

Equine Obesity; a UK perspective

Dr Ruth Morgan

MA VetMB CertAVP(EM) DipECEIM PhD FHEA FRCVS

The UK horse population

- **850,000** horses in the UK
- **631,000 privately owned** and **95,000 professionally owned**
- About **14,000 horses are currently in active training** for professional or hobby sports




Welsh Ponies
Shetlands
Shire
Clydesdale


Exmoor
Fell
Icelandic Horses
Dales
Thoroughbred

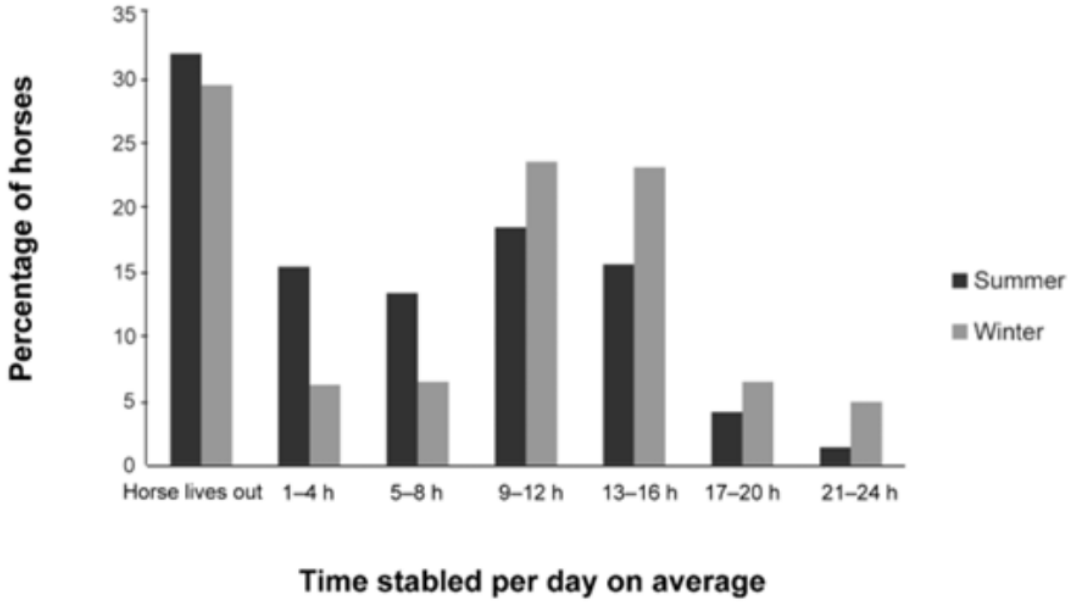
SRUC

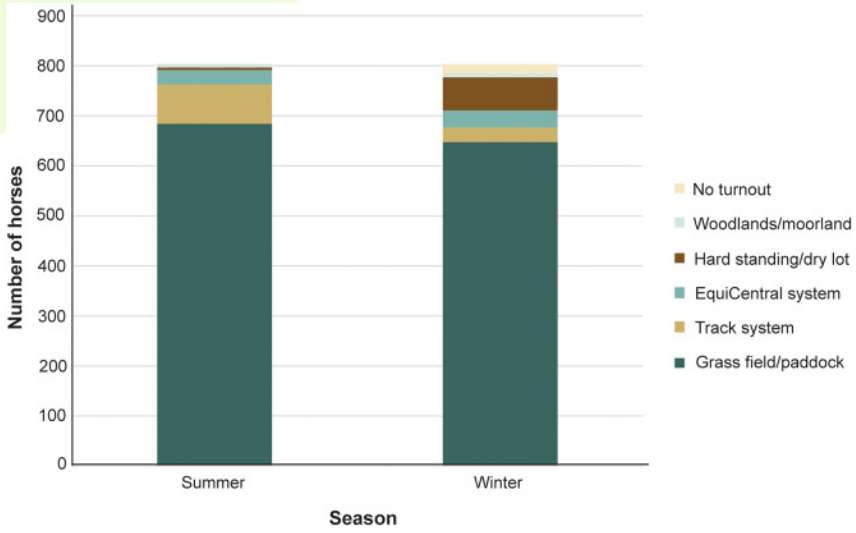
Management

- 60% kept in livery yard settings (predominantly leisure horses)

- Grass land
- Stabling
- Mixed management

- Grass, hay, haylage, concentrates







How many horses are obese?

Country	Prevalence	Study
Scotland	40%	Wyse *et al* 2008
Denmark (Icelandic horses)	24%	Jensen *et al* 2016
UK	27% winter 34% summer	Giles *et al* 2014
Australia	Horse 9.3% Shetland Ponies 72% Other pony breeds 32%	Potter *et al* 2016
USA (Southwest Virginia)	32%	Thatcher *et al* 2012

?70%

Equine obesity in the UK

Risk Factors

- Susceptible breed population
- Leisure-horse population- exercise?
- Livery yard settings
- Showing
- Extensive grass-based management systems (fertilized pasture)
- Supplementary feeding during winter
- Cultural attitudes towards equine body condition

Challenges

- Recognition and measurement of obesity (particularly in native or mixed breeds?)
- Communication around obesity
- *How does obesity cause insulin dysregulation?*
- Welfare of horses under dietary restriction
- Management of obesity in grazing horses
- SGLT2 inhibitor use

Genetic predisposition; a polygenic condition

Breed risk

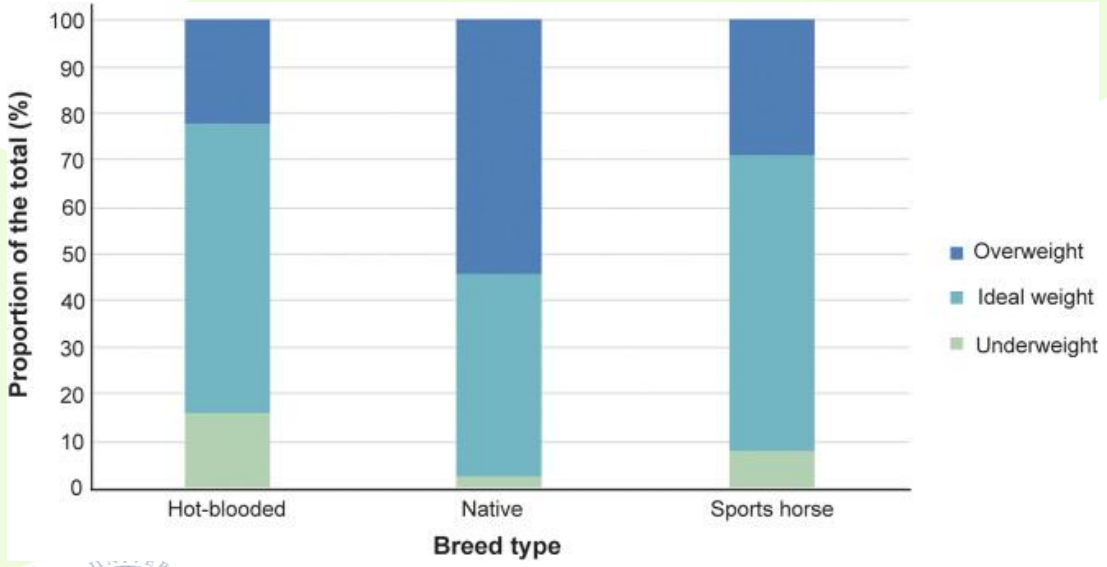


Individual risk



Familial risk





What are genes determining?

- Being overweight?
- Eating too much?
- Less efficient metabolism of food?
- The consequences of obesity?

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Breed predisposition

- “My horse lives on fresh air”
- Calorie intake > calorie output
- Disease of the brain and appetite signalling- food motivation



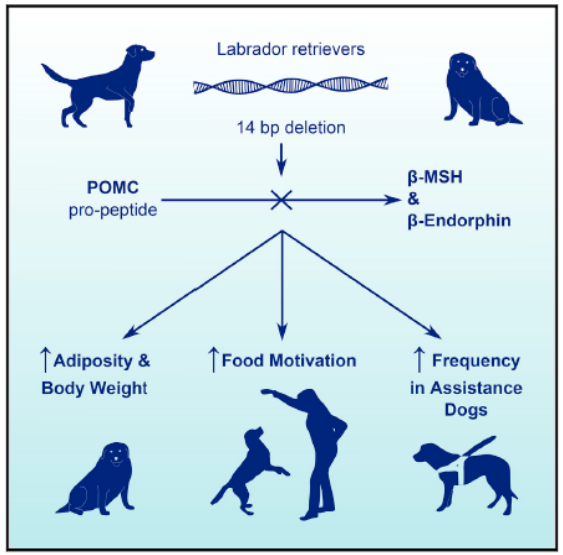
Raffan *et al* 2016

Short Article

Cell Metabolism

A Deletion in the Canine *POMC* Gene Is Associated with Weight and Appetite in Obesity-Prone Labrador Retriever Dogs

Graphical Abstract



Authors

Eleanor Raffan, Rowena J. Dennis, Conor J. O'Donovan, ..., Kerstin Lindblad-Toh, Giles S.H. Yeo, Stephen O'Rahilly

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In Brief

Companion dogs from the obesity-prone Labrador retriever breed were found to carry a mutation in *POMC* in this study by Raffan et al. The mutation is predicted to disrupt production of the neuroactive peptides β-MSH and β-endorphin and was associated with greater weight, adiposity, and food motivation in affected dogs.

What about horses?

- Is there a food motivation phenotype we can identify in horses?
- Horses v ponies
- Ponies can eat 5% of bodyweight in grass as dry matter with 24 hour access to pasture (Longland *et al* 2011)
- Horses eat ~2–2.5% of bodyweight (Cuddeford 2013)
- Ponies can consume 1% of their BWT within 3 hours (Longland *et al* 2016)
- Are ponies less satiated overall?





Is there within-breed individual variation in food motivation?

- Icelandic horses in the UK
- 35% reported as overweight, 2% as obese
- 60% reported a propensity to put on weight
- **72% reported highly motivated by food**
  - An opportunity to identify genetic drivers of appetite/food motivation?

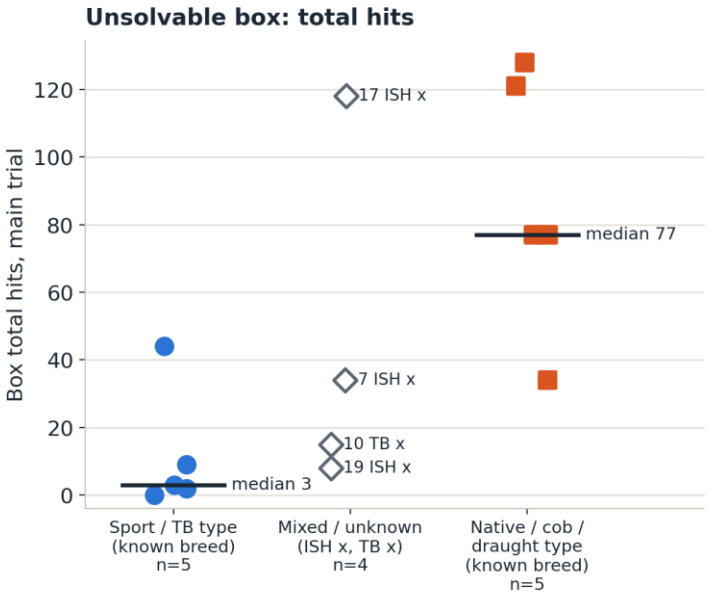
(Unpublished Nielson *et al*)

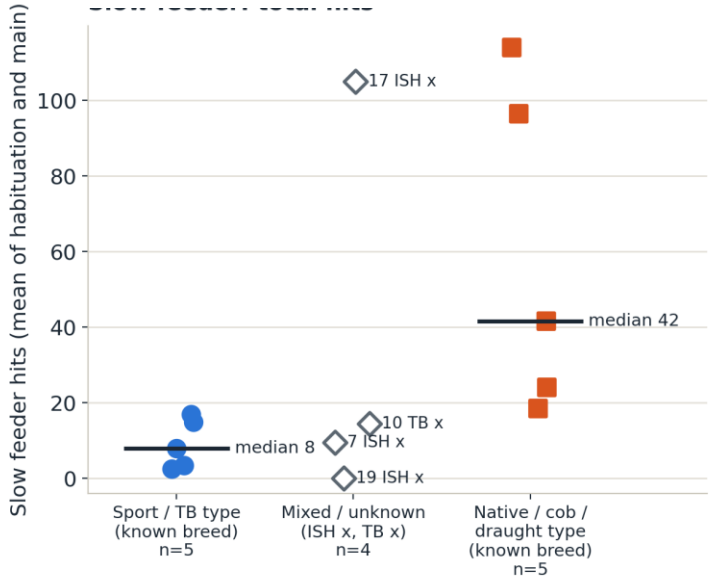


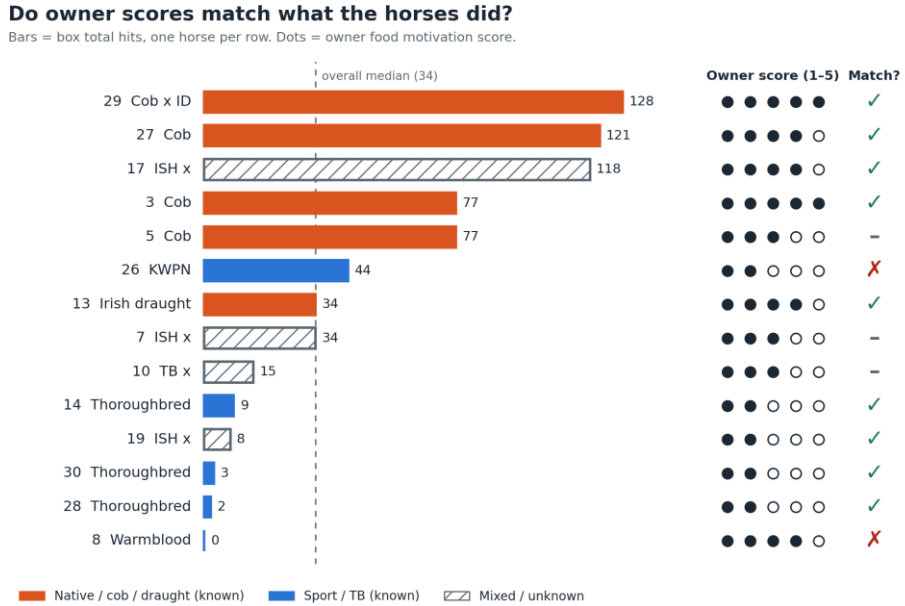
Can we measure food motivation in horses?













Unpublished data: Chloe Campbell

The livery yard in equine obesity: an obesogenic environment

Hidden in Plain Sight: Uncovering the Obesogenic Environment Surrounding the UK's Leisure Horses

Tamzin Furtado, Elizabeth Perkins, Gina Pinchbeck, Cathy McGowan, Francine Watkins & Robert Christley



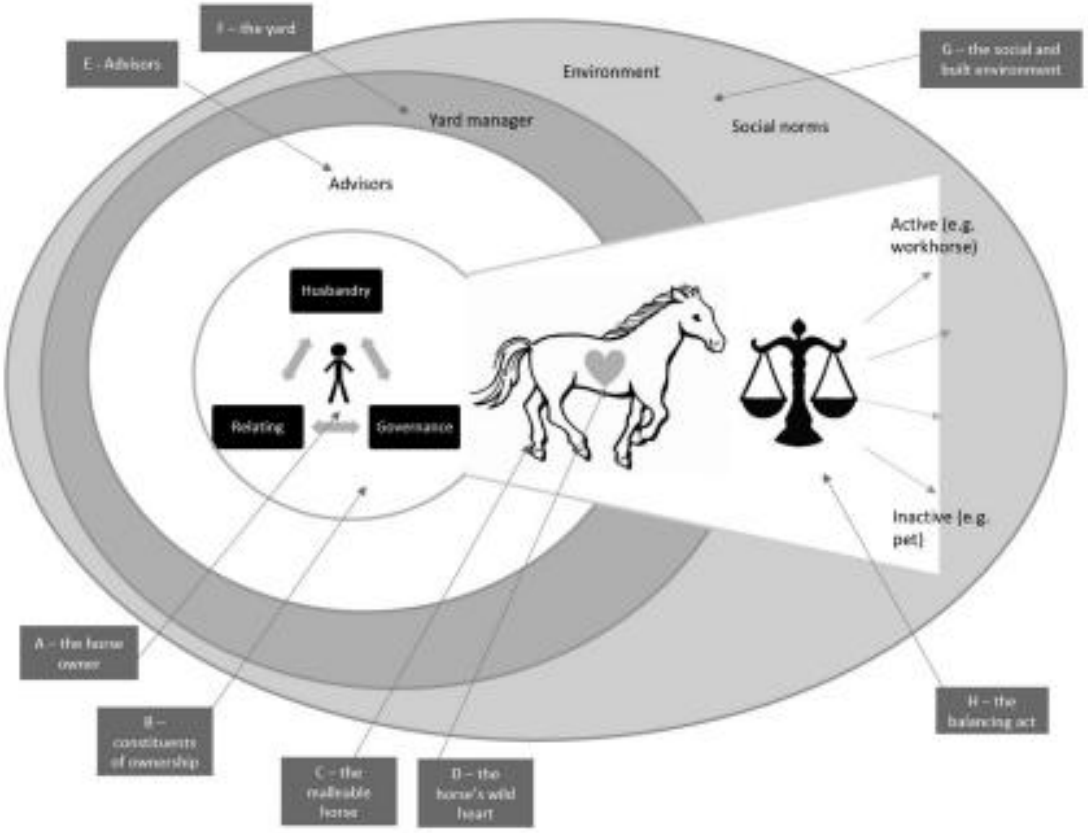


Figure 1. Conceptual model of the equestrian lifeworld of the horse owner, showing how the owner influences their horse and is simultaneously influenced by others.

The livery yard: veterinary perspectives

- How do vets communicate with owners about equine obesity and what do they think the barriers are?

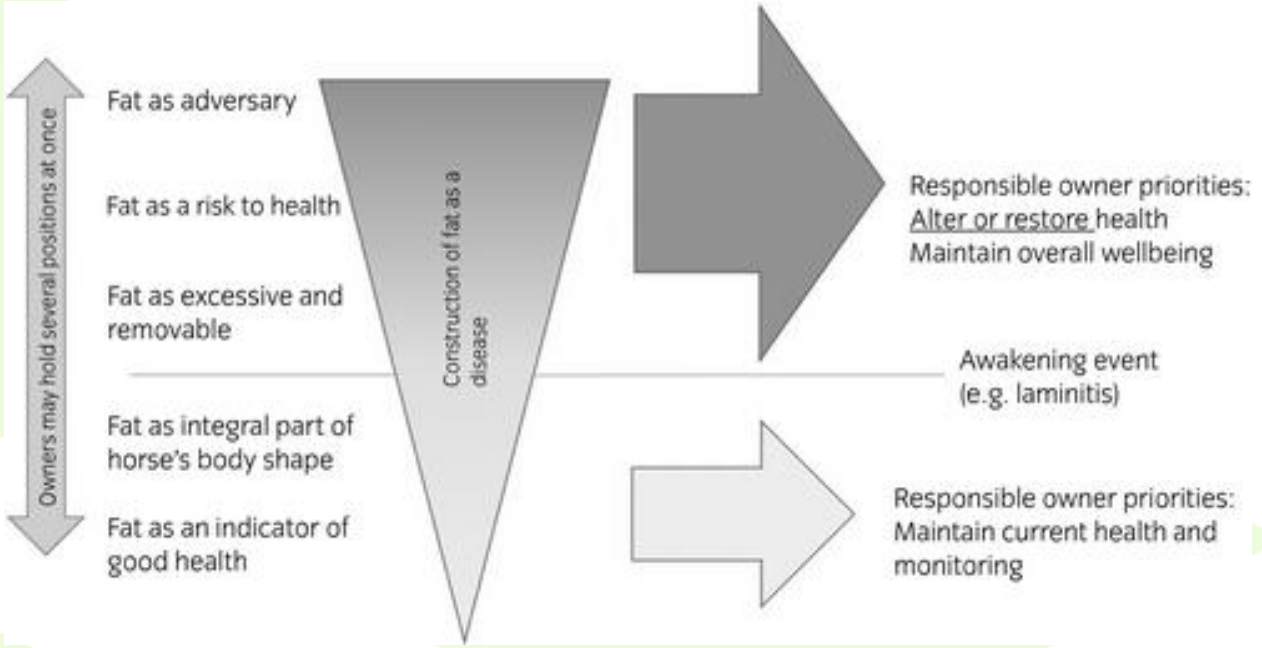
- Livery yards described by vets as a significant barrier to implementation of weight management
  - Social pressure
  - Lack of control
  - Grazing availability





Unpublished data

Cultural attitudes to equine weight



Equine Veterinary Journal BEVA

GENERAL ARTICLE Open Access

Exploring horse owners' understanding of obese body condition and weight management in UK leisure horses

Tamzin Furtado, Elizabeth Perkins, Gina Pinchbeck, Catherine McGowan, Francine Watkins, Robert Christley

First published: 01 October 2020 | https://doi.org/10.1111/evj.13360 | VIEW METRICS

- Vets described the world of showing as a major contributor to obesity and barrier to weight management
- *"I'll just roll my eyeballs 33 times around my eye sockets.[…..] fat horses are still rewarded in the show ring. Yeah, by judges who should know better, but they're training the younger judges to accept that as normal, and so the cycle shall continue." (Participant 1)*



Supplementary feeding over winter

- Weight gain in winter months
- Supplementation with ad lib forage on pastures
- Rugging
- Reduced movement
- Reduced exercise



Is straw supplementation a good solution?

- 50% supplementation
- On top or mixed through
- Type of straw?
- Palatability
- Choice



SHORT COMMUNICATION

Inducing weight loss in native ponies: is straw a viable alternative to hay?

Miranda Carlotta Maria Dosi ,[1] Roxane Kirton,[2] Sarah Hallsworth,[2] John A Keen,[3] Ruth Anna Morgan[4,5]

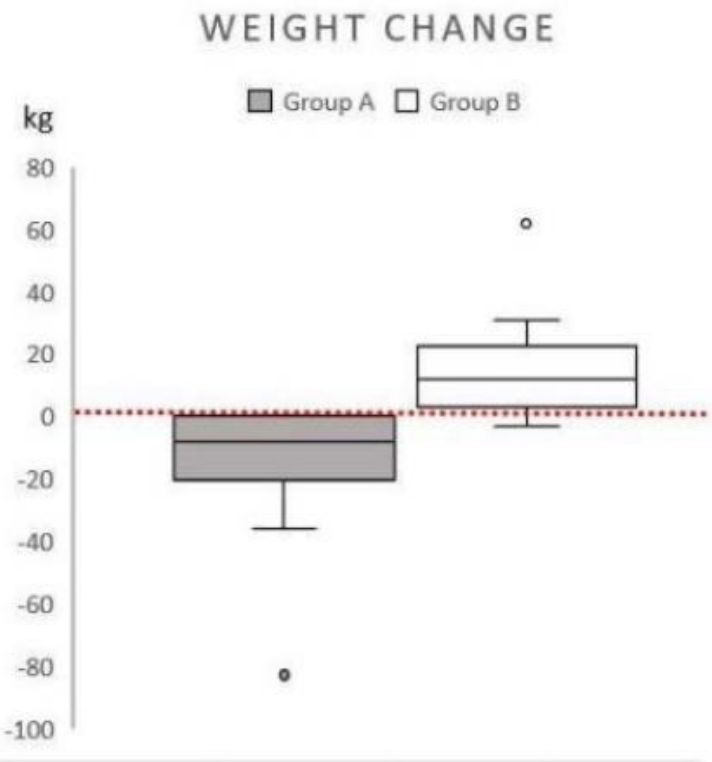


Figure 1 Box plot showing change in weight for group A (straw) and group B (hay) over the study period. It is evident that all the subjects in group A lost weight and sit therefore below the red dotted line, which indicates no change in weight. Conversely, 80 per cent of the ponies in group B sit above this line.

Challenges in equine obesity: How do we define obesity?

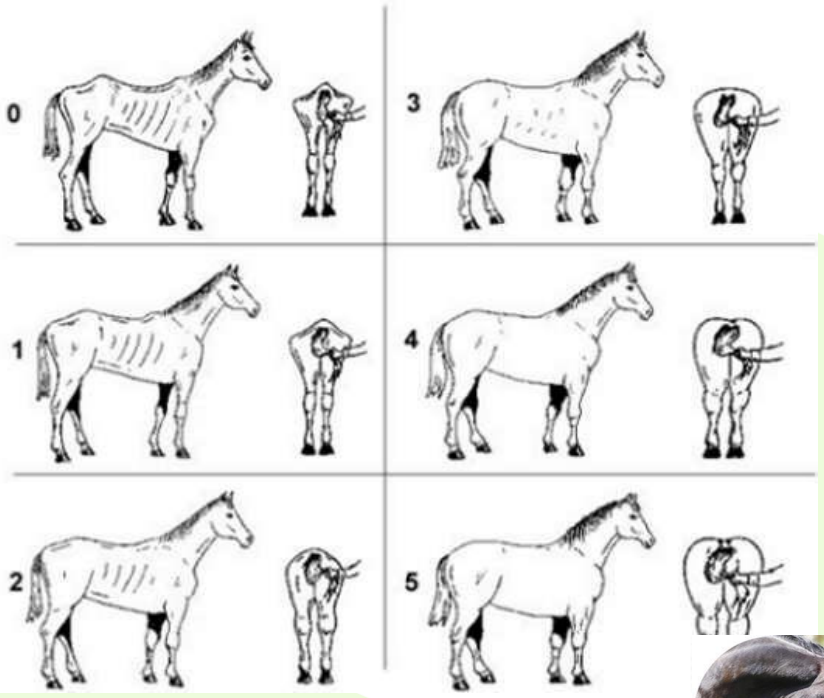
- Obesity is defined **as abnormal or excessive fat accumulation that presents a risk to health** (WHO)



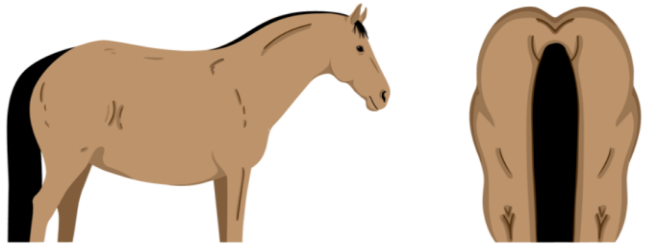
- When does fat accumulation present a risk to health in horses?
  - Probably dependent on other factors: chronicity, genetic susceptibility to metabolic disease or laminitis, age, level of work and concurrent disorders

Body condition scoring

0-5



5 – very unhealthy (obese)



The horses' neck is wide, and a large firm crest where hard fat has formed along the neck. Ribs can't be seen or felt, and the horse appears to have a 'flat' back. You may notice large pockets of fat forming across the body. The point of hip and pelvis can no longer be felt, and a deep gutter has formed along the length of the spine with a definite 'M' shape being seen.



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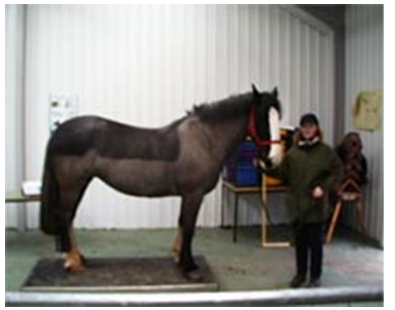
World Horse Welfare

ROSLIN

Body Condition Scoring: what does it mean?

- Assesses **SUBCUTAENOUS** fat cover in key areas: neck, withers, behind the shoulder, ribs, loin, and tailhead.
- Limitations; breed, shape, owner/vet perception of breed standard
  - Henneke 9-point scale
    - 1 = emaciated
    - 5 = moderate/ideal
    - 9 = extremely obese
- **A BCS of ≥7/9 is considered obese (20% body fat) (Dugdale et al 2011a, 2012)**

What do we tell owners?
BCS 7/9 = 20% body fat
500kg horse = 100kg of fat

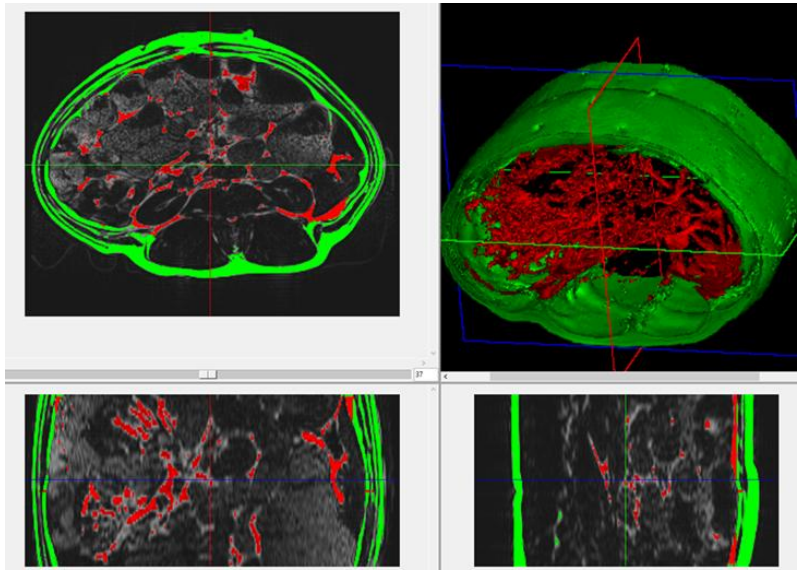






Are we measuring the right fat?

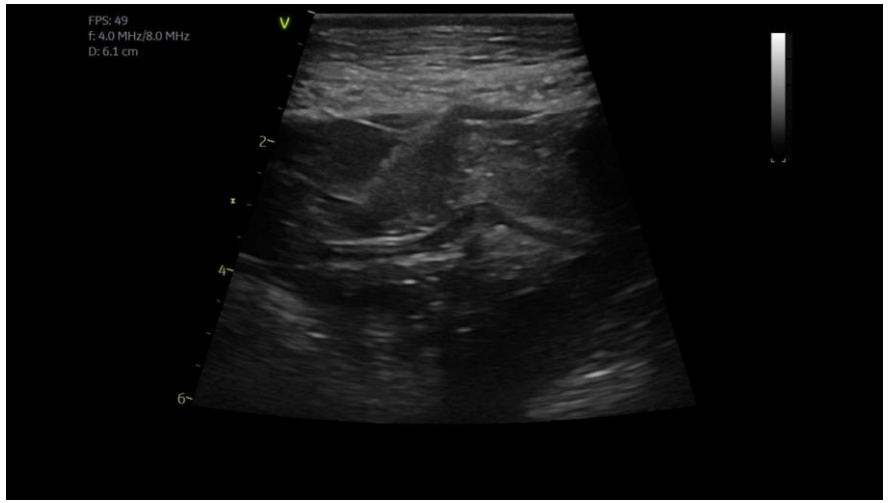
- **Subcutaneous v Visceral Adipose tissue**
- Hyperplasia v hypertrophic capacity (Bruynsteen et al 2013)
- Inflammatory phenotype
- Adipokine/Adipocytokine release



- **Thin on the Outside Fat on the Inside** (TOFI)

(Thomas et al., 2012)

- Metabolic disease without apparent subcutaneous adiposity, consider ultrasound measurements of intra-abdomInal fat



Abdominal Ultrasound

- Peritoneal area, any old US will do
- Can be used to measure “internal” fat thickness
- Tackling TOFIs
- Getting owners on board
- There aren’t any “reference ranges”, use your judgement, if it looks a lot it’s probably too much!

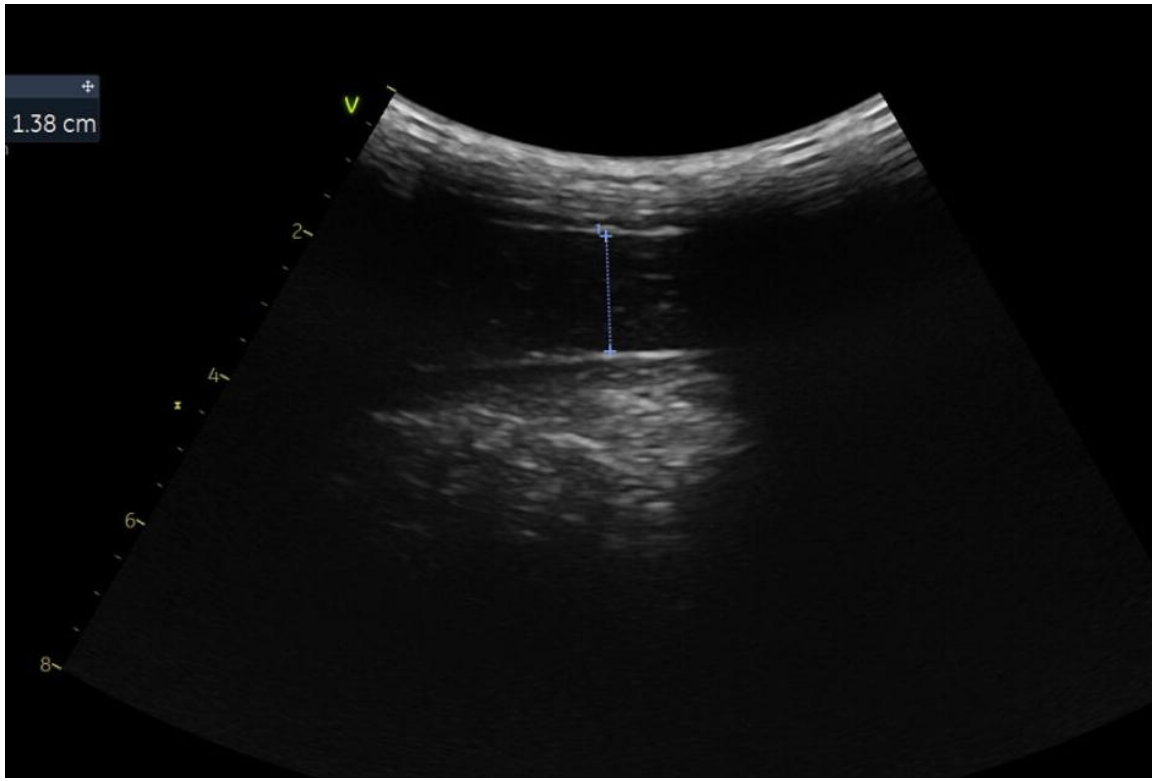


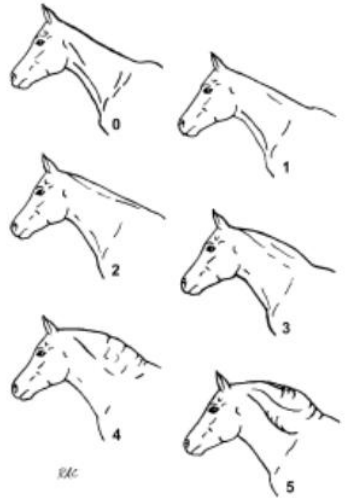


Figure 8. Ultrasonograph of the ventral abdomen showing an increased depth of subcutaneous adipose tissue.

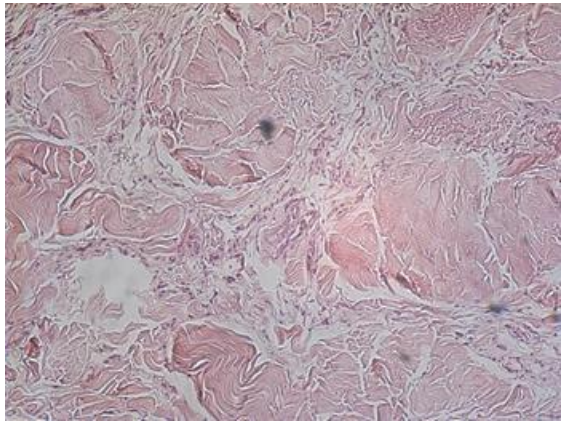
Cresty neck score; what does it tell us?

- Evaluates fat accumulation along the nuchal ligament (top of the neck)
- Uses a 0–5 scale:
  - 0 = no crest
  - 3 = large, firm crest
  - 5 = huge, drooping crest
- A score of ≥3 may indicate regional adiposity and risk of insulin dysregulation/laminitis
- What are we measuring?

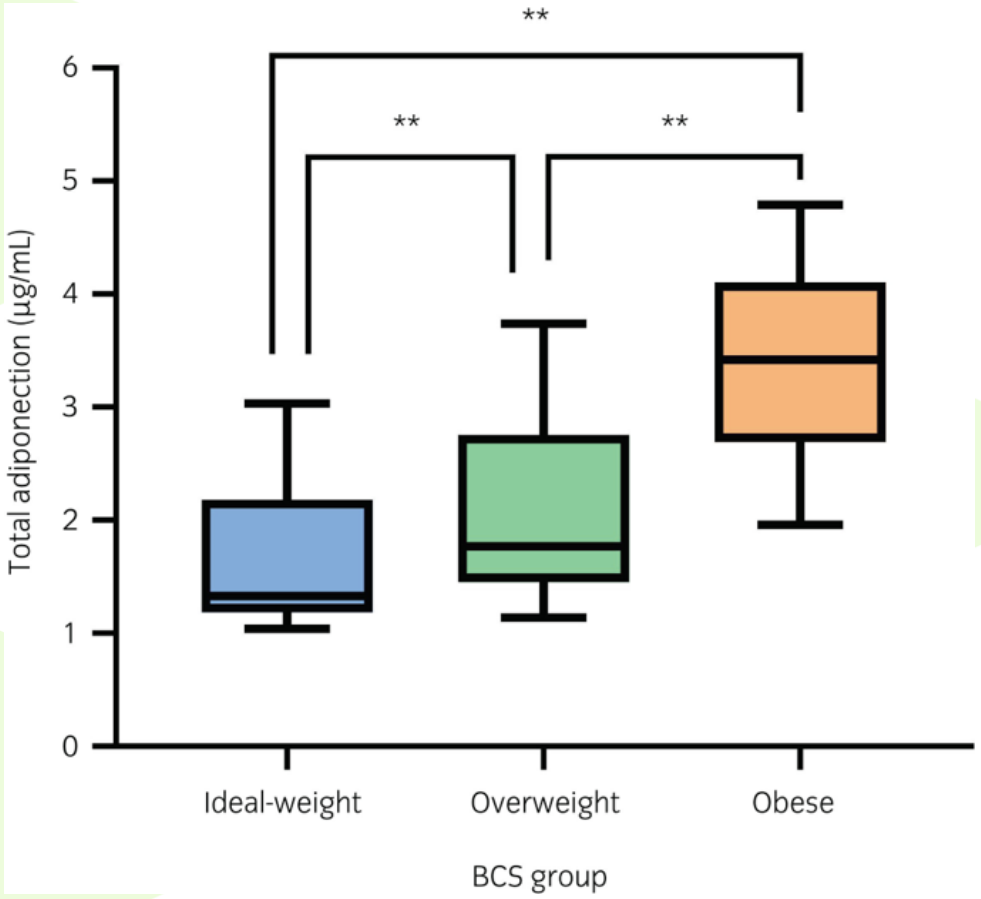








Adiponectin; what does it add?

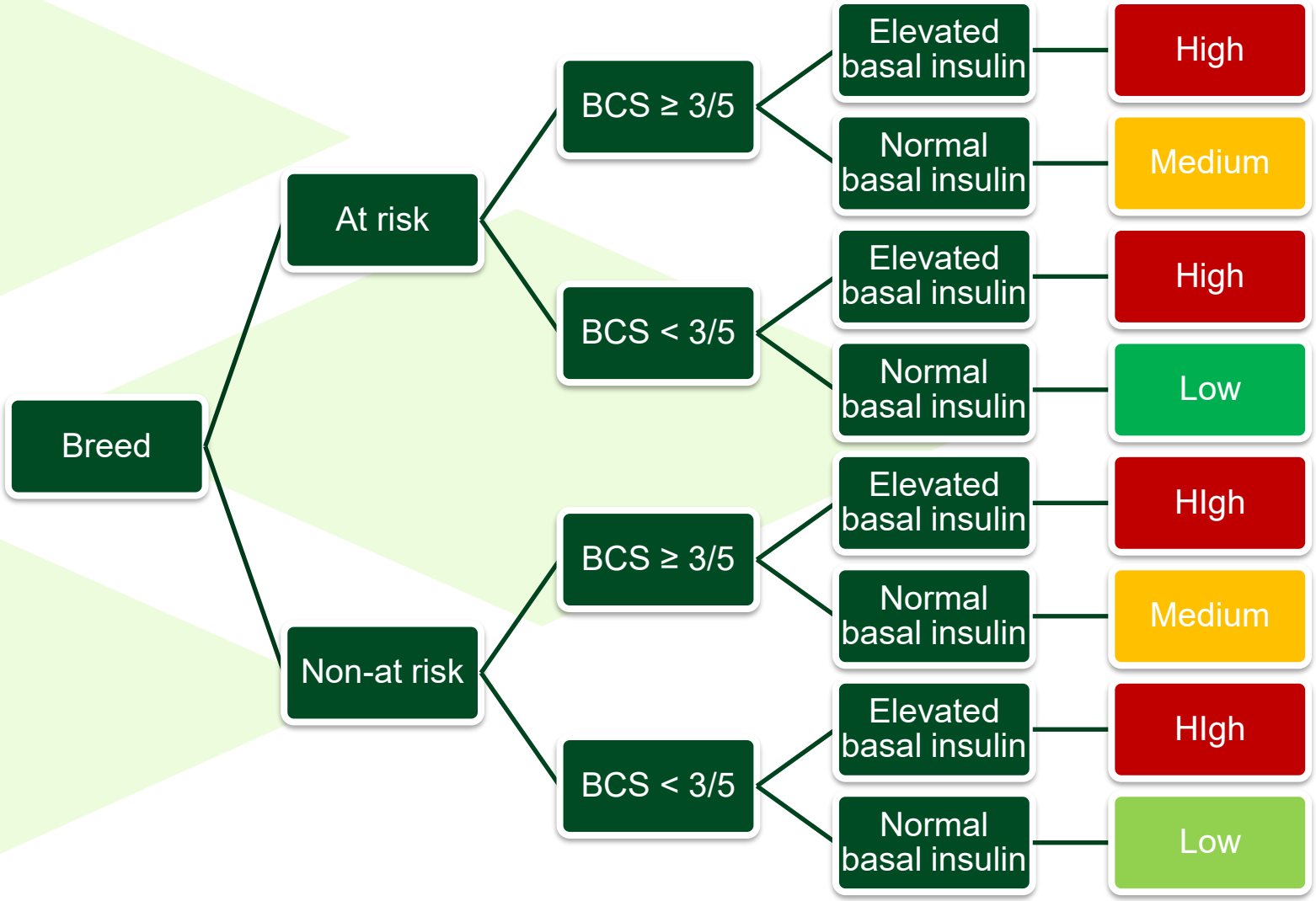




When does fat accumulation pose a risk to health in horses?

Objective measures of risk to health	Subjective assessment of risk to health
At risk breed	At risk breed
Endocrinopathic laminitis	The weight of the horse appears to be affecting mobility
Abnormal measures of insulin, glucose or triglyceride dynamics	The weight of the horse appears to be exacerbating another condition e.g. respiratory or orthopaedic

An example of herd risk analysis

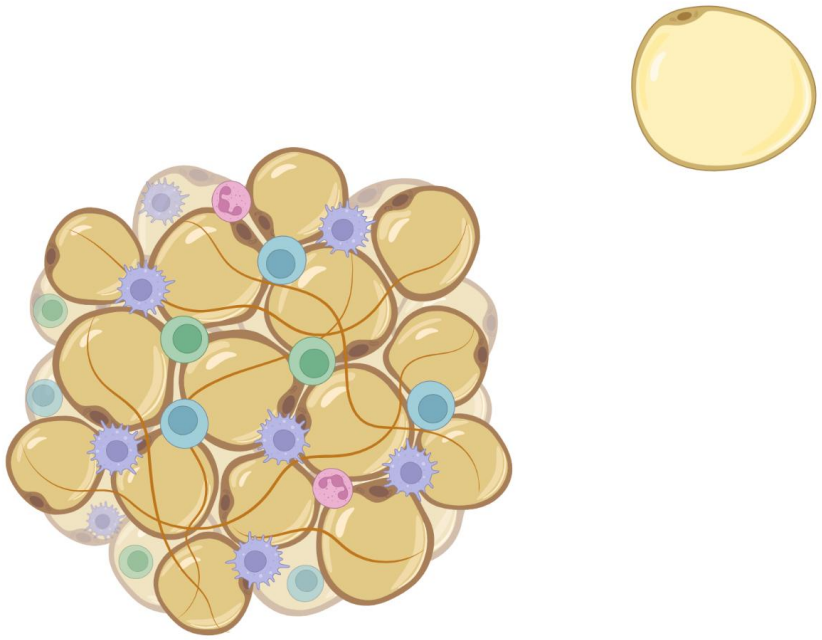


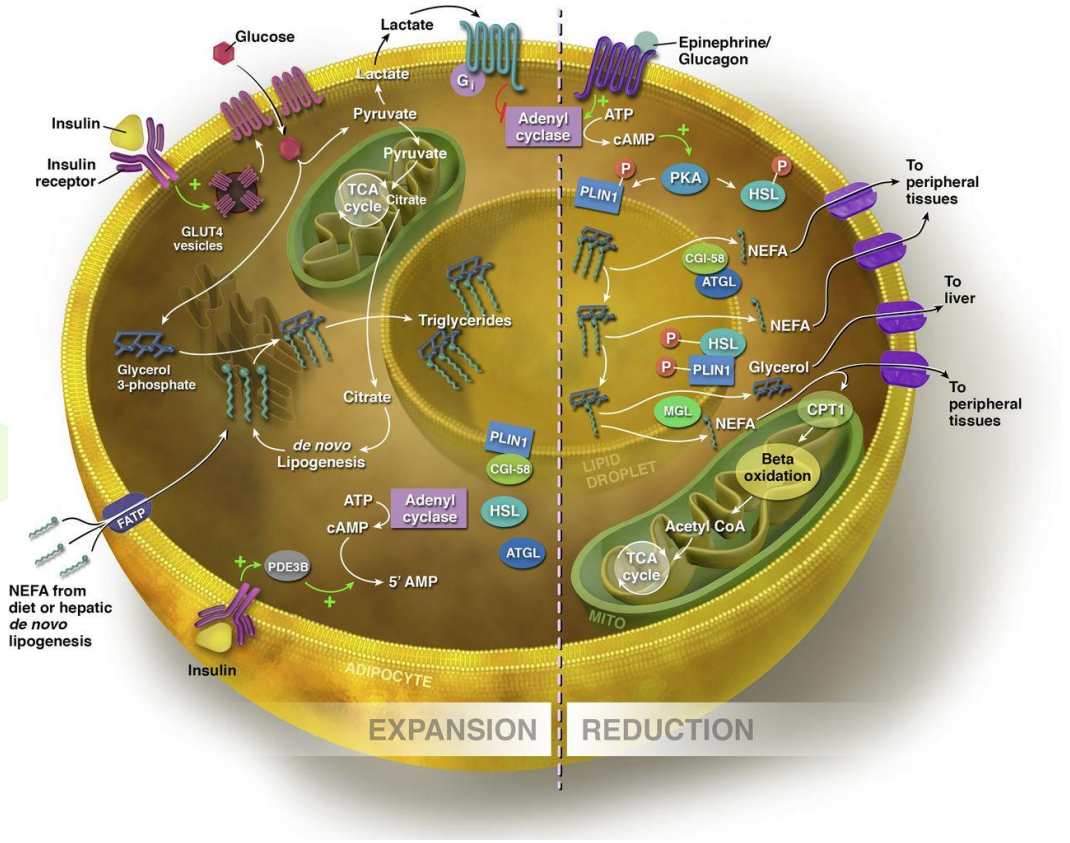
Laminitis promoted any animal to red

Adipose tissue

Adipose tissue: adipocytes, blood vessels, immune cells and extracellular matrix

- Adipose is essential for health



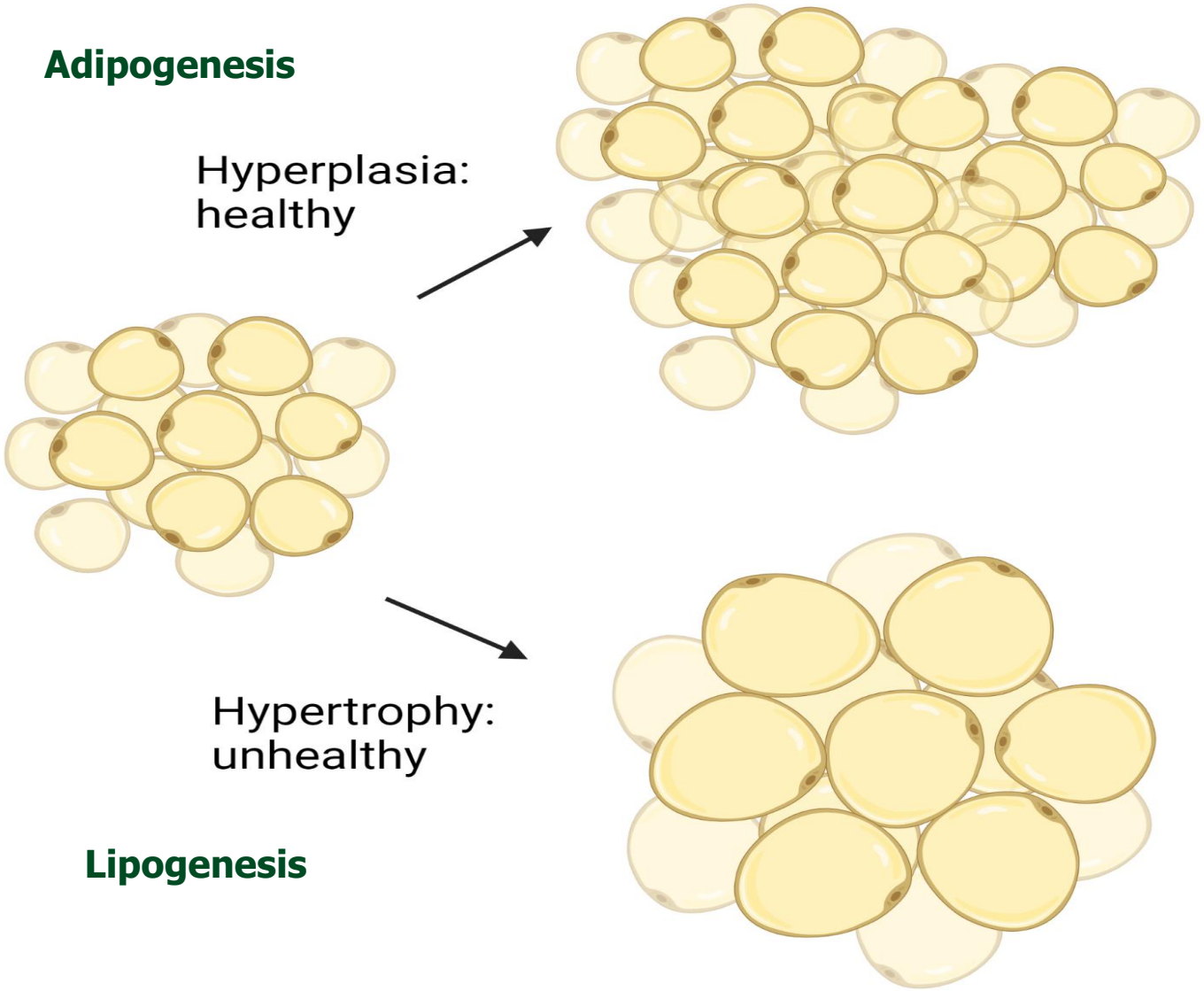


Joseph M. Rutkowski et al. J Cell Biol 2015;208:501-512

Adipose growth

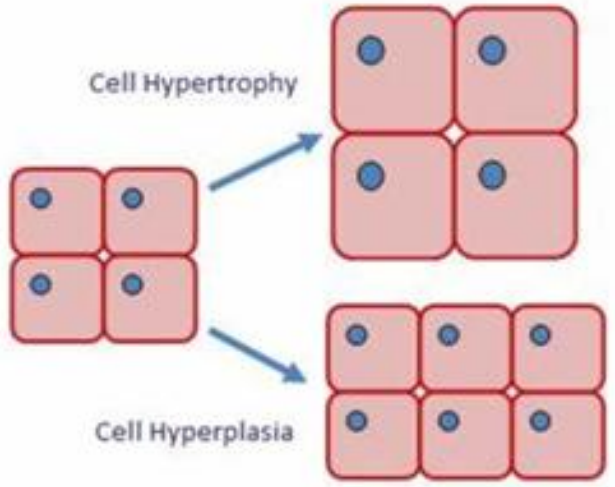
Adipogenesis

Hyperplasia:
healthy



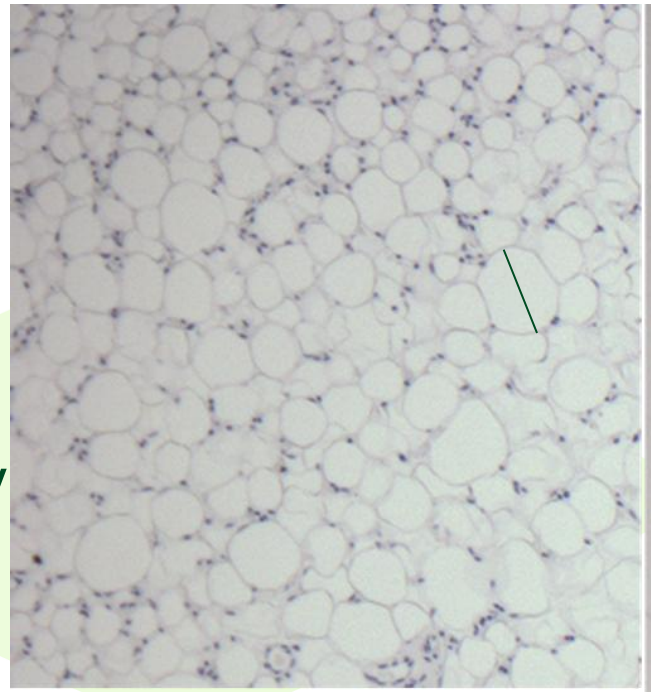
Hypertrophy:
unhealthy

Lipogenesis

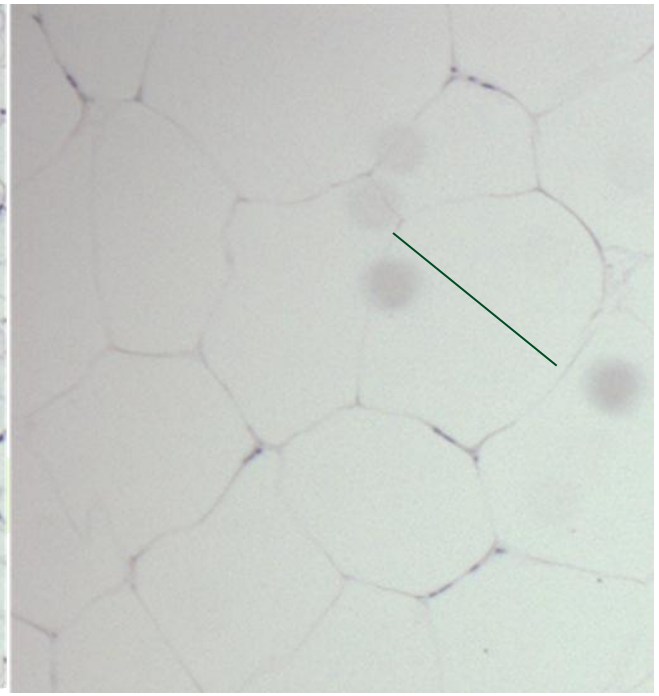


Adipocytes in equine obesity

Healthy



Lean horse



Obese horse

Unhealthy

The adipose tissue starts to out-grow its blood supply, become inflamed and resistant to the effects of insulin = unhealthy adipose tissue

Equine Veterinary Journal BEVA

General Article Open Access

Adipose tissue dysfunction in obese horses with equine metabolic syndrome

A. Reynolds, J. A. Keen, T. Fordham, R. A. Morgan

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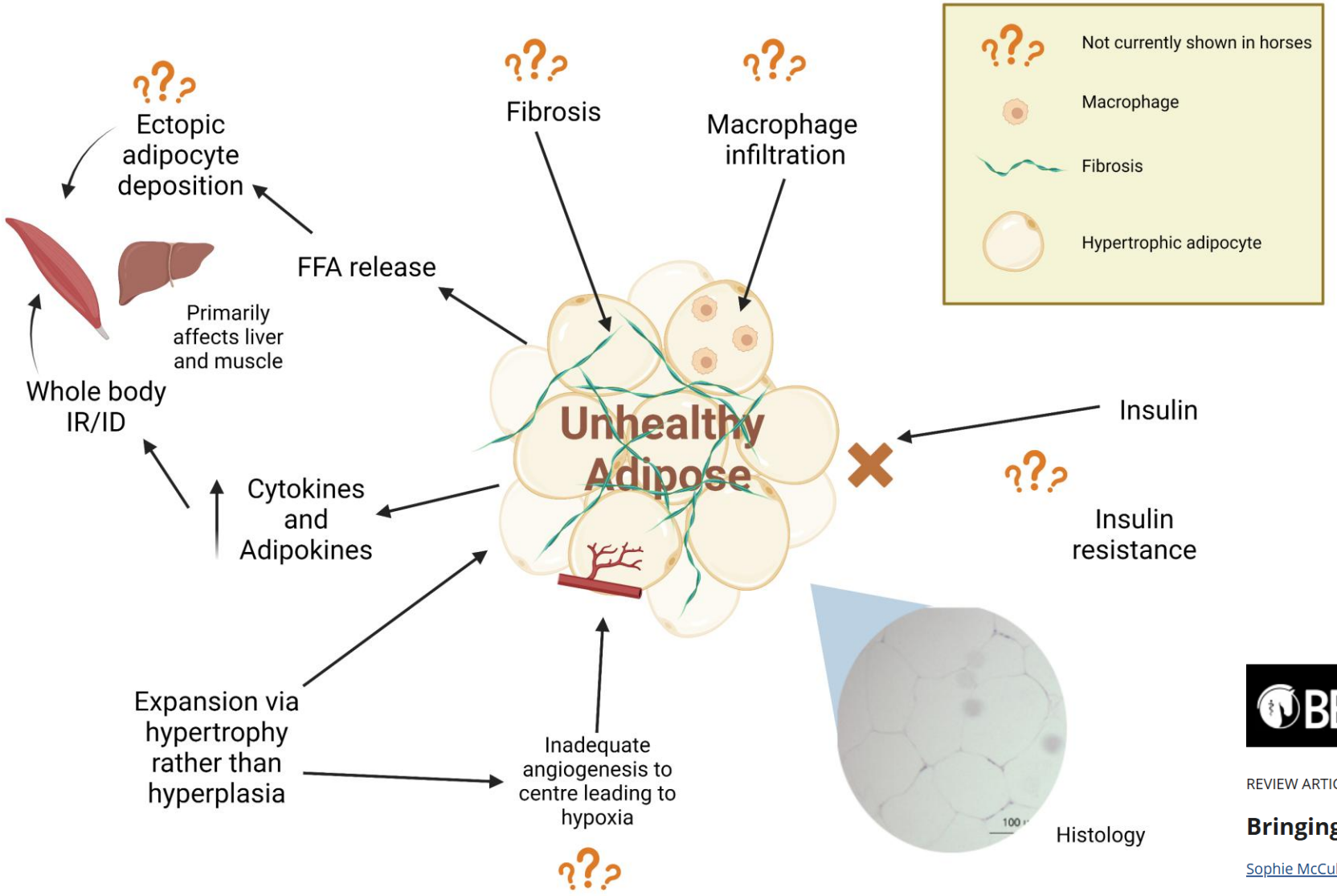
When does accumulation of adipose impair health?



BEVA AAEP Equine Veterinary Education

REVIEW ARTICLE Open Access

Bringing equine adipose tissue into focus

Sophie McCullagh, John Keen, Miranda Dosi, Ruth Morgan

Challenge: How can we balance weight loss and welfare?

- Is calorific restriction inherently stressful?
- Are we restricting horses with high food motivation?

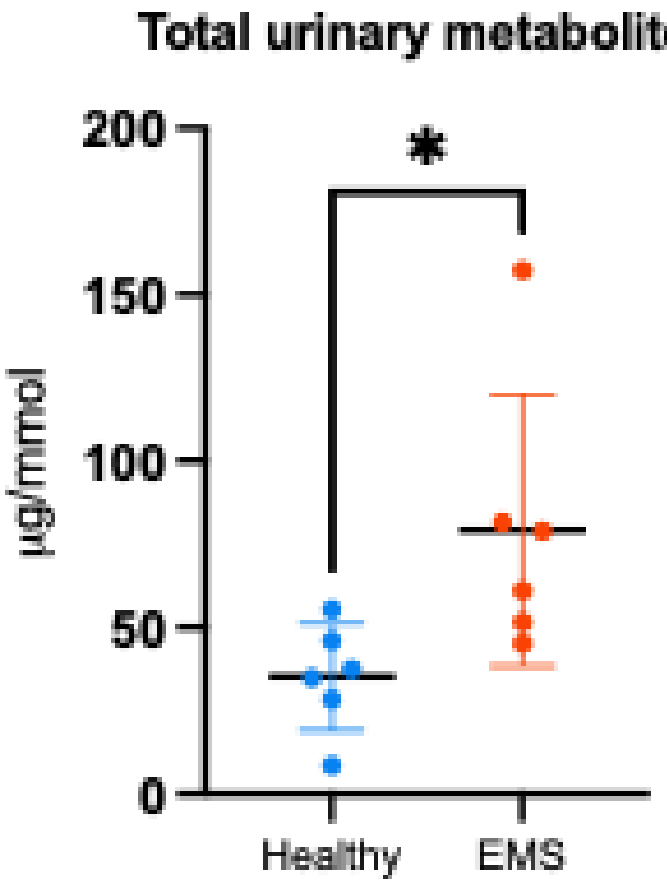
- Does the weight loss management allow the horse to demonstrate normal behaviour, have social interaction and minimise frustration/boredom?

- Friends, forage, freedom?



HPA activation in obesity

- The HPA axis is activated in obese horses
- Does this increase the likelihood of insulin resistance and laminitis?
- Care not to introduce weight loss regimes which contribute further to HPA activation and have counter-productive effects on laminitic risk



Unpublished data

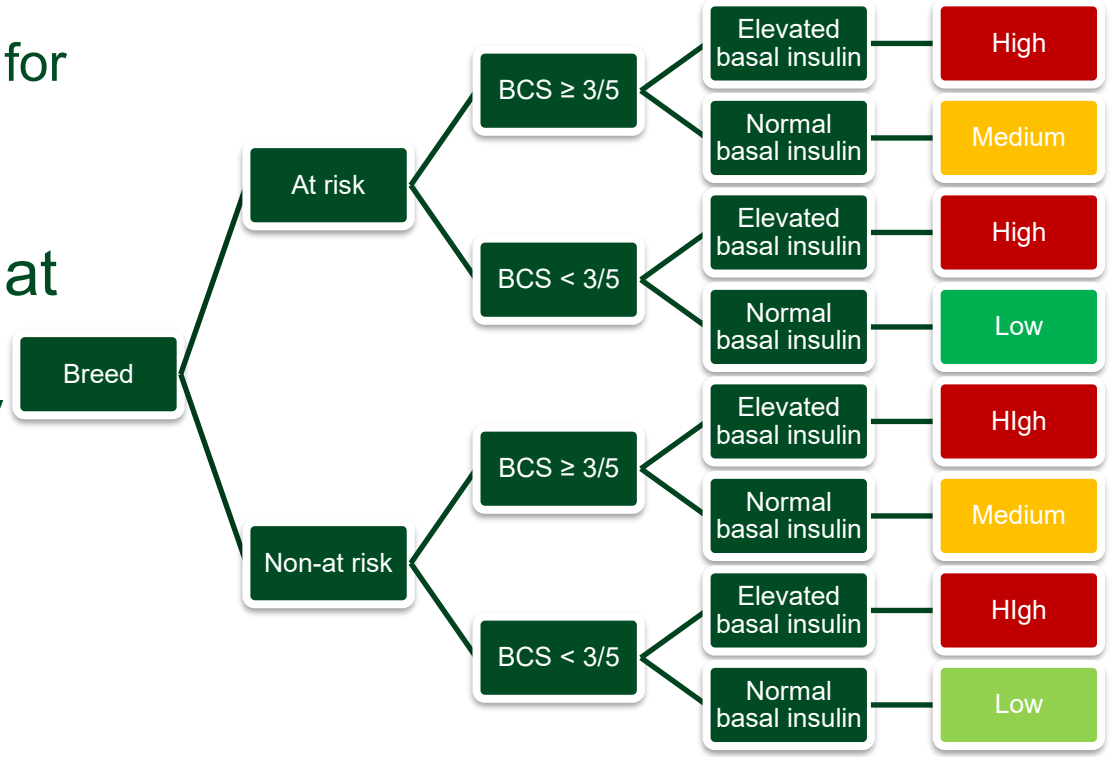


Stress activated laminitic episodes; anecdote

- Tracing laminitic episodes and basal insulin measurements in a herd of susceptible ponies;
  - Hyperinsulinaemia and laminitic episodes peaked around times of stress e.g. bringing the animals in for worming, vaccinating, foot trimming

- All RED at-risk horses onto a woodchip area at least 3 days prior to a stressful event with companions and enrichment, fed soaked hay only and did this for 3 days-1 week after the event.

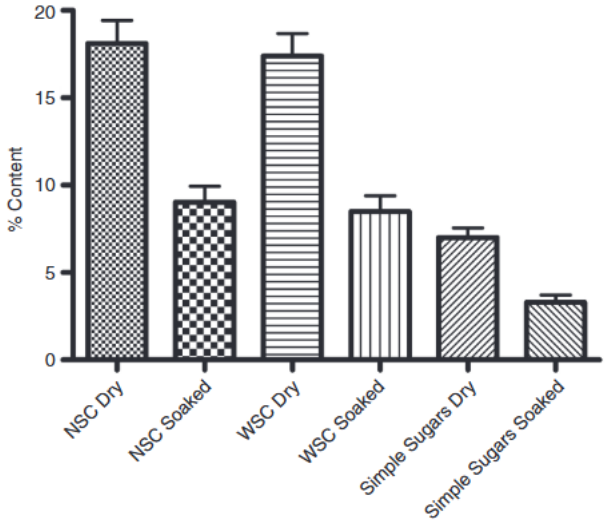
- No further laminitic episodes associated with these events, we continue to monitor.



Challenge: Stabled horses

- How much should we restrict?
- Balance intake and boredom;
- Reducing calorie density of the food and increasing time taken to eat it
- Owner concern over gastric ulcers

- Soaking hay
  - Practical challenges especially in the winter
  - Balancer requirements
- Some things UK owners try
  - Horse balls
  - Double haynets, small hole haynets
  - Apple bobbing
  - Hay through bed
  - Slow feeders
  - Straw



Impact of water-soaking on the nutrient composition of UK hays

S. J. Mack, A. H. Dugdale, C. McG. Argo, R. A. Morgan, C. M. McGowan



Challenge: Sustainable long term management

- Grass is not the enemy
- Owner perceived risk of sand colic on bare pastures
- Managing different horses in the same conditions
- Grazing muzzles
  - Davis *et al* 2020; a small reduction in allogrooming but not increase in aggressive rank or change in salivary cortisol
  - Owner perceptions





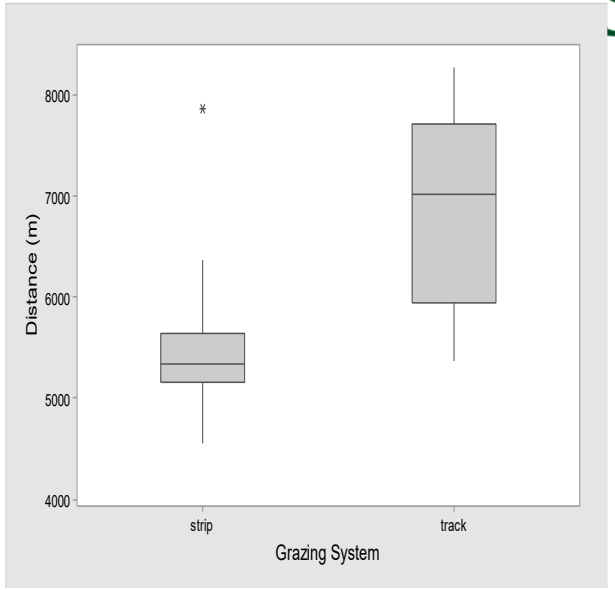
Strip Grazing v Trackway systems

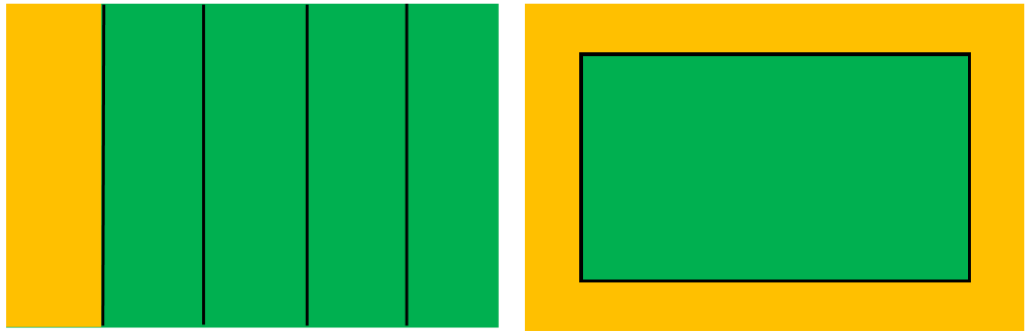
ORIGINAL ARTICLE

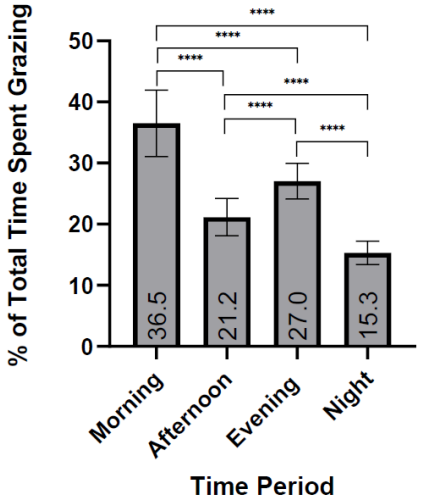
Equine Veterinary Journal WILEY

The impact of restricted grazing systems on the behaviour and welfare of ponies

Roxane Kirton[1,2] | Imogen Sandford[3] | Eleanor Raffan[3] | Sarah Hallsworth[1] | Oliver H. P. Burman[2] | Ruth Morgan[4,5]







- Increased movement on the trackway system
- Increased overt agonistic behaviour on the strip system

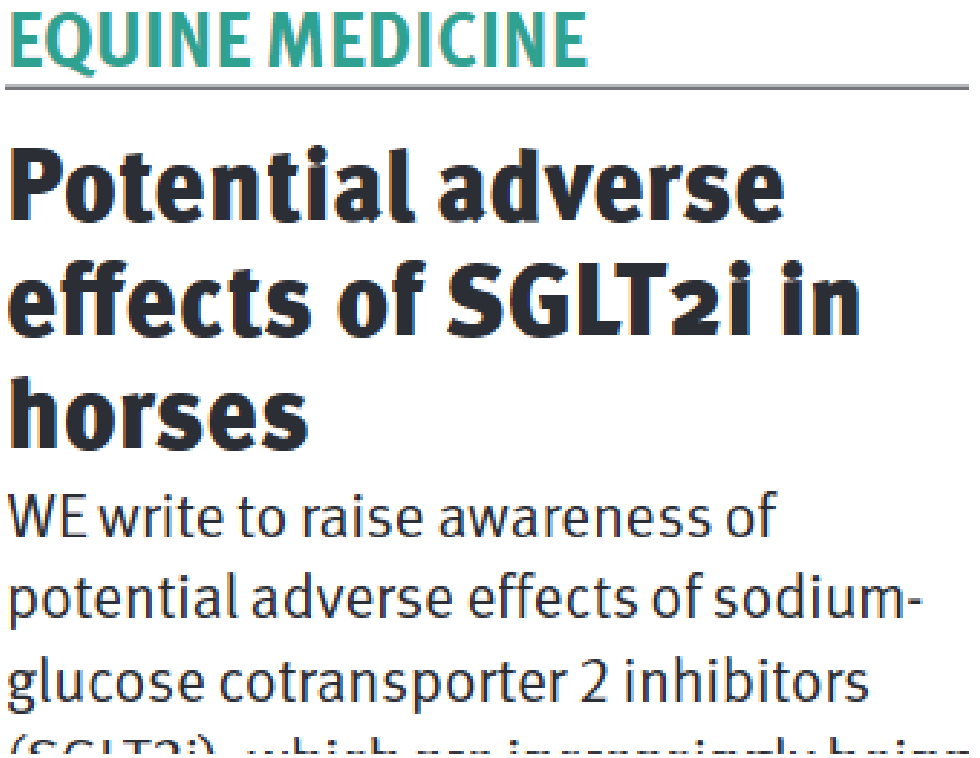
Sodium-glucose cotransporter-2 (SGLT2) inhibitors

- Act on the proximal renal tubules, inhibiting glucose reabsorption and increasing urinary glucose excretion (glucosuria).
- This results in urinary calorie loss, which can reduce insulin secretion and induce weight loss.
- Ertugliflozin: A retrospective case series involving 51 horses demonstrated reductions in insulin concentrations following 30 days of treatment
- Velagliflozin: first licenced drug in the UK (not EU)



Concerns over SGLT2 inhibitor use

- Hyperlipaemia and hepatic lipidosis
  - Increased serum triglycerides very common in treated horses
- Poor quality of evidence and lack of safety data
- Owner compliance to dietary advice
- Cost



EQUINE MEDICINE

Potential adverse effects of SGLT2i in horses

WE write to raise awareness of potential adverse effects of sodium-glucose cotransporter 2 inhibitors

Take home messages…

- Horses and ponies in the UK are at high risk of developing obesity
- Some of this risk is genetic but much of it is due to management and use
- There are many obesity challenges in the UK (and everywhere)
- Obesity management is not without risk to health and welfare
- **Friends, forage, freedom**

Thank you for listening!

