

# Fermented wheat germ extract effect study on horse behaviour

Malcolm Weetman, Tony Davies, Rosemary Brown, Max Murray, Patrick Pollock and David Sutton on the findings of a six-year study.

David Sutton, Malcolm Weetman, Max Murray, Patrick Pollock, Rosemary Brown, Tony Davies

VT48.09 | March 05, 2018 **Times**<sup>veterinary</sup>



**In VT46.18, Weetman et al (2016) wrote an account of the amelioration of suboptimal behaviour in mares during oestrus by oral administration of a fermented wheat germ extract (FWGE) eCalm, which, according to the authors, is a beneficial, non-toxic natural preparation that is simple to administer along with other feed.**

This article records the outcome of testing its utility over a six-year period in a mixed-use equine stable with, from time to time, animals being retired, sold off or bought in. Such a scenario is not ideal for controlled study conditions, nevertheless, it does represent what happens in a standard commercial stable setting.

Mares with behavioural problems clearly associated with periods of ovulation in the spring, summer and early autumn months (“oestrus” mares) were explored by an extensive series of open case studies with periods of deprivation as controls in addition to using unfermented wheat germ as a placebo.

This study (Weetman et al, 2016) showed, without exception, including FWGE in the daily feed reliably reduced fractious behaviour. A total of 190 oestrus periods were studied over a three-year period using the product therapeutically and prophylactically including deprivation crossover methodology.

Broadly, the method adopted with oestrus mares seemed an appropriate model for a study of geldings and mares with poor behaviour not associated with oestrous cycling. It also emerged during the latest study a considerable number of the animals investigated had co-morbidities in addition to the behavioural problem. These conditions, including recurrent low grade colic, poor weight maintenance, several skin conditions and hoof problems, designated by stable staff as a laminitic condition, in addition to improvement of behaviour, were also affected by administration of FWGE. A preliminary account is given here of these other conditions as it seems likely they were causally associated with the difficulties of management, which led to the inclusion of animals in the study in the first instance.

## Materials and methods



William, a 13-year-old gelding Irish show horse, 18 hands high. He had recurrent colic, was grumpy, wall kicking and had a poor appetite. After being fed fermented wheat germ extract, co-author Rosemary Brown reported: “No more colic episodes, better behaved, better appetite, gained weight and better performance.”

Over a four-year period, 66 geldings and 25 mares, with behavioural problems not causally associated with oestrus, were given FWGE as part of their standard daily evening-fed diet using, as previously, a weight-adjusted feed addition approximating to one part per thousand parts of feed on a dry weight basis. This meant small horses (about 350kg bodyweight) received 15g per day, medium-sized animals (about 500kg) 20g per day and larger animals (about 750kg) 25g per day. In all instances, the prime criterion for feed intervention was what the stable staff referred to generically as “bad behaviour”.

The impact on behaviour was recorded. This was an open case controlled study and, as with the oestrus mares, some instances of deprivation of treatment was used as a control. The ages of the animals ranged from 2 to 35 years and involved riding school, hacking and jumping, dressage and eventing horses. The duration of treatment periods varied, but was largely determined by how long it took for the restoration of normal behaviour.

The majority of animals (74/91) selected for inclusion in the study, as a consequence of poor behaviour, were also recorded as suffering during the six-year period of observation from a variety of common ailments, such as poor appetite, difficulty in retaining weight, low grade recurrent colic and hoof problems apparent in the spring as the animals spent more time on pasture. Coat and skin condition were also noted. These incidental observations are recorded in outline, not as the outcome of fully quantified trials, but because they give possible indications of some of the causes of bad behaviour and, in a preliminary manner, point to some ways in which change can be effected.

The study was undertaken in the conditions prevailing in a working stable. No particular numbers of animals were targeted, only those animals in the stables deemed by their carers as appropriate for intervention on account of poor behaviour were included.

Behavioural problems were initially recorded on paper in the terms used by the animal carers as, aggression, anxious, biting, grumpy, tense, ears back, bucking, easily spooked, difficult to mount, nervous, and excited when ridden, squealing, squirting, weaving, wind-sucking, fence refusals and unwilling to work. These terms are all widely used and easily understood, but not readily quantified.

For this study, therefore, as had been done previously (Weetman et al, 2016), a semi-quantitative composite behaviour score (BS) of 1 to 5 was adopted with categories as follows:

1. Good behaviour.
2. Mildly bad behaviour.
3. Moderately bad behaviour.
4. Severely bad behaviour.
5. Very severe bad behaviour with significant and often dangerous handling problems.

The scores made were solely the opinion of the handler(s). This system had previously been found reliable and lends itself to statistical analysis, which was effected using paired dependent tests comparing the mean BS before and after feeding with FWGE. As it emerged, scores of 1 and 2 describe the behaviour of the majority of animals regarded as having normal behaviour, and 4 and 5 define the category of poor/bad behaviour.

Daily determination of behaviour was made in the study of horses with only behavioural problems and with colic in addition to behavioural problems. Behaviour in horses with laminitis, poor weight maintenance and skin conditions – which were selected for study on the grounds of their poor behaviour, but which proved to have other conditions – were scored simply when taken into the study as badly behaved with scores of 4 or 5, and at the end with scores in the more normal 1 to 2 range.

## Results

The results are presented in relation to behaviour and, in addition, in outline in relation to other associated findings including:

- poor appetite and capacity to achieve and maintain a good working weight
- recurrent colic and gastric ulceration
- hoof problems
- coat and skin condition

Over the six-year period of study, 17/91 of the animals (10 geldings and 7 mares) at the time they were scored for the beneficial effect of FWGE on behaviour, had no other clinical symptoms that accounted for their bad behaviour. The remaining animals had, from time to time, poor weight maintenance, mild recurrent colic, hoof or skin problems. Complete case histories for each animal were kept, but these offer too much information for the present paper.

## Behaviour



Breckenridge, a seven-year-old warmblood gelding, 17.2 hands high. He was quirky to handle, suspicious of people, spooky in warm-up areas and tense when jumping. After treatment with fermented wheat germ extract, rider Kirsty Aird said: “At the Royal Highland Show he was checking out the planes at Edinburgh Airport then a double clear in another newcomers and placed. Dare I say, I think the water tray fear is cured.” Image: © Sinclair Photography

The initial effects of the use of FWGE were followed on 17 animals, 10 geldings and 7 mares – all of which had high behavioural scores. These initial cases had no other obvious clinical problems. The various descriptions of the bad behaviour included kicking the stable door, sharp and spooky, difficult to mount, nervous and excited when ridden, wind-sucking, uptight and spooky when ridden, grumpy, biting, ears back, tense and unwilling to work.

The mean BS of these 17 animals prior to intervention was 4.4+/-0.6. After feeding the product, the majority of the animals had improved BS within one to two weeks, although four horses, two geldings and two mares, took four to six weeks. In all 17 animals the various signs of bad behaviour improved to what could be considered “normal” levels. After feeding with FWGE the

mean BS was 1.7+/-0.5. The differences between the mean BS before and after intervention were statistically significant, (P<0.008).

## Colic

In the present study, over the six-year period of study, 33 horses, (5 mares and 28 geldings) were reported by the stable staff to have, in addition to bad behaviour, recurrent low grade colic not deemed on veterinary advice to require further intervention. The colic was defined by such clinical signs, as kicking at belly, flank watching, restlessness, tail swishing, sweating, tachypnoea, rolling eyes, wanting to lie down and unwillingness to have the girth tightened.

The average behaviour score of these animals at the time the colic was recognised was 4.6+/-0.4. Following the use of FWGE the mean BS was 1.4+/-0.5. The differences in BS before and after intervention were statistically significant (P<0.0001). It was also noted the clinical signs of colic in all these animals was much reduced and often abolished by feeding the product from 2 to 28 days, with the majority of the animals (24/28) showing recovery in the first two weeks.

The improvement in behaviour was co-terminal with cessation of the clinical signs of colic. The attending vet (personal communication) was very surprised with the improvements brought about in these colic instances by feeding the product.

## Gastroscope study

Condition	BS before treatment	BS after treatment	P value of difference
Behaviour N=17	4.4+/-0.6	1.7+/-0.5	<0.008
Behaviour and colic N=28	4.6+/-0.4	1.4+/-0.5	<0.0001
Severe gastric disorder N=5	4.4+/-0.5 (4.4+/-0.5 deprivation control)	1.4+/-0.5	<0.0007

**Table 1.** Behavioural score (BS)

summaries of treatment with the fermented wheat germ extract product eCalm in relation to animals with simple poor behaviour, poor behaviour and colic, and poor behaviour colic and gastric ulceration.

From the above group, five geldings with colic, which had severe or very severe behavioural problems in conjunction with various numerous external signs of gastric irritation, were referred for diagnostic gastroscopy, which was carried out at the University of Glasgow School of Veterinary Medicine.

Four of the five animals were indeed found to have significant gastric ulceration. The fifth had an inflammatory abnormality of the duodenum. These five animals were then treated daily for four weeks with FWGE. During this time, quantified observations were made on their behaviour and, after 28 days, the animals underwent further gastroscopy.

Standard numerical scores for gastric observation, behaviour, and general condition were derived. Gastric score 1 to 5 is none to severe ulceration, BS as before. The general condition score reflected poor (1) to very good (5).

All horses improved their behavioural profile within 7 to 10 days of starting treatment (mean BS 1.4+/-0.5, compared to 4 or 5 prior to intervention). All regressed to their previous bad behaviour (mean BS 4.4+/-0.5) within three weeks of cessation at the end of the period of study of feeding with FWGE. The differences in the mean BS after intervention with the product were statistically significant,  $P < 0.0007$  (**Table 1**).

In relation to gastric ulceration scoring, no differences were seen as a consequence of treatment. Differences were observed in all animals in various more subjective parameters of gastrointestinal health and abdominal sensitivity, including allowing girth to be tightened, improvement in the quality of faeces, less discomfort when being tacked up, cessation of wind-sucking and improvement in appetite. No significant differences were seen between the general condition and gastric scores between the commencement and cessation of the 28-day period of observation

## Appetite and weight loss

A total of 17 geldings and 8 mares, in addition to poor behaviour, were noted to also suffer from poor appetite and weight loss. In all cases, their behavioural problems were corrected by feeding FWGE, and restoration of appetite and capacity to retain weight were noted to have occurred by the carers.

These latter effects occurred over a period of weeks and were more noticeable in older animals. The overall results give a preliminary indication horses with poor appetite and inability to maintain weight can be improved by feeding this product.

## Hoof problems

Eight of the horses, seven geldings and one mare chosen for feeding FWGE – as a consequence of their high behavioural scores (in the 4 to 5 range) – also had a laminitic condition. This sometimes seasonal hoof condition was, in five of the animals, recurrent and, in one case, new. All animals on feed intervention with FWGE showed, within a period of six weeks, both resolution of the hoof problems and cessation of abnormal behaviour, possibly related to the pain caused by sore hooves.

Again, these observations should prompt further study on the effects of FWGE supplementation on relatively low grade laminitic conditions, which are, nevertheless, sufficiently serious to interfere with the use of the animals affected. As a start to such study, in the early spring of the following two years, the stable owner put those horses known to be susceptible to seasonal hoof problems laminitis on FWGE prophylactically. No new instances of problems arose whereas, on the basis of previous experience, some 10 would have been expected during that time.

## Coat and skin condition

It was noted in horses where coat condition was less than “optimal” that it improved noticeably during the period of intervention with FWGE. Additionally, in eight animals, four mares and four

geldings – all with poor behavioural profiles – various abnormal skin conditions were recorded. Four animals had extensive alopecia and lumpy skin, and in two of those, considerable ulceration and flaking. One was recorded as having mud rash.

Four animals suffered from sweet itch – two with extensive exudates. All signs resolved within six to eight weeks on animals fed with FWGE. Feeding with this product prophylactically by the stable owner has been undertaken and no new cases of abnormal skin conditions seen in the past two years. Several would have been expected from experiences in earlier years prior to the use of FWGE.

Further study is warranted on the beneficial effects of feeding this product to horses suffering from various chronic skin disorders.

## Discussion

In the present study, it was judged a well-behaved horse is the normal state and that a difficult to manage animal behaving in various ways, contrary to the wishes of the owner, is an abnormal condition. Whether this paradigm is correct for an animal that, in the wild, operates on a mixture of territorial, reproductive, and life-saving behaviour – often deemed fight or flight – cannot be fully argued here.

In all 126 case studies, a positive response to FWGE was observed in relation to behaviour and, provisionally, a number of associated conditions. Certain animals were tested more than once over the six-year period. In several instances, where animals had been fed FWGE continuously for several years, it was found possible to discontinue the feed without recurrence of the behavioural abnormality for which it had been initially applied.

The entire population of 91 animals studied (66 geldings and 25 mares) – as far as behaviour is concerned – benefitted from feeding FWGE as reflected by the significant improvement of the overall mean BS from  $4.4 \pm 0.4$  to  $1.5 \pm 0.5$  ( $P < 0.0001$ ).

Behaviour in horses is especially important to those involved given the marked strength and size differences between humans and horses. The associated risk involved in handling and riding these animals, which inherently have a heightened fight or flight response, is clear, particularly in relation to children riding horses. The risks involved to equine vets have also been highlighted in recent years.

The work was also undertaken in the interests of good animal husbandry, better management, improved ease of animal handling and more effective ways of dealing with poor animal behaviour.



Coram, a 25-year-old Welsh cob gelding, 14 hands high. The horse had a long history of severe recurrent spasmodic gaseous colic. After being fed the fermented wheat germ extract, response was within two days. The loud gut noises disappeared and no recurrence of colic was seen. The horse's body condition and performance improved, with many successes in the in-hand class and veteran-ridden class competitions.

Calmers are available on the market for horses, but horse owners commonly complain they give inconsistent results and, for many of them, no published trials exist demonstrating proven effectiveness. The present study goes some way to repairing this deficiency.

In equine behavioural research, so-called "personality" traits – recorded as affability, anxiety and aggression – are variously quantified and researched. In the present study, we elected to quantify "bad behaviour" as a composite measure, as previously described (Weetman et al, 2016), to include low affability, anxiety and aggression.

While empirically the results obtained clearly show FWGE can have a beneficial effect in remedying poor behaviour in horses, no indication is given of the mechanisms involved.

In the present study, various conditions other than behaviour were positively affected. With the mares in the previous study (Weetman et al, 2016), it could be supposed the difficulties of management were linked with hormone flux associated with ovulation, though this gives no idea of the exact mechanisms involved.

Behaviour is a complex entity and is influenced by multiple factors, including husbandry, hormonal factors, and also, in the case of horses, the use to which the animals concerned are put to. Although this was not the aim of the study – and it not subject to accurate assessment – it emerged owners of competing horses, who found they were performing badly (particularly disinclination to jump), performed better, along with improved behaviour, when fed FWGE.

Clearly, if this product has such a complex pattern of effects this is only credible if some indications of a possible mechanism exist.

To begin to explore the mechanisms involved in the effect of FWGE on horse behaviour, Gareth Leng from The University of Edinburgh, who has a prime interest in the impact of diet on the brain, was asked to ascertain whether FWGE would have detectable effects in his experimental systems.

Sedated rats were given the product by gavage and, in well-controlled experiments, within one hour it was found significant changes occurred in the paraventricular nucleus (PVN) of the hypothalamus – as judged by quite significant and location-specific c-fos stimulation. The PVN is a region of the brain important in relation to appetite regulation, response to stress, production of oxytocin and of vasopressin. Activation of c-fos, a proto-oncogene, is widely used as a surrogate of metabolic change and increase in function.

This clear result on the PVN gives a clue to the mechanism behind the empiric finding of behavioural changes associated with the use of FWGE as a feed constituent. Poor behaviour is frequently thought of as a consequence of stress of various kinds and the PVN is a major regulator in the brain of response to stress. This tentative suggestion does not presently rest on a clear understanding of the pathways by which oral intake of an FWGE can have such a rapid impact on the brain.

Arck et al (2010) proposed – on the basis of studying the impact of various bacterial extracts given orally on the physiological status of rodents – there exists a gut-brain-skin axis. In their studies, concerned primarily with the impact of diet on mental status, they argue the gut flora is affected by the bacterial feed intervention and that change in its species composition can have major effects on the gut, skin and brain.

Although they lay emphasis on these regions of the body, they suggest other organ systems may be involved. The bacterial extracts they used for dietary intervention are not dissimilar to the wheat germ extracts that were deployed in the present study as FWGE, in that both are derived from living cells subjected to physical degradation involving liberation of components of the biochemically complex cells involved.

The finding of Arck et al (2010) is in line with a huge body of research on the microbiome of which the gut flora is a major component. A book by Ed Yong (2016) describes in great detail the likely roles the gut flora has in maintenance and regulation of health in animals with particular emphasis on mental status. On the basis of such thinking it seems likely the pathway from the gut (where FWGE is received) to the brain where, at least in rats, it has a striking effect, involves initially the gut flora.

In relation to its effect on the behaviour of horses, it is not unreasonable to argue FWGE is a prebiotic – a substance that induces the growth or activity of microorganisms that are known to contribute to the well-being of the host. Exploration of such an effect is being undertaken.

The incidental finding of the impact on skin while feeding FWGE are in line with the notions of Arck et al (2010) that the gut-brain-skin axis is a target for feed intervention, as are the effects on colic and failure to maintain weight.

The impact on behaviour following feeding FWGE in horses with suboptimal behaviour is clear, even if the mechanism is less well-defined. The effect of feeding this product on colic, hoof problems, skin disorders and failure to gain or maintain weight is preliminary in the present study, and without properly controlled double-blind clinical trials, it is too early to speculate on an overall mechanism. It is, however, known full-blown laminitis can be associated with a neuro-endocrinological underpinning and, in the present study, the work of Prof Leng suggests FWGE has an effect on the hypothalamic pituitary adrenal axis, of which the association with laminitis and associated conditions is documented.

The development of nutraceutical and probiotic use has been rapid, but not usually based on properly controlled studies, and an understanding of the mechanism involved in the many beneficial effects that have been claimed, thus is far from complete.

As far as behaviour is concerned, the story of its improvement in geldings and mares by feeding FWGE seems clear cut. This finding could be of great value in the equine industry – in relation to both leisure and competition horses.

## References

- Arck P, Handjiski B, Hagen E, Pincus M, Bruenahl C, Bienenstock J and Paus R (2010). Is there a ‘gut-brain-skin axis’? *Exp Dermatol* **19**(5): 401-405.
- Beech J, Boston RC, McFarlane D and Lindborg S (2009). Evaluation of plasma ACTH, alpha-melanocyte-stimulating hormone, and insulin concentrations during various photoperiods in clinically normal horses and ponies and those with pituitary pars intermedia dysfunction, *J Am Vet Med Assoc* **235**(6): 715-722.
- Duberstein KJ and Gilkeson JA (2010). Determination of sex differences in personality and trainability of yearling horses utilizing a handler questionnaire, *Appl Anim Behav Sci* **128**(1-4): 57-63.
- Haritou SJA, Zylstra R, Ralli C, Turner S and Tortonese DJ (2008). Seasonal changes in circadian peripheral plasma concentrations of melatonin, serotonin, dopamine and cortisol in aged horses with Cushing’s disease under natural photoperiod, *J Neuroendocrinol* **20**(8): 988-996.
- Health and Safety report (2015). Injuries common among vets, *Veterinary Record* **177**(9): 216.
- Weetman M, Murray M, Brown R, Watson T and Davies T (2016). Supplementary control of oestrus behaviour in mares, *Veterinary Times* **46**(18): 12-14.
- Yong E (2016). *I Contain Multitudes: The Microbes Within Us and a Grand View of Life*, Bodley Head.

