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Management to Avoid Tying Up

By Dr John Kohnke BVSc RDA

'Tying Up' is the most common muscle disorder that affects exercising horses. It is technically termed 'exertional rhabdomyolysis' (ER), which describes the damaging effects resulting in dissolution of muscle cells during exercise. Exercising horses can develop signs within minutes of commencing exercise, with the initial free working stride shortening to a stiff gait, often developing into a painful muscle cramping-like condition with difficulty in moving, signs of pain, severe muscle lock-up and discomfort, combined with patchy sweating and elevated heart and respiratory rates, which most commonly occurs during or within 2 hours after exercise. Although 'tying-up' is a relatively common problem, the underlying causes are only now being more fully understood. In fact, new research now indicates that there are up to three different forms of 'tying-up'.

'Tying up' can have many direct and indirect causes and is classified into 3 types – subclinical ER, clinical ER and recurrent ER (RER), as well as a genetic, chronic form related to over storage of muscle sugars (glycogen) referred to as Polysaccharide Storage Myopathy (or PSSM) which can result in similar signs, with up to 33 breeds of horses identified as carrying the genes.

A recent review by Dr Stephanie Valberg of Minnesota University, provides new information on the prevalence and underlying causes of clinical ER and RER, both of which result in muscle pain, stiffness, hind limb lameness and inability to continue exercise for several hours. The subclinical form leads to reduced performance, pain in muscles and subtle gait abnormalities.

The genetic related PSSM is more common in Standardbred fillies, but heavy hindquartered Thoroughbred fillies have a tendency to tie-up as well. Nervy young fillies are the most likely candidates, especially those on high grain diets based on oats in excess of their exercise needs.

Subclinical 'Tying Up'

This form does not exhibit severe clinical signs, usually being associated with a loss of performance, poor finishing ability, pain over the affected muscle and subtle gait abnormalities.

Handy Hint

Muscle Stiffness 24 hours after Exercise

Horses that are stiff in the gait at least 4-24 hours following a fast work out are likely to be suffering from the affects of accumulated lactic acid build-up in unfit muscles, minor muscle strain and soreness, or improper warm out after hard, fast exercise, which is a not typical of a 'tied up' horse.

New Findings in Tying Up

1. Approximately 3% of horses in training develop ER over a 12 month period. The highest incidence occurs in galloping, polo horses and eventers but recently there appears to be an increased incidence of PSSM related tying up in Standardbred fillies in training. The risk of ER is influenced by exercise routine, work intensity, sex, age and temperament of the horse, as well as diet.
2. **Fillies have 4 times the risk compared to geldings and the incidence of ER decreases as a horse ages, or in subsequent race preparations. Episodes of ER are more likely when horses are kept in training for extended periods of 4-6 months, with an increasing risk during warm-down exercise after moderate exercise early in training, and rarely occur after racing.**
3. The incidence of RER in Thoroughbreds is approximately 4.9% in the USA, 5.4% in Australia and 6.7% in the UK. In many cases, young fillies with RER are fast and show potential for race speed, making them difficult to train and they are often retired early to stud. They may also go onto being eventers or show jumpers with a continued history of tying up. A similar genetic basis has also been linked to RER in Standardbreds. Unless a mare with RER is a good performer and the problem can be managed in training, then it is considered by some authorities to be unwise to breed with her or a related filly bloodline.

Handy Hint

Managing Tying Up in Nervy Horses

Many highly strung young horses in particular, respond to relaxant medications, such as a low dose of ACP or Sodium Phenytoin in training, which often help to take the 'edge off' and allows them to settle down. As some fillies have a tendency to tie-up when in season, a course of synthetic progesterone, such as Regumate[®], will help to suppress seasonal cycles and minimize the risk of tying up. None of these drugs can be used on raceday and have to be withdrawn under veterinary advice.

4. The diagnosis of ER and RER is based on a history, or current clinical signs of muscle pain and stiffness after exercise. Blood taken to monitor elevations in CK and AST enzymes, as well as LDH enzymes, can be used to determine the severity of the muscle damage. A urinary test stick can also be used to check for myoglobin (the muscle pigment that transfers oxygen from haemoglobin in the red cells) in the urine due to muscle damage, without the presence of blood cells or blood cell breakdown (haemolysis) in the urine. **An exercise test carried out on a horse which you may suspect as being prone to subclinical ER because of poor performance, finishing**

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without stiffness and muscle soreness after a hard hit out, trial, race or competition, is helpful to help confirm an underlying tying-up problem.

5. Although the measurement of serum enzymes can help detect an underlying tying-up problem, a number of factors can affect muscle enzyme elevations in serum. Dr Valberg suggests that blood samples should be collected at a standard time of 4-6 hours after exercise when CK peaks, especially if the horse was exercised the day before as well. Normal values need to be adjusted for the age and sex of the horses as well – 2 year old fillies generally have a wider fluctuation in serum CK levels (CK above 300 U/L) on average than 3 year old fillies and geldings (CK below 250 U/L). Nervous horses have a higher incidence of tying up as compared to more settled 'laid back' and calmer horses, especially in young fillies on a high grain diet and often have elevated CK muscle enzyme levels of over 400 U/L after transport.

6. The chronic form of ER related to over storage of muscle sugars (glycogen) or PSSM, has been linked to a dominant gene that predisposes bloodlines of PSSM affected horses to a high risk of tying-up when fed starch based rations. Up to 6% of Quarter Horses are prone to develop 'tying up', with draft horse breeds and Warmbloods to a lesser degree. Muscle biopsies to confirm PSSM in horses indicate that some Thoroughbreds and Standardbred fillies with a history of 'tying up' have high levels of muscle glycogen storage. These horses usually to have a quiet temperament, are 'good doers', but have 'hard' muscles on the neck and rump as compared to other horses.

Did You Know That...

A 3-5 fold increase in muscle CK enzyme levels can occur from as little as 20 grams of severely damaged and dying muscle tissue after exercise – a horse has over 50kg of shoulder, back and hind limb muscle tissue (not including bone or fluid).

Handy Hint

Tying-Up can be Inherited.

Studies on the genetic form of RER in Thoroughbred horses indicates that a horse has a 50% risk of inheriting the autosomal dominant genes with a risk of RER. The PSSM form is likely to affect certain bloodlines of horses, with bulky hindquarters and hard neck and rump muscles. This suggests that a mare, for instance, that has a history of RER or PSSM in training, could pass on the gene to 50% of her foals, more likely to filly foals.

Handy Hint

Evaluating Enzyme Release and Clearance Time.

The CK enzyme readings are more specific to muscle damage (limb muscles and heart muscle), as it is liberated into the blood within 4-6 hours after muscle injury and returns to baseline (less than 350 U/L) within 24-48 hours, even after a relatively severe episode of tying-up after exercise. Limited elevations to 300 U/L of CK may result from strenuous exercise or transport. Serum AST enzyme is not specific to muscle damage. AST rises more slowly than CK, peaking between 12-24 hours, and may take 2-3 weeks to return to normal (<400 U/L). Elevated AST enzyme and decreasing CK enzyme levels taken at 36 hours after clinical signs indicate that muscle damage has ceased after a tying-up episode.

Vitamin E and Selenium by Injection as a Supplement?

It has become a common practice to give selenium by intramuscular injection once a week to help prevent 'tying-up'. Vitamin E and selenium deficiency have not been shown to be an underlying cause of tying up. They help provide oxidative protection to damaged muscle tissue and may reduce the symptoms of tying up, but not the cause. Intra-muscular injection can result in muscle soreness and risk of introducing infection if sterile injection techniques are not followed. Daily oral supplements are more economical and provide higher overall levels of antioxidants.

Muscle XL

Many trainers have found that a daily supplement of 60 g Kohnke's Own Muscle XL daily for 7-10 days after a severe episode of 'tying up' provides natural Branched Chain Amino Acids (BCAA's), glutamine and vitamin E to maintain the muscle cells.

Handy Hint

Exercise Test for Subclinical Tying-up

Trot at a steady, free flowing speed for exactly 15 minutes. Take a blood sample (serum tube) at exactly 5 hours after the test. A 3-4 fold increase in CK enzyme levels can confirm subclinical ER. CK levels of up to 20,000 U/L have been found in fillies which had been suspected of tying-up, but showed no clinical signs. Most normal horses show little change in CK enzyme readings after the standard 15 minute trotting test.

Basic Management for Tying Up

1. Do not feed oats at all, and minimal (less than 1kg) of extruded grains in the evening feed in fillies with PSSM.

Do not give susceptible horses a day off - work them every day, walk them in the afternoons for 15-20 minutes.

3. Do not warm down at the trot – go from pace work straight to a 10-15 minute walk to 'cool out'.

4. Consider using a magnesium/Vitamin E supplement, such as Kohnke's Own Mag-E, to help maintain normal nerve and muscle function.

5. Avoid feeding lucerne hay as a roughage – limit hay to 3-4 kg daily of grass hay.

6. Supplement all high risk horses with at least 1000IU of vitamin E and 1mg of selenium, preferably organic selenium, in the feed, such as in Kohnke's Own Cell-E PREMIUM or alternatively E-Se Supplets. E-Se Supplets are the most economical form to use during training, with the pellet form eliminating sift-out, dust or waste.

Handy Hint

Preparations for Tying-Up.

There are a number of supplements, salt mixes and injectable products recommended to help prevent tying-up. Some of these are beneficial, but in PSSM horses, careful dietary management is the best way to ensure control.

Management to Avoid Tying Up

Dietary Management of Problem Horses

Some horses that 'tie-up' on a diet containing oats may have a genetic predisposition or "Polysaccharide Storage Myopathy", or PSSM for short, where they store an excess amount of muscle sugars (glycogen) in their rump and limb muscles. PSSM horses are most commonly quiet natured, "good doers", which have bulky, hard muscles because they are packed with excess glycogen.

The amounts recommended are for horses in race training for other horses, reduce the amount of feed relative to the level of work. Note: Do not feed oats or extruded feeds - the starch uptake from these feeds (oats 75% soluble starch uptake from small bowel to muscle glycogen) is much more efficient than from raw barley or corn and packs glycogen into the muscle cells to overstore it in PSSM type horses.

Handy Hint

Daily supplementation of young horses with **organic** magnesium and vitamin E, as exclusively in Kohnke's Own **Mag-E**, can help horses maintain normal nerve and muscle function during training, and help minimise the chances of tying-up, by correcting low or inadequate dietary intake of these two important muscle nutrients. A number of leading trainers routinely give all young horses Mag-E for the safety of stable hands, work riders and jockeys of young horses on high grain based rations which are likely to be low in these nutrients for the nerves control.

Dietary Suggestion for Racehorses and Harness Horses

After Training: Feed 2-2 ½ kg of steam-rolled barley, up to 1 kg cracked corn, and 300-400g protein meal (eg soyabean or lupins) (no starch). This grain feed will help replenish muscle glycogen without rapid uptake. Chaff – limit to an equal volume of grain, or no more than 1 ½ volumes of chaff to grain to ensure sugar, protein and fat uptake. Feed predominantly cereal chaff – check for excess grain in oaten chaff.

Midday Meal: (optional) Offer 1 kg steam rolled barley and ½ kg cracked corn, with 1 ½ volumes of chaff to a horse in full training if extra energy is required.

Mid Afternoon: **Ensure that the horse is walked for at least 20 minutes on a lead or in a walker – turning out may not always encourage self exercise in a lazy, bulky horse.** Limit grazing on lush pastures to 1-1 ½ hours in the afternoon.

Evening Feed: Feed a maximum of 1 kg grain, combined with 1 kg cracked lupins, 4 cups sunflower seeds and 125 mL oil (e.g. Kohnke's Own **Energy Gold** with Vitamin E). Lupins, sunflower seeds and oil (fat) do not contain starch which could over store during the night in a PSSM horse that is resting. Also supplement with vitamin E and organic selenium and a salt mix, such as Kohnke's Own **Cell Salts**.

Did You Know That...

New genetic Test for PSSM relating tying-up

A new genetic DNA based test is being developed to identify horses carrying the PSSM gene so that breeding with horses carrying the glycogen over-storage gene can be avoided. It is hoped that the test will be available commercially in 12 months.

Handy Hint

To recognise a PSSM affected horse, feel for "hardness" in the neck, shoulder and rump muscles by pressing with the fingertips before the horse is worked in the morning – a "hard" consistency is likely to be PSSM. Softer, more pliable muscles on a horse are considered normal in a fit horse. After 3 days on the suggested ration and exercise in the afternoon, check the consistency of the neck, shoulder and rump muscles - normally they will now feel "softer" and more pliable because glycogen overstorage is decreased. Most horses will not 'tie-up' again under this dietary program.

Handy Hint

Reducing PSSM related Tying Up

Providing a diet low in soluble starch by avoiding oats, feeding only a small amount of cracked, steam rolled corn or barley (1kg) at night along with cracked lupins and oils (no starch) and exercising affected horses twice daily, with 20-30 minutes walking in the afternoon. Also see Point 5 above.

Notes:

- Hay – Always try to offer good quality grass hay – the lupins will provide adequate protein normally contributed by lucerne hay.
- Avoid giving full rest days – always walk or exercise the horse every day, cutting the grain back to one third in the morning feed and increasing the hay or chaff.
- A muscle buffer may be of benefit when given over the tongue after fast work to assist removal of lactic acid – not the cause, but it may help relieve the 'soreness' in the muscles.

Horse Details:

Name: **THOROUGHBRED TYING UP RATION**

Breed: THOROUGHBRED

Age: 4 years

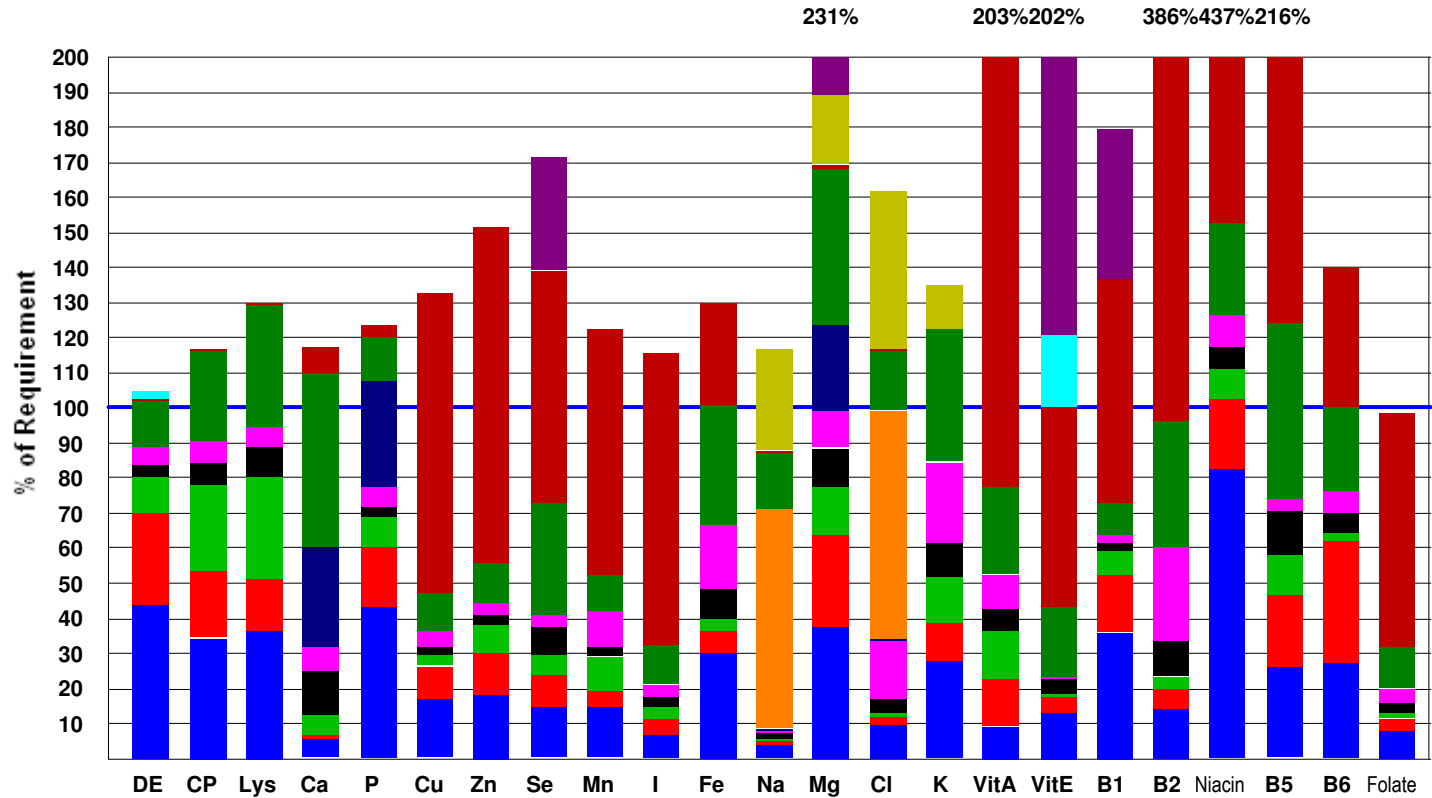
Activity: Thoroughbred Racing (3 years or older)

Owner: RACE HORSE TRAINER

Body Weight: 500 kg

Diet Contents:

Ingredient:	kg/day
Barley	4.500
Corn	2.500
Lupins	1.000
Lucerne Chaff	0.500
Oaten Chaff	1.000
Dicalcium Phosphate	0.060
Salt	0.060
Lucerne Hay - Mid Bloom	2.000
Kohnke's Own Cell-Vital	0.040
Kohnke's Own Energy Gold	0.080
Kohnke's Own Cell-Salts	0.060
KohnkesOwn E- Se Supplets	0.015
TOTAL	11.815
REQUIRED	12.500



Management Notes:

This is the analysis of a ration suitable for a THB to help reduce the risk of tying up during training.

The ration is based on steam-rolled barley and cracked corn as the major energy sources to reduce the chances that the horse will over-store muscle sugars on a grain based diet in the overnight period.

The supplements recommended are those that would be available in Bundaberg.

The ration should be split into 2 feeds as follows...

Morning feed..... 3.5kg(6 litres) steam-rolled barley, 1.5 kg (2 litres) cracked corn , 360g (3 litres) lucerne chaff , 500g (4 litres) oaten chaff , 30g (1 1/2 tablespoonsful) of dicalcium phosphate (DCP), 45g (1 1/2measures) Cell-Salts , 40g (1 scoopful) Cell-Vital, half a biscuit of lucerne hay.

Daytime- paddock exercise. Afternoon exercise 45 mins walking on machine or by hand.

Night feed.....1kg(1 1/2 litres) steam-rolled barley, 1 kg (1 1/3 litres) cracked corn , 1kg (1 1/3 litres) cracked lupins , 120g (1 litres) lucerne chaff , 500g (4 litres) oaten chaff , 30g (1 1/2 tablespoonsful) dicalcium phosphate(DCP) , 45g (2 tablespoonsful) salt , 80mL Energy-Gold and half a biscuit of hay overnight. Other hints on training are provided on the attached sheet.

Horse Details:

Name: **HARNES HORSE TYING UP RATION**

Breed: STANDARD BRED

Age: 4 years

Activity: Trotting/Pacing Race Training

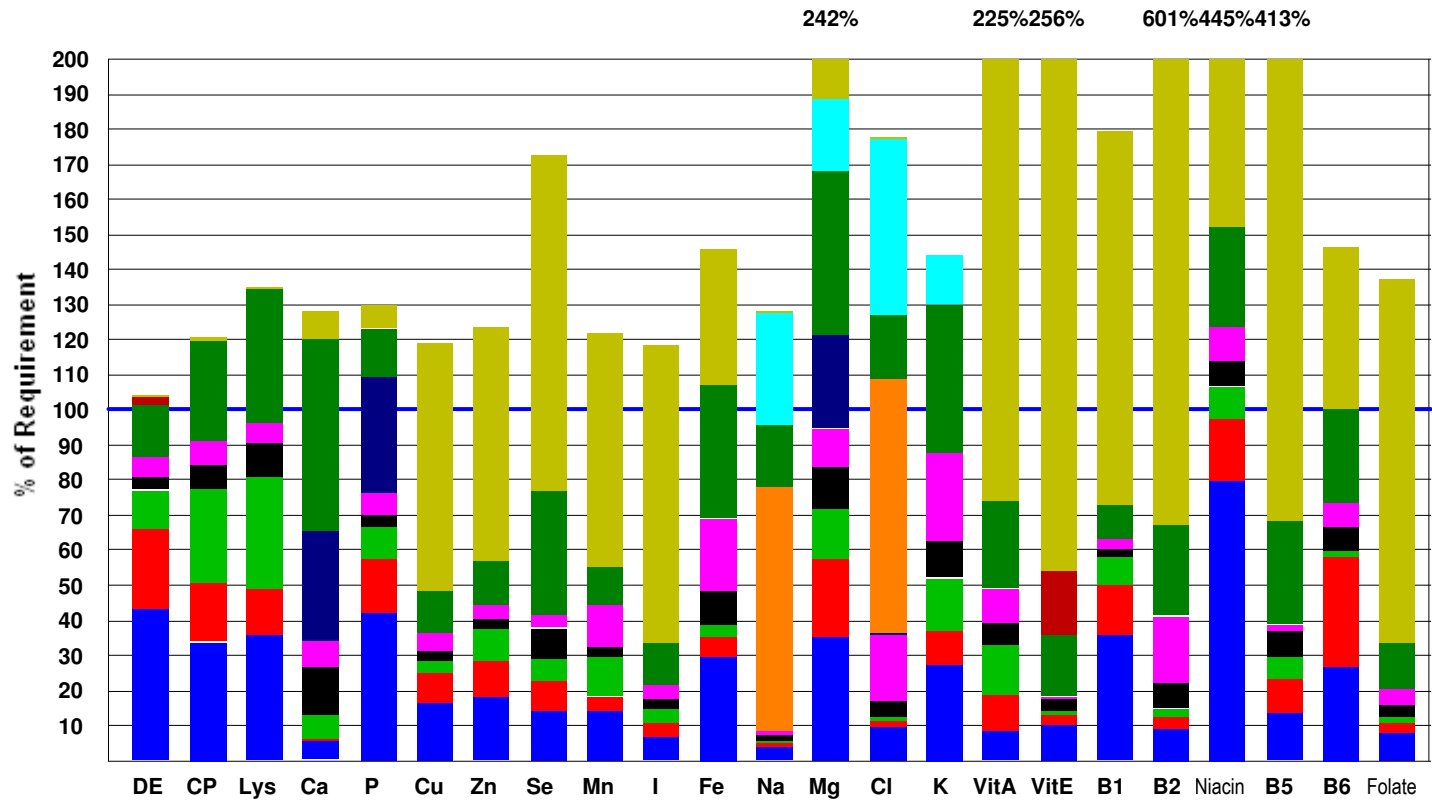
Owner: HARNES TRAINER

Body Weight: 450 kg

Diet Contents:

Ingredient:	kg/day
Barley	4.000
Corn	2.000
Lupins	1.000
Lucerne Chaff	0.500
Oaten Chaff	1.000
Dicalcium Phosphate	0.060
Salt	0.060
Lucerne Hay - Mid Bloom	2.000
Kohnke's Own Energy Gold	0.080
Kohnke's Own Cell-Salts	0.060
Kohnke's Own Harness Special	0.060

TOTAL REQUIRED 10.820
11.250



Management Notes:

This is the analysis of a ration suitable for a harness horse to help reduce the risk of tying up during training.

The ration is based on steam-rolled barley and cracked corn as the major energy sources to reduce the chances that the horse will over-store muscle sugars on a grain based diet in the overnight period.

The ration should be split into 2 feeds as follows... Morning feed..... 3kg(5 litres) steam-rolled barley, 1 kg(1 1/3 litres) cracked corn , 360g (3 litres) lucerne chaff , 500g (4 litres) oaten chaff , 30g (1 1/2 tablespoonsful) of dicalcium phosphate (DCP), 45g (1 1/2measures) Cell-Salts , 40g (1 scoopful LARGE END) of Harness Special, half a biscuit of lucerne hay. Daytime- paddock exercise. Afternoon exercise 45 mins walking on machine or by hand. Night feed.....1kg(1 1/2 litres) steam-rolled barley , 1 kg (1 1/3 litres) cracked corn , 1kg (1 1/3 litres) cracked lupins , 120g (1 litres) lucerne chaff , 500g (4 litres) oaten chaff , 30g (1 1/2 tablespoonsful) dicalcium phosphate(DCP) , 45g (2 tablespoonsful) salt , 20g (1 heaped scoopful SMALL END) of Harness Special, 80mL Energy-Gold and half a biscuit of hay overnight. The horse should not be trotted or jogged to warm down after fast work or a hobble-up- go straight back to a walk to cool out over 10 mins. Minimise jogging on slow work days- work at a faster pace for a shorter time and cool out at the walk.