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The equine gut during exercise

by Dr Rensia de Wet

To fully understand how the digestive system can influence exercise performance, one must firstly have an understanding of the size and weight of the equine digestive system. Secondly, one must understand the impact that feeding has on the digestive system, and what impact exercise has on gut function and nutrient digestibility.

The equine digestive system

Horses have a specialised digestive system that allows them to thrive on high fibre diets. The hind-gut comprises the cecum and colon, and accounts for approximately 64% of the empty weight of the horse's gastro-intestinal tract (GIT). The hind-gut can hold between 108-162 litres of fluid, and house billions of bacteria and protozoa that ferment plant

fibre. The small stomach makes up less than 7% of the empty weight of the GIT, and emphasises the need for continual intake of feedstuffs. The small intestine is the longest structure in the horse's GIT, and makes up 27,5% of the GIT weight. A fed horse has a fluid capacity within the digestive system of nearly 225 litres.

Impact of feeding

Cardiovascular changes in response to feeding include increased heart rate in response to an upcoming feeding and continue during ingestion of food. The cardiovascular response generally decreases after the ingestion of food. Along with cardiovascular changes in response to feeding, changes also occur in the distribution of blood flow within the body.

The distribution of blood flow is controlled by two mechanisms – centrally through the-

nervous system (the sympathetic nerve fibres), and locally by the environmental conditions in the immediate vicinity of the blood vessels. Increased sympathetic nerve activity (excitement/panic) causes vasoconstriction (contraction) of the arterioles of the GIT, while causing vasodilation (relaxation) of arterioles in skeletal muscle. This response shunts blood away from the digestive system to the working muscles.

This intervention results in an oxygen supply that is inadequate for the requirements of the GIT tissues, and leads to the release of vasodilation (relaxation) metabolites from the GIT tissue. These metabolites act locally to dilate the arterioles, which increases the blood flow and the oxygen supply.

Blood is distributed to the various body tissues by a combination of central and local control. One study reported that in fasted horses, 20,4% of blood flow was directed to the GIT tissues, and 79,6% of blood flow was found in other tissues including skeletal muscle. When horses are fed, a redistribution of blood flow takes place such that 27,4% is distributed to the GIT tissues, and 72,6% to the non-digestive system. During exercise, blood flow is thus shunted away from the GIT, leading to a decrease in nutrient digestibility.

Feeding also increases the amount of material in the GIT, which has an impact on the body weight of the animal. For every one kilogram of dry hay intake, approximately 10 kg of water is stored (this can be utilised to the benefit of the endurance horse). Eating hay stimulates saliva production and increases the secretion of digestive juices in the GIT. Much of the fluid in these secretions comes from blood plasma, resulting in a drop in plasma volume, which then stimulates the thirst response.

Fibre also binds water in the GIT, which facilitates the holding of water in the hindgut as the amount of fibre in the diet increases (beneficial to the endurance horse). The amount of water ingested with mixed diets (forage and concentrate) is roughly half that of an all-forage diet (keep this in mind when

feeding your horse at checkpoints).

The higher the fibre content of the diet, the greater the fluid content of the GIT, and the more weight carried by the horse. This is manipulated in the horse performing high intensity, short duration exercise (racing) where hay feeding is eliminated up to 12 hours prior to racing. Endurance horses on the contrary have increased requirements for water and electrolytes due to the duration of exercise, and benefit from the water and electrolyte-holding characteristics of high fibre diets. Grain intake should be minimised during the endurance ride to avoid fluctuations in blood sugar (glucose and insulin peaks and troughs).

The preceding information has detailed the size and weight of the equine GIT, the changes in blood flow associated with feeding, differences in gut fill and water intake associated with different diets and changes in blood flow and nutrient digestibility with exercise. From this information, we must determine the type of diet and the pre-exercise feeding schedule that will allow our endurance horses to perform at optimal levels.

Some feeding guidelines

Total diet: Feed 70% of good quality roughage, and 30% of a 12% balanced commercial concentrate ration. The diet should be supplemented with fat/oil and 30-60 g coarse salt daily.

Feeding recommendations at the endurance ride

- Hay feeding – free access to high quality roughage (1:2 teff/oulandsgras and ½ lucerne)
- Grain feeding – eliminate or minimise during the ride
- Water – no restrictions
- Electrolytes – give pre-ride, during and post-ride. Make sure it is a product suitable for endurance horses, as most are formulated for race horses. **DR**

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