Feeding for Topline & Condition

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We all want our horses looking good and performing to their best. Many disciplines reward well conditioned horses with a good topline.

What is condition and topline?

Condition is measured using a 9 point score from poor/emaciated (1) through to extremely fat or obese (9). The upper curvature of a horse's withers, back, and loin is called the "topline."

Pertinent points

- Both condition and topline are determined to large extent by a combination of muscle and fat to put on weight.
- Sports horses conditioned for endurance and racing generally have little fat on the topline.
- At a condition score 5 and above, increasing amounts of fat covers the muscles. A well conditioned horse has a uniform fat cover. An over conditioned horse has too much fat which can lead to serious metabolic disorders.

How do we put condition and topline on a horse?

Condition is the result of regular exercise consistent with the discipline required of your horse, and appropriate diet. Body fat is produced from glucose and fatty acids derived from the diet. Glucose is derived from carbohydrates and from proteins. Fatty acids are derived from oils. Oils are energy dense (38KJ/g) , and supply 2.4 times more energy than the same amount of protein or carbohydrate (16KJ/g).

Protein is an expensive source of glucose, and digestible carbohydrates are the cheapest. Non structural carbohydrate (NSC) is the sugar and starch content of the feed, and supply most of the glucose. As explained below, oil and digestible fibre are the 'key secret' high energy, components in a diet for topline and condition.

How body fat is formed...some science

1. Glucose. NSC is digested in the intestines and converted to glucose. Glucose enters the bloodstream, and the hormone insulin is released to prompt the muscle cells to take up the glucose as an energy source and to maintain acceptable blood glucose levels. The muscle cells are Sensitive to Insulin. Some of the glucose is converted into fatty acids and stored in the fat cells. As the level of NSC increases, the amount of glucose stored as fat will increase, unless the horse is worked harder. Horses tend to store abdominal fat before a noticeable change to the topline.

2. Oil. The horse does not have a bile gland, and hence secretes bile continuously into the small intestine to enable absorption of fatty acids into the lymphatics. Coconut oil is unique in that it is absorbed directly into the portal blood. Fatty acids are stored in the fat cells as triglycerides. Fatty acids cannot be converted to glucose, and are used directly to produce energy inside the muscle cells. Fatty acids do not increase insulin, and hence are termed **"cool energy"**.

There is a limit to how much oil can be included in the diet. Levels above 15% may reduce fibre digestion. However the energy content at 2.4 times that of carbohydrates means a 'small amount' can be the substitute for a large component of the grains in the diet.

Importantly, not all oils behave the same way in the horses' diet (as pointed out in previous issues). Vegetable oils such as canola, linseed, and fish oil have higher ratios of Omega 3 fatty acid, and therefore provide a beneficial balance to the high Omega 6 found in most grains. These are unsaturated fatty acids. By comparison, the tropical oils such as coconut oil are unique in that they are saturated medium chain triglycerides (MCT), do not go rancid and and after absorption are metabolised in the liver. Coconut oil also contains lauric acid, which is converted to monolauren in the body, which may provide antibacterial actions.

3. Digestible fibre. Digestible fibres are complex carbohydrates,that are slowly digested and broken down into glucose. These are termed "slow feeds'. Horses, as discussed in previous articles, are naturally "slow feeders" – meaning most chaffs, grassy hay, and lucerne hay are ideal and necessary components of the diet.

Feeding high NSC for condition...the downside

Many feeds contain levels of NSC above 20% and will maintain good body condition, and in many cases cause obesity. The downside is that high NSC feeds are often associated with hot or fizzy behaviour, and metabolic disorders including ulcers, lameness, laminitis, tying up, insulin resistance, EMS and possibly cushings through the effects of insulin on cortisol. Studies indicate that feeding high NSC feeds to pregnant mares predisposes the foals to insulin resistance, because of the high levels of insulin crossing the placenta into the foetus.

High NSC and Insulin... why these cause the problems.

When high NSC feeds (>15% NSC) are fed, the horse produces more insulin to lower the levels of glucose in the blood. The muscle cells can become Insulin Resistant i.e. they are unable to take up more glucose, and so are resistant to higher levels of insulin. The levels of insulin and glucose in the blood rise. So what does the horse do with the increased glucose? If the horse is in extreme sports work, then it may use the extra glucose for energy. If not, then some of the glucose is converted to fatty acids. In addition, depending on breed, some of the glucose can be stored as a polysaccharide and stored in muscle cells causing tying up (PSSM) and some will form a proteoglycan and be stored in connective tissue in the legs causing lameness (see other articles in this series).

Fatty acids combine with glycerol to form triglycerides which are stored inside the fat cells. Triglycerides are too big to pass out of the fat cells., and have to break down to fatty acids and glycerol so that the fatty acids can pass back into the blood stream.

High levels of insulin cause: -

1. Increased uptake of fatty acids into the fat cells by increasing the activity of the enzyme LPL (lipoprotein lipase) on the wall of the fat cells.
2. Reduced breakdown of triglycerides into fatty acids inside the fat cell by suppressing the enzyme HSL (hormone sensitive lipase). This means the fatty acids cant get out of the fat cells until the insulin level drops.
3. Creation of more fat cells.
4. Liver to increase production of triglycerides and transport to the fat cells.
5. Partitioning of energy from the diet into fat cells, and so energy is not available for the muscles. The horse therefore is hungry, even though it is fat.
6. Increased feed intake. If the horse eats more of the high NSC feed, it produces more insulin and gets fatter.
7. Inflammation and tissue stress and hence increased production of cortisol.

This is a vicious cycle. This happens in humans. For more information see "Why We Get Fat" by Gary Traubes.

High levels of cortisol.

Cortisol is the "stress or anxiety hormone" released from the adrenal gland. Cortisol exacerbates insulin resistance by increasing fat storage and raising blood pressure and circulating glucose which further stimulates insulin. High levels of cortisol are involved in Cushings disease. A question remains: is glucose causing insulin resistance and stress, causing increased cortisol [and sometimes leading to cushings], or is it that the cortisol increases glucose causing IR in these horses? [Reference: H.C. Schott, Pituitary Pars Intermedia Dysfunction [cushings] 31st Bain Fallon Memorial Lectures – Equine Veterinarians Australia 2009]

What to feed for condition and topline and not cause bad behaviour and insulin resistance.

"Why We Get Fat" outlines the role of sugar and starch in obesity and diabetes Type II in humans. If you want to lose weight and reduce the incidence of diabetes, avoid refined carbohydrates!

The same logic applies to horses and dogs.

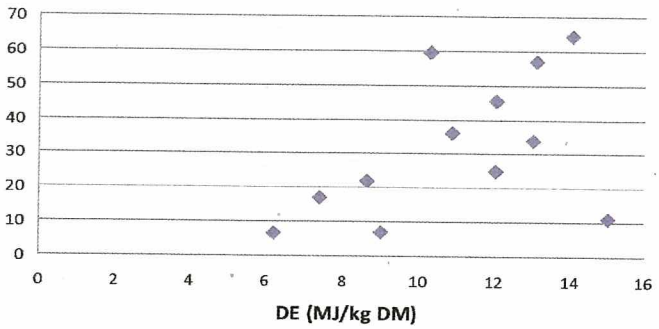
To put weight and condition on your horse, and avoid the NSC related disorders, you have to select a high digestible energy (DE) feed with low NSC, and high digestible fibre. This can only be achieved by including oil in the diet to replace the carbohydrates.

The following table shows the relationship between NSC content and DE in a range of feeds. Low NSC is usually associated with pasture and hay, or feeds that have been diluted with fillers. High NSC feeds are grain based. Molasses has a very high NSC from the sugars.

	DE	NSC
Wheat straw	6	7
Timothy hay	7	17
Lucerne hay	9	22
Kikuyu	9	7
Molasses	10	60
Beet pulp	11	36
Oats	12	46
Pellet	12	25
Sweetfeed	13	34
Barley	13	57
Corn	14	65
Copra meal	15	11

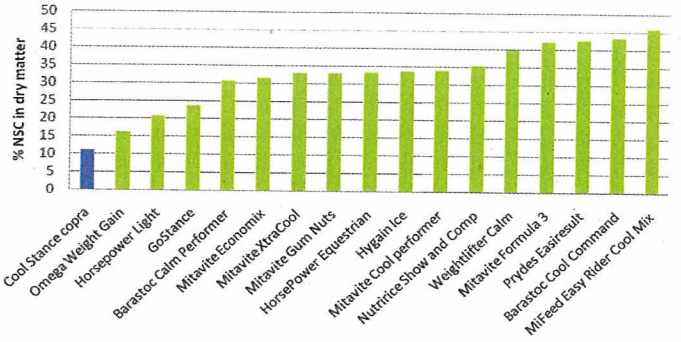
Copra meal has a low NSC and yet has a high DE from the oil and digestible fibre. The graph depicts Molasses and Copra being the outliers in the almost straight line between NSC % and DE MJ/kg for the other feedstuffs.

NSC vs DE



A range of Australian horse feeds were analysed for NSC content by Dairy One in the US

NSC in Australian Horse Feeds



These analyses show that there is a large variation in the NSC content in horse feeds.

Conclusion.

Feeding for topline and condition can be reliably, safely and successfully achieved by considering the feed requirements of your horses. The tables above give you a scientific guide to ensure the energy component of the diet is the right combination.

Fat is derived from glucose and oils. Feeding high NSC diets will provide lots of glucose and deposition of fat to give a topline, however the extra glucose may cause insulin resistance, obesity, and sometimes bad behaviour and metabolic disorders.

For most equine disciplines select low NSC, high DE feeds, which usually contain oil and digestible fibre.

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