FEEDING FOR TOPLINE
AND CONDITION IN HORSES...
THE ISSUES

Dr Tim Kempton
Stance Equine
www.stanceequine.com

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/obese (9). The upper curvature of a horse's withers, back, and loin is called the "topline."

Pertinent points

1. Both condition and topline are determined to large extent by a combination of muscle and fat to put on weight.
2. Sports horses conditioned for endurance and racing generally have little fat on the topline.
3. At a condition score 5 and above increasing amounts of fat that 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. Nonstructural carbohydrate (NSC) is the sugar and starch content of the feed and supply most of the glucose. As explained below, oil and digestible fiber are the 'key secret' **high energy,** components in a diet for topline and condition

How is body fat 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 fiber 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 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 after absorption are metabolized in the liver. Coconut oil also contains Lauric acid, which is converted to monolauren in the body, which may provide antibacterial actions.

3. Digestible fiber. Digestible fibers 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 chaff, grassy hay, and alfalfa 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 behavior, and the metabolic disorders including ulcers, lameness, laminitis, tying up, insulin resistance, EMS and possibly Cushing's 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 fetus.

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. 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 can't 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 stimulate insulin. High levels of cortisol are involved in Cushing's disease. The question remains is

glucose causing insulin resistance and stress, causing increased cortisol [and sometimes leading to Cushing's], or is it that the cortisol increases glucose causing IR in these horses? [Reference: H.C. Schott, Pituitary Pars Intermedia Dysfunction [Cushing's] 31st Bain Fallon Memorial Lectures – Equine Veterinarians Australia 2009]

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

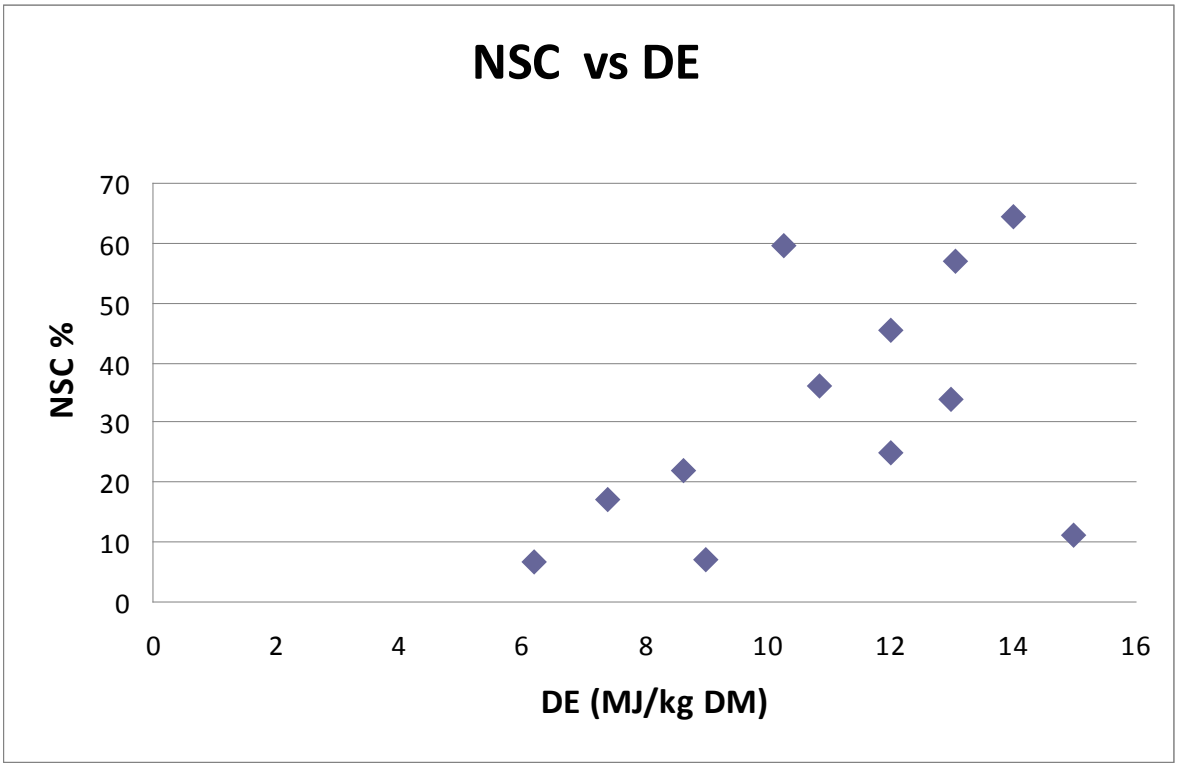
"Why We Get Fat" outlines the role of sugar and starch in obesity and diabetes Type II in humans. If you want to lose weight and reduce the incidence of diabetes, avoid refined carbohydrates!

The same logic applies to horses and dogs.

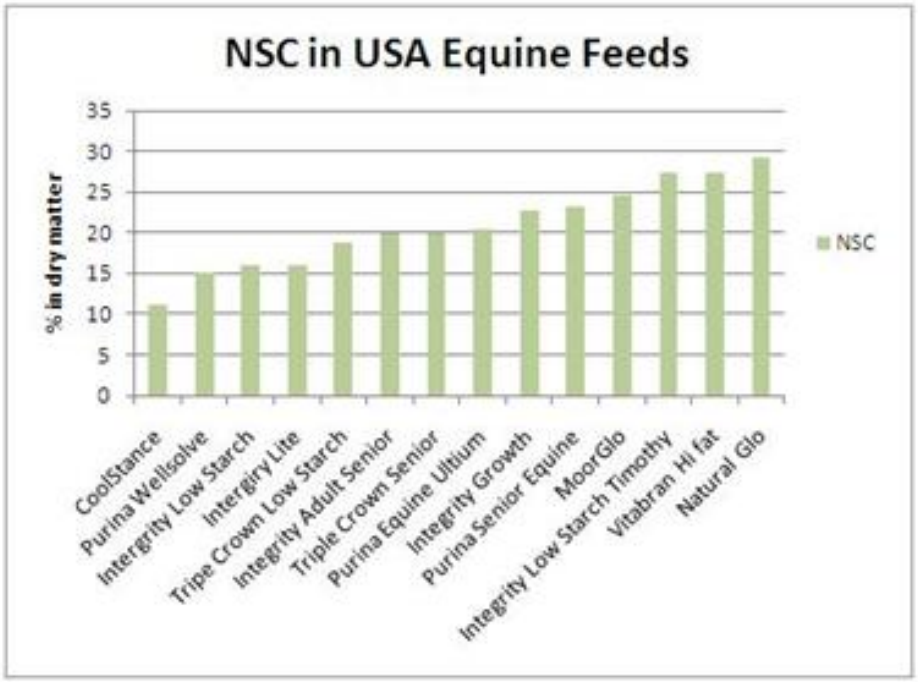
To put weight and condition on your horse, and avoid the NSC related disorders, you have to select a high digestible energy (DE) feed with low NSC, and high digestible fiber. This can only be achieved by including oil in the diet to replace the carbohydrates.

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

	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
Sweet feed	13	34
Barley	13	57
Corn	14	65
Copra meal	15	11



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



For more information or to order CoolStance, please call 803-647-1200 or e-mail Claudia@stanceglobal.com

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

The Benefits of CoolStance Coconut Oil?

Aside from presenting the horse industry with an attractive alternative to animal fat as a source of saturated fatty acids, CoolStance coconut oil has other unique properties including:

1. It is stable and resistant to rancidity. Because of its saturated structure, coconut oil can be stored for long periods of time without risk of rancidity. Rancid oils reduce the palatability of a feed, interfere with the utilization of fat soluble vitamins and may cause damage to muscle and organ tissue if consumed.
2. Coconut oil contains medium chain fatty acids that are easier to digest, absorb and utilize in comparison to the long-chain fatty acids found in other oils such as corn, soy, canola and rice-bran oil. Medium chain fatty acids appear to behave more like glucose than fat in the body and are preferentially oxidized to generate energy over long-chain fatty acids, meaning coconut oil provides a ready source of energy for use during exercise.
3. Some of the medium chain fatty acids (Lauric acid, Capric acid) in coconut oil possess antibacterial and antiviral properties. These fatty acids may assist the horse's immune system in fighting off viral and bacterial challenges, leading to improved overall gut health and wellbeing.
4. Coconut oil may have performance benefits. A study by Pagan *et al* (1993) found that horses supplemented with coconut oil versus soybean oil had lower blood lactate and ammonia and higher free fatty acids than a control group of horses who were not supplemented with fat during the gallop and the warm down phase of a standardized exercise test. These effects may have a positive influence on performance. In addition, a study by Matsumoto (1995) found that mice supplemented with medium chain fatty acids took longer to reach a state of exhaustion whilst swimming than un-supplemented mice.

Conclusion.

For more information or to order CoolStance, please
call 803-647-1200 or e-mail Claudia@stanceglobal.com

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 behavior and metabolic disorders.

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

ABOUT THE AUTHOR:

Dr Tim Kempton has a degree and PhD in the basic and applied aspects of nutrition and specializes in the relationships between nutrition and performance of animals. He pioneered the concept of .cool feeds. For horses in Australia with the introduction of copra meal in the 1980.s, which is now fed extensively as a cool feed. More recently, he has researched the role of NSC in horse feeds, and is committed to providing equine education and products based on sound science to avoid harming horses with kindness, through overfeeding and underworking.

For more information or to order CoolStance, please
call 803-647-1200 or e-mail Claudia@stanceglobal.com