



# EquiBiome

Microbial Analysis of the Hind Gut

## THE MICROBE- GUT-BRAIN AXIS IN HORSES

### ABSTRACT

Genomic sequencing and translational metabolomics have allowed us to gain deeper and more meaningful insight into the pathogenesis of metabolic-related syndromes of horses. The data included in this pdf has been gathered from a population of over 2,000 competition horses, and racehorses with freely grazing horses as controls. The aim is to have a greater and more precise understanding of the effects that diet, management, and stress have on the health and welfare of the horse.

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The microbe-gut-brain axis and fibromyalgia/myofascial pain Part 1

## What is the gut-brain axis?

The gut/brain axis is a signaling or communication system that allows the gut to talk to the brain and vice versa, the two organs talk to each other by way of the immune system, the hormonal and the nervous system.

## The microbe-gut-brain axis

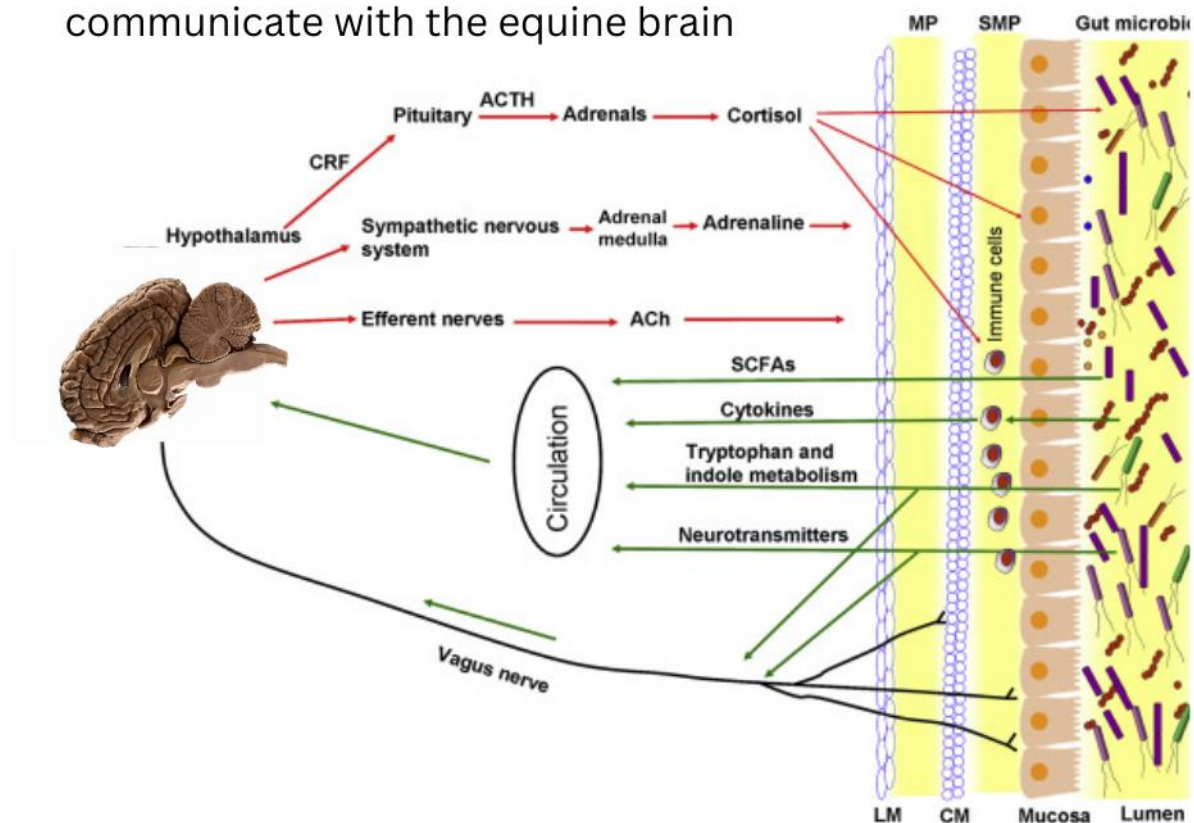
More recently the gut bacteria that reside in the gastrointestinal tract of all mammals has been identified the major component in the gut/ brain communication system.

The microbe-gut-brain axis is more extensive than the gut-brain axis and includes immune cells, glands, gut, the nervous system, hormones, intestinal bacteria, and the brain.

The main purpose of this axis is to maintain balance (homeostasis) a steady state able to provide the best functioning conditions of the gastrointestinal tract.

When an imbalance in microbe-gut-brain axis occurs an opportunity for disease or discomfort is created, this can be all gastric discomfort syndromes including colic and colitis, the onset of obesity, EMS and laminitis, and gastric pain. It can also include other organs of the body such as the musculoskeletal system.

## How the gut and microbes communicate with the equine brain



### **Defining myofascial and fibromyalgia pain.**

Fibromyalgia is a common complaint in humans as is myofascial pain syndrome, new research indicates the onset of both may originate from an imbalance through the microbe-gut-brain axis.

There are multiple links and similarities between fibromyalgia to myofascial pain syndrome, though symptoms relating to active trigger points may be different in fibromyalgia. Myofascial pain syndrome involves mainly pain originating in a muscle whilst the pain from fibromyalgia is often widespread through the body and may include joint and gastric pain.

Myofascial trigger points have been detected in horses, (Macgregor & von Schweinitz 2006).

Myofascial trigger points in horses and humans are defined by symptom criteria as follows- abnormal spontaneous electrical activity, spike activity, and local twitch responses at the trigger point site.

Fibromyalgia and myofascial pain syndrome causing chronic back pain has been described in a published paper (Ridgway 1999), the cause was hypothesised to be the result of a trapped nerve and acupuncture was the recommended therapy.

### **Symptoms of Fibromyalgia**

Chronic pain signs and impaired performance, bloating and abdominal pain.

Muscle soreness (tying up) joint pain, severe nerve pain and tenderness, and excessive sweating. Cranial nerves can be affected, causing facial nerve paralysis, head tilt, laryngeal dysfunction, and difficulties in swallowing (choke).

Fibromyalgia is frequently seen in racehorses (most of the symptoms coming under the banner of poor performance syndrome) and accounts for at least 25% of racehorse loss each year, especially prevalent in National Hunt horses.

### **The role of the gut bacteria in fibromyalgia and myofascial pain.**

The microbe- gut- brain axis is crucial for creating and maintaining the health of the entire body. If the balance within the gut bacteria community is altered (through diet/environment/stress) the result can be an increased production of chemicals that affect the nervous system, promoting pain and sensitivity.

### **The gut profile of horses with chronic pain/fibromyalgia/myofascial pain.**

Gut bacteria can produce secondary metabolites (chemicals) that support good health or that are detrimental to good health, too many bacteria producing toxic/harmful chemicals will alter the homeostasis (health balance) of the whole horse and will cause symptoms to appear in other organs of the body away from the gut as they react to higher levels of chemicals that aren't good for them.

Though all the bacteria listed below are part of the core family of microbes present in most horses, an increase of any within those listed causes an imbalance within the community that can have devastating effects on the homeostasis of the gut and the rest of the body.

### Higher levels of the following gut bacteria-

1. Eubacterium, Faecalibacterium prausnitzii, Ruminococcus, Clostridium, and Actinomycetaceae. These bacteria reside predominantly in the small intestine and whilst hippuric acid production is a normal and important part of equine metabolism, an excess (can be measured in urine) is an indication of an unnatural (detoxification) process by the gut.
2. Higher percentages of Fusobacteria nucleatum and faecalibacterium causing an increase in 2-hydroxyisobutyric, this is the most damaging of the three chemicals to be produced. Higher levels of fusobacteria only occur in horses under stress (competing), higher percentage of fusobacteria are also linked to colic and colitis. 2-Hydroxyisobutyric acid is chemically similar to lactic acid.
3. Higher levels of lactic acid-producing bacteria such as lactobacillus. Lactic acid is part of many metabolic and biochemical processes in horses and especially relates to the muscle ie tying-up (rhabdomyolysis) and PSSM, it is also mentioned in the onset of hindgut acidosis and laminitis.

### Long term changes

If the gut imbalance isn't rectified then the persistent, chronic noxious stimulant produced by the metabolites mentioned above can sensitise the nervous system and eventually make 3 long-term changes that cause chronic pain to perpetuate.

The changes to the nervous system include-

1. The growth of extra nerves
2. Nerves that increase their area of innervation (creating oversensitivity to touch)
3. The nerves become more sensitive to the pain stimulus.

**Coming next** managing the diet/environment and stress levels of horses with fibromyalgia/myofascial pain to restore health to the biome.

### References

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