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FEEDING THE THREE-DAY EVENT AND DRESSAGE HORSE

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Eventing and dressage in Great Britain

Great Britain is one of the most successful nations in the world when it comes to horse trials (eventing), and our riders have been consistently successful in World, European and Olympic Games. No other country boasts the number and variety of events, so much so that many of the world's leading riders choose to base themselves in England to take advantage of the opportunities.

Top class event horses come in all shapes and sizes and because Horse Trials demand such a wide range of equine abilities it is almost impossible to design a blueprint.

The size of the industry

In Great Britain, there are an estimated 500,000 horses - 17,000 of these are in training for racing, 7127 are registered event horses and 4171 are registered dressage horses. The actual numbers of horses competing at advanced dressage level and advanced eventing levels are very small indeed, 157 and 718 respectively. Having said that, both sports attract a large spectator and support following and are an inspiration to the far greater numbers competing at the lower levels.

The largest number of events are one-day horse trials. Two-day horse trials add steeplechase and roads and tracks to the cross-country giving competitors a chance to practice the technical and practical skills they will need for a 3-day event.

The ultimate test is the 3-day event. Each test takes place on a separate day starting with dressage. Day 2 is the roads and tracks, separated by the steeplechase - followed by cross-country. The final day is show-jumping day.

Badminton Horse Trials in Avon attracts a crowd of over 400,000 people on Saturday, the cross-country day. It is actually as famous for its shopping aisles as the horses!!

The event horse needs to have soundness and toughness to withstand the rigors of cross-country - the requirements for speed and stamina mean that Thoroughbred blood is preferable. They need good paces for dressage and an athletic jump. The event horse therefore represents quite a challenge to the nutritionist.

The NRC Requirements (1989) make no allowance for breed, temperament or management of horses; the only two criteria that are taken into account are the weight of the horse and its workload.

If one assumes that a pure dressage horse and an event horse are the same weights and are doing the same work, then there is no scientific justification to assume different dietary requirements - as our current knowledge stands. However, there is a definite perception in most riders' minds that the requirements are different.

The NRC does acknowledge that the requirements are minimum amounts needed to sustain normal health and performance and that the following should be borne in mind:

- digestive and metabolic differences among horses that result in some horses being "hard keepers" and others "easy keepers," and appropriate adjustments in feed intake to compensate for this variation;
- variation in production and performance capabilities of the animal and expectations of the owner;
- health status of the animal;
- variations in the nutrient availability in feed ingredients;
- interrelationships among nutrients;
- previous nutritional status of the horse;
- climatic and environmental conditions;

This is why it is so valuable for a nutritionist to be a practical horseman.

Cuddeford (1995) summarizes some of the metabolic diferences between horses and ponies; these differences can be applied to different "types" of horses.

Obviously, the types of feed available will influence the feeding strategies applied. There are several different feeds available that are uncommon in other countries.

Micronized feeds

Undigested starch in the large intestine can cause multiple metabolic problems, from poor performance through to laminitis and colic. The main energy sources fed to performance horses are the cereals which contain high levels of starch.

The activity of the horse's amylase is only 8-9% that of a pig's, so that any manufacturing process which aids the breakdown of starch is of benefit. Micronizing is the cooking of cereals under an infra-red cooker. When infra-red rays penetrate grain or seeds, they cause the molecules of the material to vibrate at a frequency of

80-170 million megacycles/sec. This causes rapid internal heating and a rise in water vapour pressure. The material becomes soft and plastic, causing it to swell and fracture. Immediate flaking gelatanises the starches.

Table 1. AMOUNT OF STARCH DIGESTED BY ENZYMES IN ROLLED CEREAL COMPARED TO MICRONIZED CEREAL.

Cereal	*Barley*	*Wheat*	*Maize*
% starch digested in rolled cereal	32	28	43
% starch that could end up in large intestine	68	72	57
% starch digestion in micronized cereal	98	90	74
% in large intestine	2	10	26

(University of Newcastle; Shetty, Lineback and Seib 1974)

Obviously, the more starch that is 'pre-digested' the less risk there is in undigested material reaching the large intestine.

Extrusion, which is more common in the USA, has a similar affect but the UK market is resistant to the appearance of extruded products. The majority of compound mixes (sweet feed) or muesli contain flakes, but only a few companies use totally micronized flakes. There is a perceived practical increase in digestibility of mixes over straights, leading to reduced intakes and more cost-effective feeding.

A three year study using *in vitro* techniques and fistulated ponies is being sponsored by Dodson and Horrell (the largest producers of micronised feeds) into the "Degradability of starch and non-starch polysaccharides in processed and unprocessed feeds." Preliminary results should be available for next year's short course.

Haylages

Great Britain's hay production is declining and the production of haylages is on the increase. The hay available is generally poorly dried due to our climatic conditions and therefore dusty. This is obviously a potentially damaging situation for the performance horse, who needs to be able to utilize lung capacity to maximum potential.

Although the case histories described in this paper are all feeding hay, a large proportion of event and dressage horses are fed haylage as an alternative to hay.

Haylage is made from mature grass which is cut and wilted for 24 hours, baled and compressed. This results in mild lactic acid, anaerobic fermentation- in effect pickling the grass.

Typical analysis of Haylage

DM	55%	DE 9-11 MJ/KG
Protein	9-12%	Ca 2.5-4.0 g/kg
MAD Fibre	32-36%	P 1.7-2.5 g/kg

There are typical problems associated with feeding haylages mainly due to their high water content and cost. People will only feed the same weight of haylages they do hay - in effect halving the fibre intake. In addition, horses appeared to be receiving extra energy from haylage compared to hay. This resulted in a reduced usage of compounds and therefore a reduction in vitamin, mineral and dry matter intakes. A recent 4X4 Latin Square digestibility trial at the Royal (Dick) Vet School, Edinburgh, Scotland gave the following results.

Table 2. DIGESTIBILITY COEFFICIENTS IN PONIES

	haylage	*timothy hay*	*% increase*
Organic matter	0.52	0.45	15
ADF	0.42	0.38	10.5
Crude protein	0.62	0.36	72
Energy DE	0.55	0.43	28

Because of the reduction in dry matter intakes in horses being fed haylages, many horses developed behavioral abnormalities such as wood chewing, dung eating and similar. Consequently, there is a trend in Great Britain to soak hay. Until recently this was avoided in large yards as it was recommended to soak for 24 hours. However, recent work (Warr and Petch 1992) indicates that a half hour soak is sufficient to reduce the respiratory challenge and to minimize nutrient loss.

Chaffs

In order to further extend fibre intake, chaff is commonly added to concentrate feeds. Generally speaking, ‘a scoop’ per feed is added (1 lb, 0.5 kg) to bulk out the feed. There are 4 main types of chaff available in Great Britain: molassed straw chaffs, containing between 40%-60% molasses; limestone and straw; high temperature dried alfalfa with 10%-20% molasses; a straw and alfalfa 50:50 mix and unmolassed pure hay and straw chaffs. The increased rate of chewing for fibre (Meyer, Ahleswede and Reinhardt 1975) in comparison to cereals is the main reason these chaffs are added to the feeds.

What management and nutrition tricks maximize performance? What is performance?

Performance is defined in the dictionary as 'realism of potential.' In simple terms performance can be defined as getting the best from one's horse at whatever level it is being used. Management tricks are as important as nutrition and certainly daily turnout is beneficial to all performance horses. The racing industry has much to learn from other performance industries. 99% of top event and dressage horses are turned out daily for two hours even when they are at peak fitness; their welfare is improved by this. Limits on performance will include genetics, ability of horse and rider, training, commitment and expectation.

Obviously when one looks at diet, it is necessary to consider long term nutritive factors such as energy sources, roughage types and intakes as well as short term nutritive factors such as glycogen and glucose. Although according to the NRC (1989), the energy requirements for a horse doing a similar workload and similar bodyweight are identical, the diet can be manipulated to utilize different energy sources depending on the type of work involved. The following tables indicate how work type can be linked to energy type.

Table 3. TO ILLUSTRATE ENERGY SOURCES AVAILABLE TO A HORSE.

		Energy Substrate Obtained From		
Energy Source	*Dietary Source*	*Small Intestine*	*Large Intestine*	*Cells*
Starch	cereals	glucose	VFA's lactic acid	glycogen fatty acids
Fibre	roughage	-	VFA's	glycogen fatty acids
Fatty acids	oil/fat	fatty acids	VFA's	fatty acids
Proteins	roughage cereals	amino acids	VFA's microbial protein	fatty acids glucose (glycogen)
Sugars	molasses sugar beet	glucose	VFA's lactic acid	glycogen

Many top eventers and dressage riders come from a long history of association with horses, and many of their feeding practices are based on years of practical experience. As with many large yards, cost is very important and nutrition is often compromised.

TABLE 4. HOW THE HORSE USES ENERGY SOURCES.

Energy Source	*Relative Energy Content*	*Relative Speed of Metabolism*	*Relative Efficiency of Use of Energy*
Starch	high	fast	high
Fibre	low	slow	high
Fatty acids	very high	slow	very high
Proteins	high	moderate	moderate
Sugars	high	very fast	moderate

Table 5. WHY NUTRITION IS LINKED TO EXERCISE PHYSIOLOGY. EXERCISE EFFECTS MUSCLE TYPE WHICH INFLUENCES DIETARY ENERGY SOURCE.

Exercise Level	*Muscle Fibre Types (dominant)*	*Dietary Energy Sources*
Low walking	I	roughage
Endurance	IIA	roughage, cereals
Trotters driving	IIA, IIB	roughage, cereals, oil
3-day eventing	IIA, IIB	roughage, cereals, oil
Show jumping	IIA, IIB	roughage, cereals, oil
Racing	IIB	cereals, roughage

The following graphs summarize typical feeding practices from some of the top event and dressage yards in Great Britain.

There is a distinct difference between the energy and appetite intakes of dressage and event horses (Figure 1). Typically the horses surveyed were Thoroughbred eventers and Warmblood dressage horses; this suggests the NRC perhaps overestimates energy requirements for the Thoroughbred type horse (being fed about 20% less energy than recommended) and possibly underestimates that of the heavier horse type. Interestingly the rider's perception is that the stuffy warmblood needs more energy to do its work; however this could be contra-indicative and simply result in increased weight gain. The difference in energy intakes could also be a reflection of the different body conditions.

There is no clear pattern to the feeding of protein and obviously lysine intake reflects the protein intakes (Figure 2). It should be noted that if these horses were being fed straights as opposed to compounds, their lysine intake would most definitely be compromised. It should be remembered that high protein intakes can be detrimental to performance, due to the energy required to remove the excess nitrogen and of course the build up of ammonia in the stable.

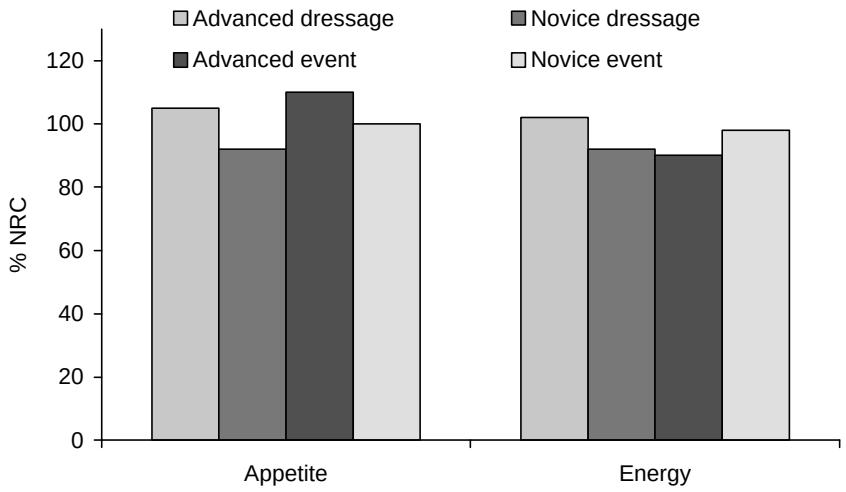

Figure 1. Nutrient intakes as a percentage of NRC (1989)

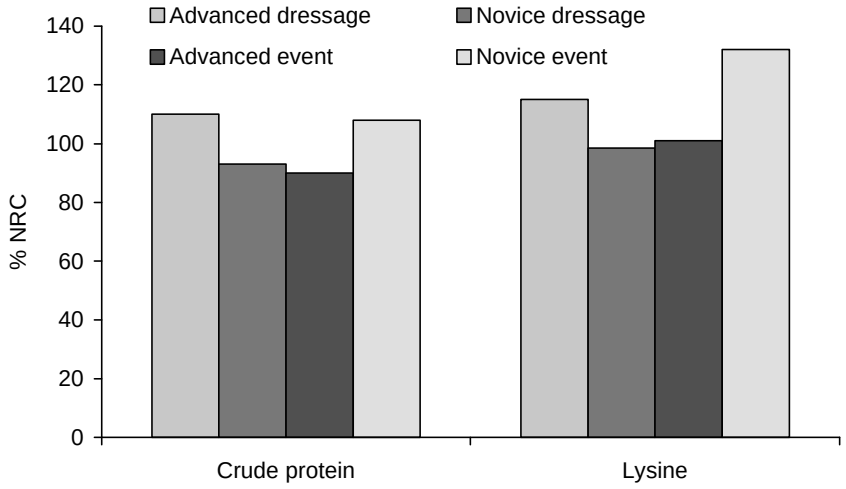

Figure 2. Nutrient intakes as a percentage of NRC (1989)

When calcium to phosphorus ratios are 1:1 or lower, the diets should be altered. Because all these horses are being fed compound feeds (Dodson and Horrell) the Ca:P ratio is not reversed, which is often seen on unsupplemented straight diets. Although in all cases phosphorus is being fed excess to requirement, it should be remembered that some of this will be in the form of phytates, whose availability is still unresearched (Figure 3).

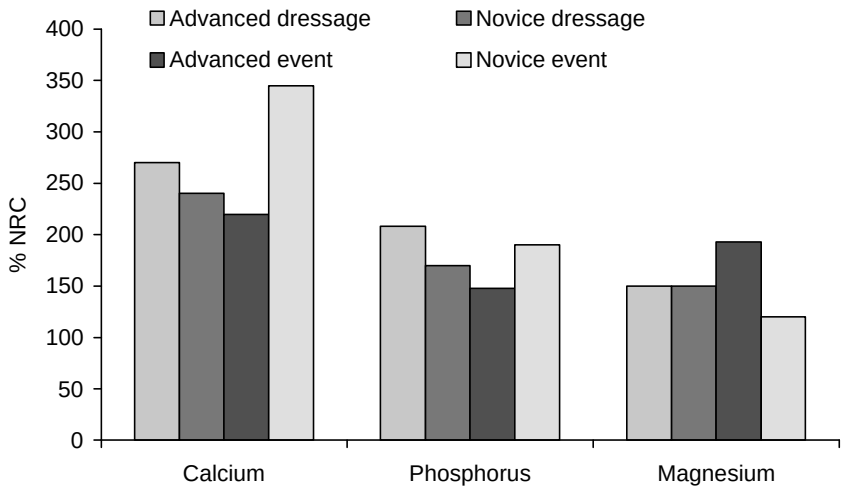

Figure 3. Mineral intakes as a percentage of NRC (1989)

The high potassium intakes are as a direct effect of reasonable forage intakes. This excess could be further exacerbated by high molassed feeds (molasses being high in K 4.2%). This could be considered contra-indicative due to potassium's diuretic effect, especially for horses that are working hard in hot climates...sweat. Sodium intake is typically low, hardly surprising when most compound feeds contain on average 1% salt. Most working horses will require electrolyte supplementation (Figure 4).

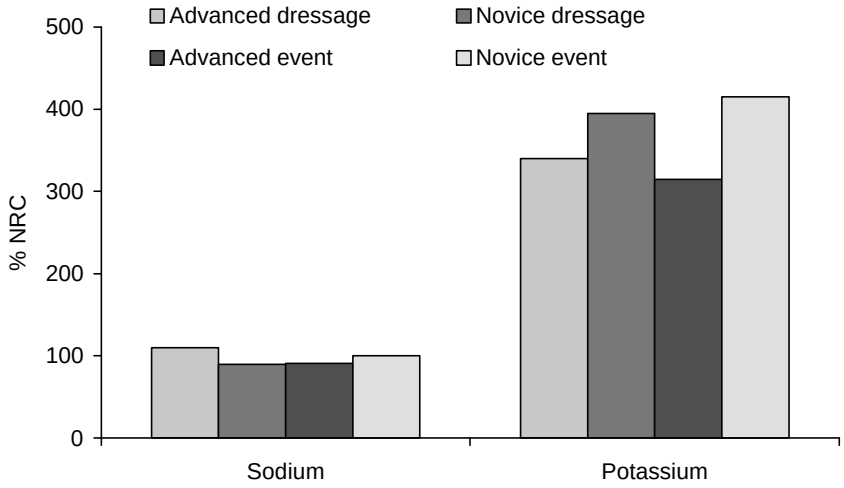

Figure 4. Mineral intakes as a percentage of NRC (1989)

Nearly all groups of horses were on additional vitamin and mineral supplementation which is surprising as nearly all minerals are already fed excess to requirement. These were not used in the calculations. Will there be any competing for copper and zinc uptake? This is one argument for the inclusion of bioplexes in feeds; however a lot more work needs doing on the role of bioplexes in equine nutrition before we can substantiate their benefits. Interestingly, in Great Britain there is still a belief in the veterinary profession and some nutritionists that iron supplementation is important. Iodine is universally over-supplemented, it is not at the 5 mg/kg toxic levels, but it does throw into question the NRC recommendations (Figures 5 and 6).

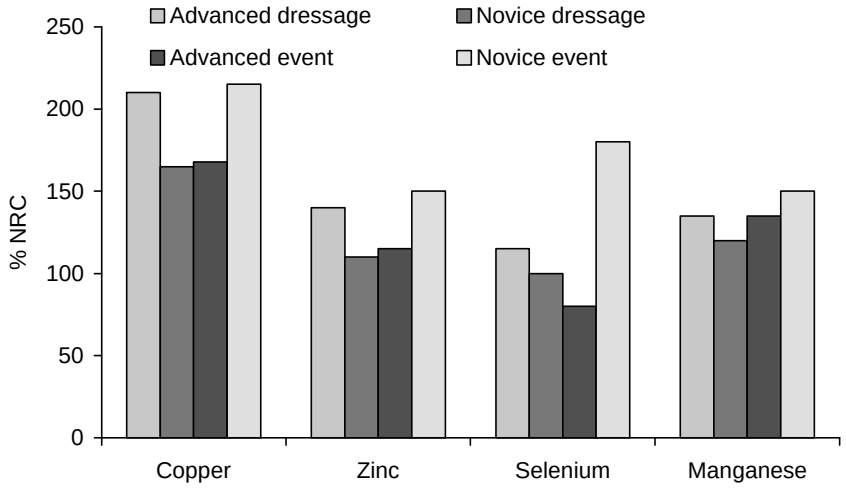

Figure 5. Trace mineral intakes as a percentage of NRC (1989)

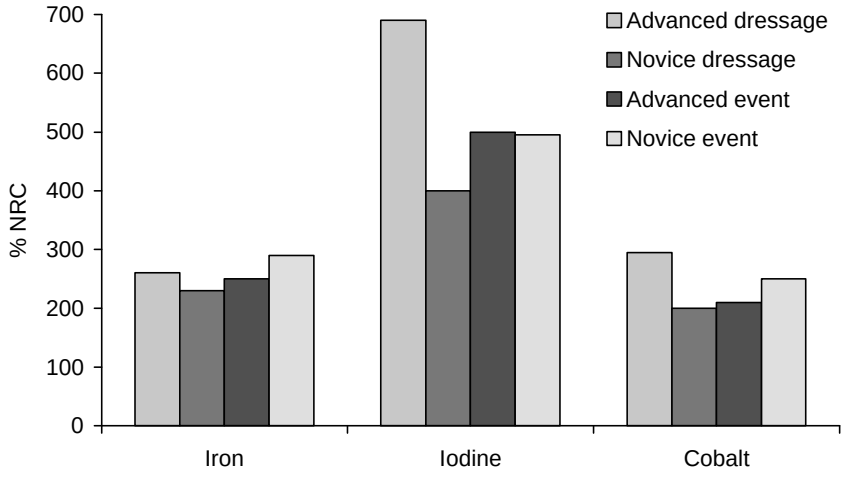

Figure 6. Trace mineral intakes as a percentage of NRC (1989)

Why do feed compounders put such high levels of vitamin A into their rations? Commercial pressure and the numbers game is perhaps the only reason. Are the horses absorbing the vitamin efficiently or perhaps there is a poor uptake? These percentages represent an intake of up to 172,000 IU of vitamin A a day for an individual horse who is eating 9.5 kg of food a day ... i.e. 18,105 IU/kg, which is over the maximum tolerance level (Figure 7).

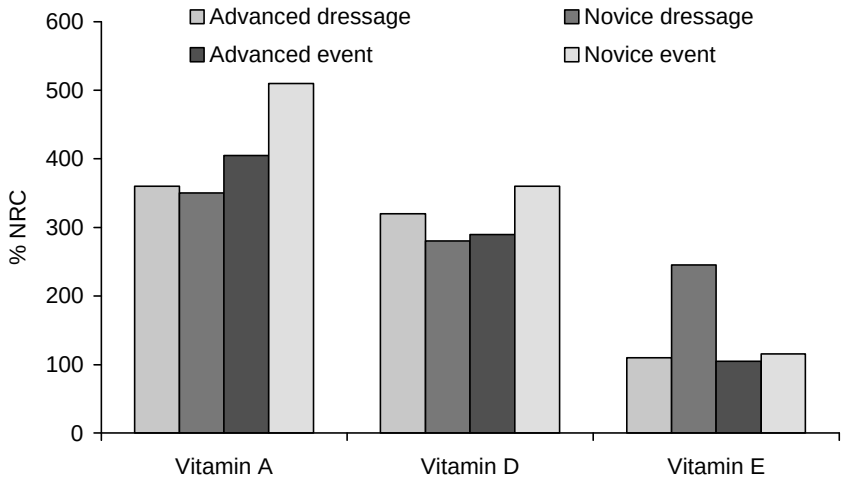

Figure 7. Vitamin intakes as a percentage of NRC (1989)

Although vitamin E intakes are higher than NRC, many nutritionists recommend higher levels (J. Pagan, personal communication). Although it is suggested that horses turned out for part of the day can manufacture vitamin D, the natural production of D in England is not sufficient (Dr. Frape, personal communication).

There is obviously a large discrepancy between nutrient intakes in the 'real' world and those obtained under controlled experimental conditions. All these case histories discussed are competing at world level without any apparent compromises. Some of the horses are also used for breeding and the different nutrient intakes do not hinder the continued success of their offspring. There may be several reasons for the apparent discrepancies: a) incorrect weight of horses, many yards use weight tapes, the accuracy of weigh formulas available have been called into question; b)daily intake varying according to personnel on the yard; c) a need to see well rounded horses resulting in a general overfeeding d) a lack of research on the apparent different needs for different breeds of horses. Finally and probably the most influential, a misinterpretation of work load. There is no simple physiological way of measuring work. People's perception of hard work is very contradicting. A horse working at Grand Prix Level will be working very hard for the duration of his test and during the last half hour of warm up. How does this compare with a fast sprint around a

steeplechase or a slog around a cross country course? Would a TB breed exert less energy doing the same task as a warmblood? How high have the heart beats been raised and perhaps more importantly, for what duration? The old wives tales on feeding and some of the suspicion of scientists by practical, professional horsemen and women would be dissipated if exercise physiologists and nutritionists (both equine and human) could work more closely together to answer some of the questions. The more you delve into the nutrition of equines, the more questions evolve. That is why the whole field of equine nutrition is so exciting and why we are all here today!!

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