PROCESSING AND STARCH INTAKE

- Feed processing and cooking techniques improve starch uptake through alteration of the starch structure
- Structural changes make it easier for the enzymes present to effectively digest more complex starches
- However, even when processed and digestibility is improved, if fed in excess the system is overloaded and undigested starch continues to the large intestine
- The rapid rate of passage through the small intestine combined with a low level of enzyme activity is simply too great a challenge when large quantities are presented in one meal



0 = Oats, B = Barley, C = Corn (Maize)

USE OF ENZYMES IN EQUINE DIETS

- Rate of passage of feeds can be slowed through feeding post fibre intake or with the inclusion of chaff in the feed
- Adding enzymes to the diet resolves the issue of natural low activity and has a significant and proven effect on starch digestion in equines for a variety of feed ingredients

Addition of amylase, glucanase and xylanase to milled wheat fed to Equines

Measurement	Milled Wheat	Milled Wheat + Enzymes
Starch intake (grams per day)	2533	2427
% digestibility before reaching the ceacum	95.3	99.1
Amount of starch reaching the ceacum	116	22

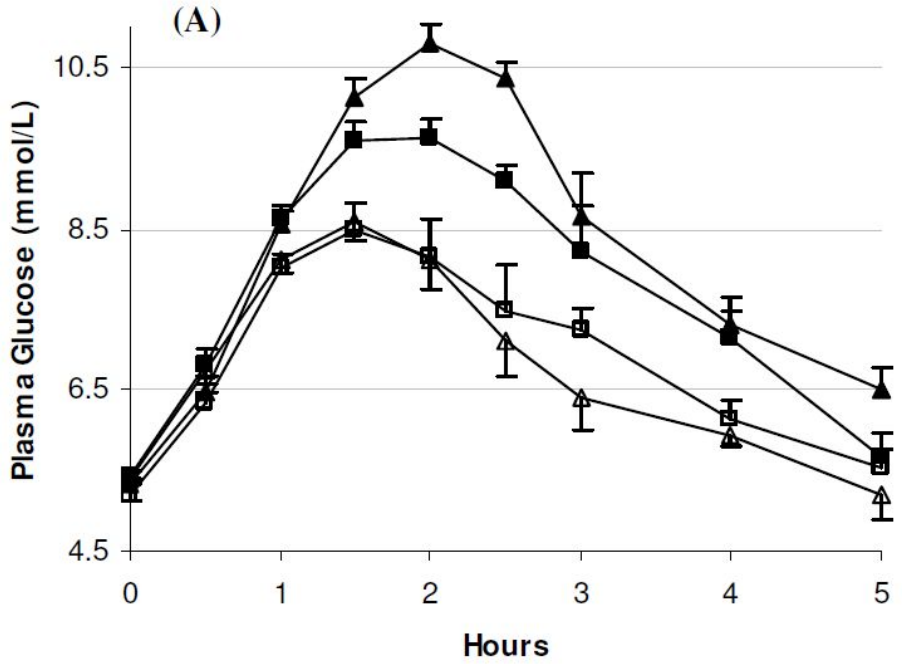
Addition of amylase to maize fed to Equines

Feed	% starch digestion in the small intestine
Ground corn (maize)	45.6
Ground corn (maize) + amylase	57.7

USE OF ENZYMES IN EQUINE DIETS

- Improving starch digestion is also represented by increased glucose response
- Glucose is the primary fuel for muscles and improved conversion of carbohydrates to glucose is an advantage particularly for horses in training

Study of glucose response to steam rolled triticale fed to Equines with different enzymes



Key

- Alpha-amylase
- Amyloglucosidase (AMG)
- Amylase + AMG
- Control – no supplementation

USE OF ENZYMES IN EQUINE DIETS

- The horse produces a low level of amylase in comparison to other species
- Having evolved to live on a fibrous based diet the digestive system is not designed for efficient digestion of starchy substances which form the core of racing diets
- The addition of enzymes to the diet provides the missing link in adapting to a higher starch and lower fibre diet

Species	Amylase Activity (U/g)
Horse	7
Pig	196
Rabbit	26
Dog	174

BENEFITS TO HINDGUT HEALTH

- Increasing starch digestion in the small intestine directly benefits the health of the large intestines
- Undigested starch reaching the large intestine is fermented and can decrease the pH level causing hindgut lactic acidosis
- The effects of acidosis include reduced feed conversion, behavioural changes and diseases such as metabolic acidosis and laminitis

THE HINDGUT PROFILE

- The hindgut digestive system is entirely different to that of the large intestine. Digestion is via fermentation rather than enzymes.
- There are 3 major categories of bacteria in the hindgut.
- **Cellulolytic** bacteria – this group ferments fibrous materials
- **Amylolytic** bacteria – this group ferment starch should it reach the hindgut
- **Lactate Utilising** bacteria – this group covert lactate, when present, to propionate

THE HINDGUT PROFILE

- The bacterial groups have different population doubling rates, meaning they grow and can proliferate the gut at different rates
- The amylolytic bacteria are capable of growing at a faster rate and so when starch is present their population can quickly change
- Amylolytic bacteria produce **lactic acid** which alters the pH leading to hindgut lactic acidosis
- The products of digestive fermentation are volatile fatty acids (VFA's) which via different pathways contribute towards the horses' daily energy requirement
- Each bacterial group has a different characteristic VFA profile

THE HINDGUT PROFILE

- The three VFA's produced are acetate, propionate and butyrate
- When excess starch reaches the hindgut amylolytic bacteria can proliferate
- The production level of the various VFA's alters

	Cellulolytic Bacteria	Amylolytic Bacteria	Lactate Utilising Bacteria
Metabolic Rate	Slow	Fast	Slow
Population Doubling Time	18 hours	0.25 – 4 hours	16 hours
Optimum pH	6.2 – 6.8	5.5 – 6.6	6.2 – 6.8
End Products	VFA's	VFA's + Lactic Acid	VFA's
Characteristic VFA profile	55% acetate, 25% propionate,15% butyrate	70% acetate, 15% propionate, 10% butyrate	-

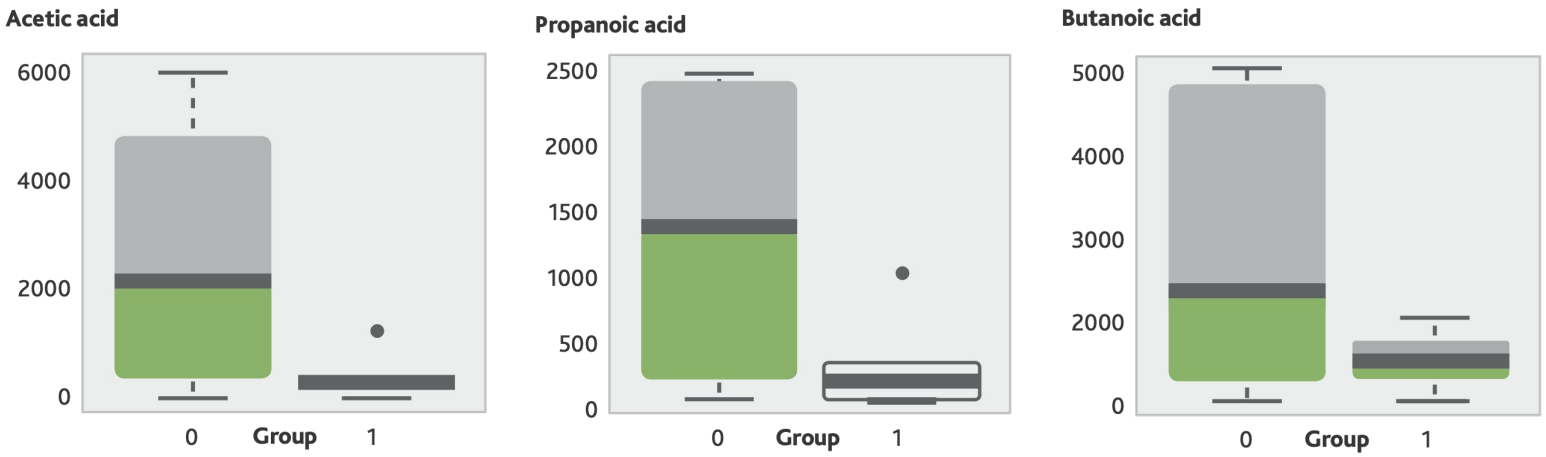
- As amylolytic bacteria increase presence of lactic acid the pH drops
- When the pH lowers significantly growth of lactate utilising bacteria decreases and so the hindgut's normal mechanism for processing lactic acid is reduced
- The pH level will then continue to drop as lactic acid accumulates

EFFECT ON VFA PRODUCTION IN THE PRESENCE OF STARCH

- When excess starch reaches the hindgut the ratio of VFA's will alter.
- The presence of lactic acid produced by amylolytic bacteria increases propionate production by the lactate utilising bacteria.
- The relative proportion of acetate lowers.
- This effect is seen in horses, sheep and cattle where the proportion of grain increases and forage intake decreases.
- Production level of all VFA's is higher when starch is present in the hindgut as a fermentable substrate.
- Measurements of VFA's in faeces is a useful tool for monitoring changes in the hindgut bacterial population.

EQUINECTAR AND VFA PRODUCTION

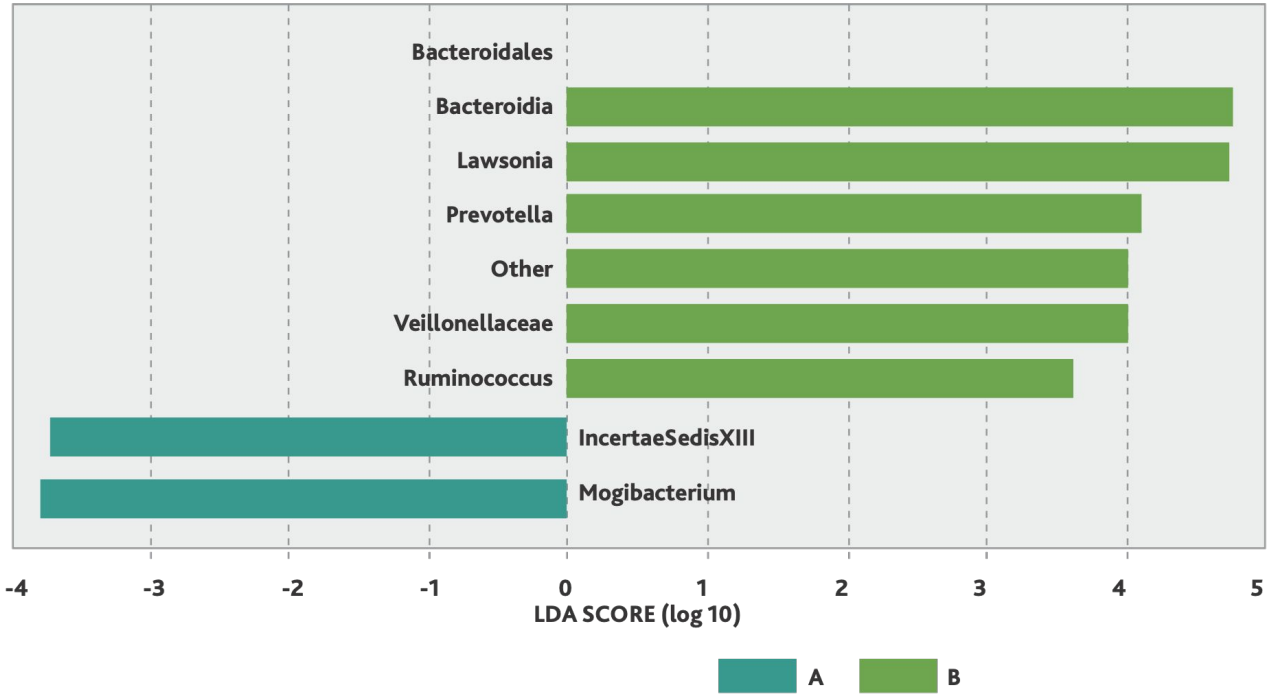
- Including EQUINECTAR in the diets of **racing horses** fed a typical grain based feed during active training has proven effective in altering the VFA profile
- The reduced amounts of all VFA's seen, with statistical significance in the case of both acetic and propionic, indicates that less starch reached the hindgut and was correctly digested in the small intestine



CJ Proudman *et al*: Characterisation of the faecal metabolome and microbiome of thoroughbred racehorses, Equine Veterinary Journal, June 2014

EQUINECTAR AND HINDGUT BACTERIA

- As part of the study of the faecal metabalome and microbiome the EQUINECTAR team examined the effect of EQUINECTAR on the microbial profile. This was the first study of its kind specifically looking at the thoroughbred metabolome in training.
- The microbiome of the equine is an area of increasing interest as studies in other species, including humans, are providing increasing evidence on the interactive effect of the microbiome on health and performance
- The presence of EQUINECTAR in the diet appears to cause a metabolic adaptation of existing bacterial communities
- The variation in profile between horses can be significant, as with humans and further research is needed to identify causes of variation



STRATEGY FOR HEALTH AND PERFORMANCE

- Starch is a much needed carbohydrate in the racehorses' diet
- To ensure maximum starch conversion in the small intestine and minimise starch fermentation in the large intestine the following practices are recommended,
- Keep starch intake per meal below 2g/kg of bodyweight per meal with an ideal intake of 1g/kg of bodyweight
- Include chaff in each meal to slow rate of passage through the small intestine
- Use EQUINECTAR to supply effective enzymes to improve starch conversion in the small intestine

EQUINECTAR CASE STUDY

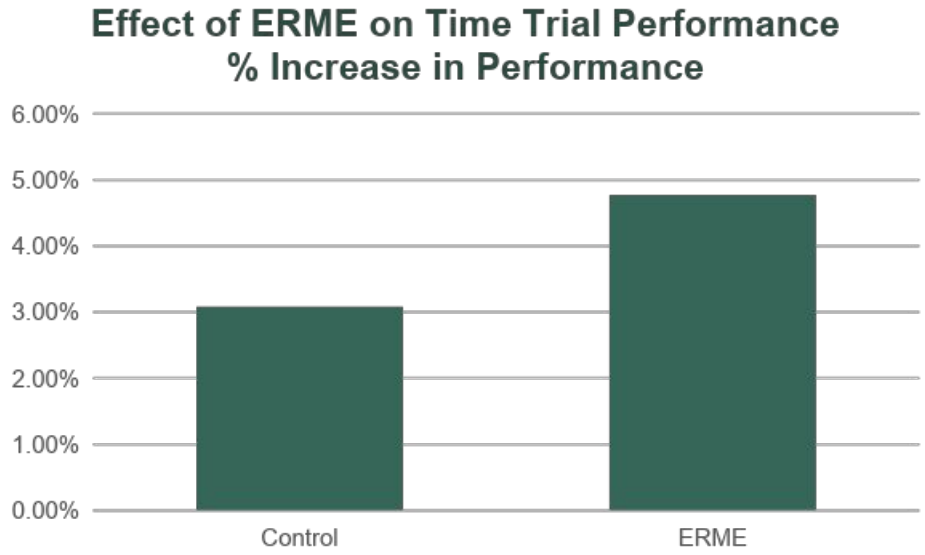
- EQUINECTAR is approved under the BETA NOPS scheme and has been fed successfully to horses in training in Newmarket as part of the study in to its effect on VFA profile and the faecal metabolome and microbiome.
- Supplementation of EQUINECTAR at the yard continued from 2013 to 2015. During this period performance was monitored and compared to results of 2010 to 2012.
- During the period of supplementation, despite a lower number of races run, the horses performed better as measured by yard wins, and those placed in the first three places.
- These results combined with the significant changes seen in VFA profile and the knowledge of enzyme effect on starch digestion strongly indicate that EQUINECTAR positively influenced performance of the yard during this period.

Luca Cumani - Newmarket

Cohort	Runs	Wins	First 3 Places
2010 to 2012	941	157	399
2013 to 2015	901	174	456

EQUINECTAR – HUMAN CASE STUDY

- EQUINECTAR in the human form of ERME is currently being trialled with high performance cyclists following an initial study in to its effects on performance over 10 mile time trials
- The increase in performance seen over the training period was greater for athletes supplemented with ERME



EQUINECTAR PROFILE

- Dose rate of **300mls per day** to be split across a minimum of 2 feeds
- Easy pouring sweet tasting syrup
- Appetising even with fussy feeders
- Natural source of B Vitamins
- Provides energy through a combination of complex carbohydrate and sugars
- Delivers live enzymes supporting starch digestion and digestive health

For more information

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READING LIST

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