

Stud Newsletter

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HORSEPOWER

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There have been some interesting and important things happening in equine nutrition research recently. Some of these new insights will impact on stud farm management and how we understand the way nutrition affects the health of mares and yearlings.

We thought some of this new information was important enough to inform our stud clients about. It will affect the advice we provide to you, and may help to provide some insight into the intractable problems of bone disease in young horses in particular.

Some of the science is quite complex, and the parts relating to insulin especially may be unfamiliar. What follows will attempt to explain the science and also provide the "Bottom Line" practical implications for feeding management. Much of the news is distilled from the recent "Australasian Equine Science Symposium" held on the Gold Coast earlier this year, so it's bang up to date.

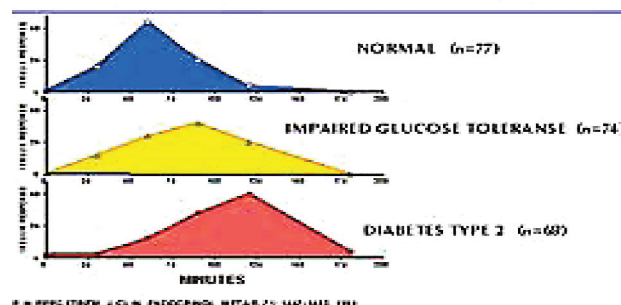
Insulin, Insulin Resistance, Glucose Intolerance – What's this all about?

There's been a lot of research recently around the topic of carbohydrate metabolism, insulin and insulin resistance, and the impact of insulin on bone growth and health etc. I will cover a couple of these topics in more detail, but first here's some basic background on how insulin works in sugar metabolism.

Insulin is a hormone, made in the pancreas, which controls blood glucose – all carbohydrates get turned into glucose before entry into the body or soon after, as glucose is the primary energy fuel used by cells.

Following a carbohydrate meal, glucose from sugars and starch is absorbed from the gut into the blood. Blood glucose rises triggering an increase in insulin – the "Insulin response". The higher blood insulin level promotes absorption of glucose by cells and conversion to storage forms like Glycogen. So, the blood glucose level falls and less insulin is produced restoring equilibrium within a few hours as in the blue graph below.

PEAK INSULIN RESPONSE AFTER ORAL GLUCOSE



This graph shows the insulin response in humans following oral glucose. The yellow curve is flattened because the peak insulin level is lower – the normal response has been reduced by a high carbohydrate diet. More fat kids = More Diabetes! It's happening right now.



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When excess sugars (carbs) are repeatedly fed, the response is blunted and less insulin is produced for a given blood glucose level, or less glucose is removed from the blood for a given level of insulin.

*This is called " **Glucose Tolerance**" or "**Insulin Resistance**" and results in persistent high blood glucose and / or low blood insulin levels. In humans this can be related to damage to the pancreas and cause diabetes requiring treatment with supplementary insulin. Note that persistent low insulin levels mean the normal insulin response to high blood sugars is not happening.*

This is now thought to be a critical factor in conditions ranging from OCD to Laminitis.

Insulin does not only affect blood sugar but also has impact on the normal development of bone. It's the hottest topic in equine nutrition worldwide at present.

Research Findings on Insulin & Bone Development / OCD

Put simply, fat mares overfed carbohydrates during pregnancy are more likely to have insulin resistant foals, and those are more likely to develop OCD. Their foals may be already pre programmed at birth for an increased risk of OCD.

Note.

These low insulin levels may not be low enough to have diabetic like effects, but are low enough to affect bone growth and development.

1. INSULIN & OSTEOCHONDROSIS IN THOROUGHBRED YEARLINGS.

There is a current theory that low insulin levels post-feeding predispose growing horses to develop OCD. It follows that diets high in carbohydrates which raise insulin levels repeatedly and eventually blunt the Insulin response may cause OCD. There is a strong positive correlation between Insulin Resistance / Glucose Tolerance, and OCD. This is why OCD is more common in young horses growing fast on high energy diets.

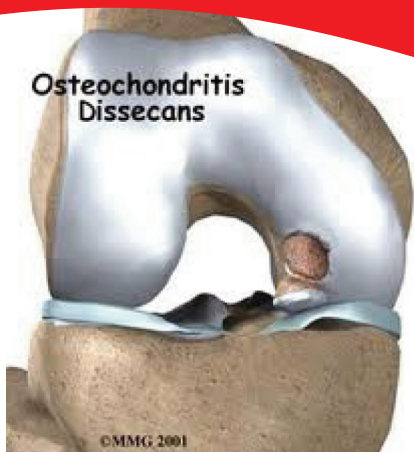
One study involved 197 yearlings born in 2007 / 2008 from 5 farms with an overall incidence of OCD of 27%

In all farms the yearlings with OCD had significantly LOWER fasting insulin levels in their blood – ie. They were more insulin resistant. Following this finding, insulin levels were tested in samples which had been taken from those same yearlings at 2 months and 5 months age, and from their mothers during late pregnancy.

In the foals, insulin levels were significantly lower in those which later developed OCD compared with those which developed normally. In their mothers, the mares which had the OCD foals had higher blood glucose levels during pregnancy and higher body condition scores as well. They were heavier.

This means that low insulin levels in young foals may be linked to OCD lesions discovered later when they are X-rayed for sale as yearlings. Furthermore, the influence of mare nutrition during pregnancy may well influence normal skeletal development in their foals later on.

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2. PREGNANT MARE NUTRITION LINKED TO INSULIN RESISTANCE IN THEIR FOALS

Another study fed pregnant mares on high energy and low energy diets (150% and 100% of requirement levels). Their subsequent foals were later tested for insulin levels. Foals from the High Energy group mares at 10 months age had significantly lower resting blood insulin levels than the Low energy group. ie. They were insulin resistant and probably born that way.

The author theorised that the high energy intake during pregnancy may suppress the degree of pancreatic growth in the foetus which would explain the results. Again, the pregnant mare's diet has long term consequence for her offspring.

These papers and several others all agree to the importance of nutrition of the pregnant mare in determining the fate of her foals. The emphasis is shifting to focus on this, and away from weanling nutrition ***because well before weaning time, the seeds of damage have already been sown.*** This applies to mineral and trace element nutrition as well as carbohydrates.

3. How common is OCD?

The study mentioned above indicated a rate of OCD of 27% on the five farms involved during those years. Another one covered 250 weanlings foaled in 2010, from 9 TB studs in the Hunter Valley. ***23.2% of horses showed OCD lesions on radiographs. Of these, 45% were in the stifle joint, 34% in the Hock and the rest in fetlocks.*** These two studies tally with yet another showing a 26% incidence in Australasian Thoroughbreds.

BUT, on the studs which Horsepower is involved with, we are convinced we do not see anything like such a high incidence. In fact, we think the rate we see is under 10%, but we simply don't know for sure because we have not yet collected any hard data on the issue.

Horsepower Stud Survey on OCD

If we're correct in our assumptions there must be some reason for the difference between "Our" studs and the average ones in those studies.

To that end we will soon be conducting a survey of as many studs as possible to determine the facts about how much OCD they see. We want to keep it as simple as possible and are working on a questionnaire to get the basic information we need to do this. We are hoping as many studs as possible will cooperate, because if we're right, it really matters!





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4. CALCIUM AND PHOSPHOROUS STATUS IN REPEAT BREEDERS.

Foetal development is very time critical and deficiency of a nutrient even for a few days during pregnancy can impact on the whole of later life for that foetus. Humans loose bone during pregnancy and accumulate it after weaning. Does this happen in horses?



BONE BIOMARKERS. In a fascinating study by A.J. Barton and others at the University of Queensland, two bone hormones were measured to establish whether mares & foals were accumulating or depleting their skeletal bone stores during pregnancy, and for the first four months of the foal's life.

Thoroughbred mares are re- bred each year so mares have a limited opportunity to re- mineralise their skeleton. ***In horses, the bone fracture rate is 50% higher in second and third foals, than in the first foal of a mare. Perhaps this is because the mares of those 2nd & 3rd foals are running out of skeletal mineral reserves to pass to their foetus.***

Results:

Mares were shown to lose bone during pregnancy and, especially from the 6-7th month on, they are resorbing their own skeleton to provide minerals to the foetus. After foaling this continues for two months then they start accumulating bone again. The foal is rapidly accumulating bone for the first two month of life to coincide with that continued loss in the mare. The first month is critical and the rate slows at three months age. This is the time when most OCD lesions develop - if they were not there already at birth, and some certainly are.

*Just like
cows milk,
mares milk
drains a lot of
Calcium from the
skeletal reserves.*

The significance of all this is that mineral nutrition, ***especially Ca & P*** are very important during the last trimester of pregnancy and first 2 – 3 months of lactation for the mare, and may determine foal OCD and later bone strength in her offspring.

For re- bred mares, if minerals like Calcium are not present in abundance they will perhaps be unable to adequately re- mineralise their skeleton in preparation for the demands of the next pregnancy. In turn, that will predispose her subsequent foals to problems like OCD, bone chips, and fractures.

Bottom line is that we should concentrate more on mare nutrition during pregnancy if OCD rates are to be reduced – by the time the foals are weaned it's just too late for many of these bone problems to be avoided.

From the results of our diet analyses over twenty five years we know that many mares have high energy intakes during pregnancy, and often these are coupled with marginal mineral intakes. In the future **Horsepower** will continue to work with our studs to raise awareness, and minimise the damage associated with these known risk factors.

