

Nutraceuticals or Feed for the Competition horse?

Currently there is a bewildering array of nutraceuticals for almost every aspect of horse performance and maintenance from boosting power, through repairing joints to combatting ulcers.

However when you look at these products a bit more closely it's no great surprise to see many are extracts or preparations of natural ingredients. For example glucosamine is derived from the biochemistry of all animals (Glucose-6-phosphate + glutamine), chondroitin is derived partly from this metabolism and partly from glucuronic acid whilst MSM naturally occurs in some primitive plants.

The immediate question that occurs is: "Is it necessary to add these supplements as the body makes them itself, or should we try to improve nutrition so the base materials are present for optimum metabolism?" After all with many products there are debates whether such molecules can survive enzymic digestion and absorption and can actually be transported intact to the relevant active site (in the case of glucosamine, chondroitin and MSM this is *inside* the cartilage capsules around the joints)

Another example is the rising popularity of nucleotides. Nucleotides are precursors of DNA and RNA and consist of a sugar base (ribose or deoxyribose), a purine or pyrimidine base and a phosphate group. The function as regulators of cellular messaging and enzyme reactions and also as energy sources (ATP & GTP). One of the first biochemical "rules" a student learns is that the metabolism of 1 unit of glucose releases 38 units of ATP, and ATP is the energy source in muscle contraction. It is, therefore, easy to see the attraction of using a nucleotide; it's in the form needed for the function we want to perform – muscular work.

What about stomach ulcers? There are products based on a pectin/lecithin complex that, at high acidity levels, become mucilageous and helps coat the stomach wall and reduces incidence of gastric ulcers.

And rehydration? There are many electrolyte preparations that restore those lost during heavy exercise that are intended to improve recovery time.

So should we pay attention to these products? Joint cartilage is worn and damaged during exercise, muscles do need ATP, we have a moral duty to ensure animals in our care do not suffer from preventable conditions and we should help a stressed and dehydrated animal to recover. And the science behind these products is logical and persuasive.

The four examples are all relevant to the competition horse. It is believed that 90% of all racehorses suffer from gastric ulcers, we look to increasing performance all the time – and that includes improving joint function – and rapid recovery after a race is both beneficial to the horse and groomers. So let's look a little closer.

Gastric Ulcers.

The horse's stomach constantly secretes hydrochloric acid. For a trickle eater this is essential as the acid helps prepare food for enzymatic digestion – and microbial fermentation – in the intestines. To protect the stomach lining there are also specialised secretory cells (goblet cells) that produce a

mucin that coats the lining. However, if a horse is fed individual meals or is stressed – and stabling, transport, training and unfamiliar surroundings can all be stress factors) there is disruption in normal gastric functioning. Excess acid is not bound within the food and mucin secretion can stop. Stomach linings can be exposed and the acid can act directly on it. Also the rising acidity of the contents can encourage specialist bacteria that will digest the stomach wall and ulceration occurs. Clinical trials have shown that pectin, at high levels of acidity, forms a gel (in nutritional terms pectins are defined as mucilages) that strengthens and thickens the stomach mucin. The presence of the lecithin – a surfactant – facilitates this process. Plant oils contain appreciable amounts of lecithin and **both Speedi-Beet and Fibre-Beet are particularly rich in pectins as sugar beet fibre contains approximately 30% pectin.**

Power.

Muscular contraction occurs when strands of actin slide over strands of myosin (two protein types) in a type of ratchet mechanism. The energy is supplied by ATP (nucleoside triphosphate) which is degraded to ADP. Under normal circumstances the ADP is converted back to ATP by reacting with Creatine Phosphate. However, during extreme exercise, this pathway cannot cope and ADP is further broken down to AMP (a nucleotide) and on to IMP (each step releasing energy to power the contractions). IMP can be re-aminated to AMP and so back to ATP if there are sufficient nucleotides present to drive the relevant biochemical cycle. It is this area where supplemental nucleotides are thought to aid recovery, as well as replenishing the ATP to improve muscle contraction activity. However, research has shown that purified nucleotides have little effect in the performance horse, whilst their source, yeast cell walls do. This cycle is measured by monitoring levels of blood ammonia. Ammonia levels rise as ADP struggles to produce ATP, producing IMP. It has been shown to take 5 hours to replace 90% of loss nucleotides and up to 24 hours to replenish the last 10%.

Feeding beet pulp, compared to a glucose rich diet, gives significantly lower levels in blood ammonia and creatinin (another marker for ATP metabolism) indicating that replenishment of ATP is improved. **Feeding Speedi-Beet and Fibre-Beet can be instrumental in improving muscular activity and recovery.** It is likely that high levels of the sugar arabinose in beet, interconverted to ribose, forms the base for nucleotide synthesis.

Joints.

High blood ammonia has another negative impact on the horse. The acidity of ammonia has impacts on cell pH and blood flow. Ammonia and nitrites impact blood flow and have been shown to oxidise and breakdown cartilage. As beet pulp reduces blood, and therefore cellular, ammonia cartilage integrity is preserved. Additionally beet pulp is high in uronic acid, which can be converted to glucuronic acid, and galactose – both these sugars are the base units for chondroitin. Additionally the fermentation patterns of beet fibre can replace significant proportions of glucose in energy generation, allowing more glucose to convert to glucosamine. **The fibre profile of Speedi-Beet and Fibre-Beet contain products that are intrinsic in joint regeneration.**

Recovery.

As mentioned above the reduction of ammonia in the blood indicates a more efficient regeneration of ATP. This leads to increased power utilisation but also impacts on the recovery time. Various trials have shown that fibre rich feeds result in better recovery times than starch rich diets and beet diets may activate this through its fibre profile. In addition there is the effect of rehydration. Beet pulp, and more especially Speedi-Beet have high water holding capacities and low water binding capacities which means that Speedi-Beet can carry large amounts of water through the gut and easily release it for absorption in the hind gut. More so than other materials. Consistent hydration reduces the amount of dehydration and therefore reduces the need for rehydration.

Although there are many preparations of electrolytes to replace trace elements that are lost from interstitial fluids, either as sweat or through increased metabolism, these are quickly replaced from cellular reserves, and cellular reserves can be boosted through normal dietary intake. It is not essential, in a good feeding programme, to supplement electrolytes.

Speedi-Beet and Fibre-Beet can help recovery times by improving muscular triphosphate nucleoside status and aiding rapid rehydration.

There is much anecdotal evidence that various nutraceutical preparations do make a difference. Scientific research is a little less positive with some trials giving measured responses and some none.

However it could be argued that the response may well be dependent on the base ration. If a ration contains Speedi-Beet or Fibre-Beet, not only does it provide a high energy diet with less reliance on starch, and a prebiotic effect (beet fibre has been shown to improve the overall fibre utilisation of the whole ration), but it also has a profile that can supply its own range of "nutraceuticals" which are of particular importance to the performance horse. If nothing else it allows a more targeted approach to the use of nutraceuticals as they would be working from a higher base line.

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