

KRYPTOPYRROLURIA (KPU)

The “Never Quite Right Horse” Syndrome



WHAT IS KPU IN HORSES?

Kryptopyrroluria (KPU) is not a disease but a metabolic disorder that can present itself in a wide variety of symptoms.

Symptoms of KPU

This metabolic disorder can lead to a wide range of health issues. The visible symptoms span from digestive problems such as fecal water, diarrhea, or recurring colic, to skin conditions like mud fever, sweet itch, hives, or dermatitis. Other manifestations include allergies, chronic respiratory diseases, laminitis, tendon or suspensory ligament injuries, decreased performance, and many more.

Due to this diverse range of symptoms, the underlying disorder went unrecognized for a long time, with only the visible

conditions being treated. Consequently, affected horses often have a long history of suffering and frequently present as “multimorbid,” meaning they suffer from multiple conditions - for example, chronic cough, sweet itch, and fecal water syndrome. They may also be “non-responders,” horses that show little or no response to medications and treatments. Additionally, these horses tend to have severe reactions to medications and often develop sensitivities to wormers or even adverse reactions to vaccinations. Many horses show fewer symptoms during summer months while on pasture compared to winter, and symptoms often worsen with haylage feeding compared to hay.

What causes KPU?

To understand this, we need to look at the processes occurring in the horse's liver. This is where detoxification takes place - all waste products produced by the body, as well as all ingested toxins such as mycotoxins, medications, or poisonous plants, must be neutralized through what's known as the liver's biotransformation.

Liver Biotransformation: Phase 1

This detoxification process occurs in two phases. In Phase 1, substances are initially transformed. However, the resulting intermediate products are sometimes more toxic than the original substances, making it crucial for Phase 2 to start immediately.

Liver Biotransformation: Phase 2

During this phase, toxins are further neutralized and modified so they can be eliminated from the body. After this step, the liver releases these waste products into the bloodstream for excretion through the kidneys and urine. Phase 2 detoxification requires a catalyst - in horses, this is Pyridoxal-5-Phosphate, or P5P, which is an activated form of Vitamin B6.

When the P5P Catalyst is Missing

If P5P is lacking, biotransformation stops after Phase 1, leaving the body carrying a transformed but still toxic substance that it cannot eliminate. In healthy horses, P5P is normally produced in sufficient quantities by the hindgut microbiome. Horses and their gut microbiome live in symbiosis, with the horse traditionally receiving adequate supply from this source. As a result, horses appear to have either lost or never developed the ability to activate Vitamin B6 to P5P on their own through evolution. In horses, P5P deficiency typically results from damage to the microbiome. This makes equine KPU distinctly different from human KPU/HPU.

DETOXIFICATION CASCADE IN THE LIVER OF THE HORSE

Phase 1

Toxins are transformed by attaching a "functional group" that acts as a kind of "trailer hitch" for further processing.

Vitamin B6

is activated by the hindgut microbiome to

Pyridoxal-5-Phosphate (P5P)

acts as an essential catalyst to initiate Phase 2

Phase 2

A water-soluble molecule is attached to the "trailer hitch" that was added in Phase 1. The resulting water-soluble double molecule can then enter the bloodstream for excretion through the kidneys.





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Trace Element Deficiency Due to Impaired Biotransformation Cascade)

When P5P is lacking and Phase 2 biotransformation cannot proceed normally, the liver begins binding waste products to certain minerals to make at least some of them excretable. This primarily involves zinc and selenium, as well as sulfur. Manganese and iron may also be used. Since horses are highly sensitive to zinc deficiency in their blood but more tolerant of selenium or manganese deficiencies, these latter deficiencies appear more frequently in blood tests.

Selenium Deficiency - A Widespread Phenomenon

Many horses show selenium deficiency in their blood work. While selenium-poor soils are often blamed, the cause is more frequently not insufficient intake but rather excessive consumption due to the impaired biotransformation cascade. While supplementing temporarily raises selenium levels in blood plasma, the deficiency typically reappears soon after discontinuing supplementation. This indicates it's not a true deficiency. The selenium deficiency actually masks an underlying zinc deficiency, which in turn results from P5P deficiency. The root cause of P5P deficiency and consequent impaired biotransformation lies in a disruption of hindgut microbiome.

Symptoms of Zinc Deficiency

KPU can cause either latent or clinically detectable zinc deficiency, along with increased sulfur consumption. This often leads to secondary conditions and symptoms including skin conditions like sweet itch or mud fever, as well as poor hoof growth, difficult moulting, thin mane and tail hair, and a weakened immune system resulting in allergies, susceptibility to infections, or chronic cough. As more minerals become deficient, more diseases and symptoms manifest, and the horse becomes increasingly less responsive to therapies and medications.

What Causes This?

The root cause of KPU is insufficient P5P supply. But how does this occur? Most mueslis, pellets, and mineral supplements contain plenty of Vitamin B6, but this is in its inactive form, which horses cannot activate themselves. Brewer's yeast is also not a good source of P5P, since it often adds to hindgut dysbiosis. The key is to restore the horse's natural microbiome to normal function. When this happens, the horse automatically receives all active B vitamins, Vitamin K, and many essential amino acids and fatty acids that are also produced by gut symbionts. It's also crucial to avoid anything that disrupts the horse's gut microbiome. Feeding non-natural feeds like haylage, chaff, beet pulp or starch-containing concentrates is often the point where KPU starts.



TREATMENT APPROACH

When KPU is suspected, a urine test should be performed, even if blood work appears normal. Testing services are available through laboratories such as www.vetscreen.de. When KPU urine testing is not available in your country, please contact a Sanoanimal-certified therapist who will assist you with diagnosis and treatment planning.

1. Urine Testing

Two parameters are measured: indican as an indicator of hindgut dysbiosis, and kryptopyrrol as a marker for impaired liver biotransformation. In horses, the indican value is more meaningful, as it reveals early-stage KPU even when the liver is still able to compensate.

2. consult a therapist

If the test is positive, you'll need a qualified therapist for necessary therapeutic and supporting measures, as these can vary in detail depending on the test values, horse breed, age, and health conditions. You can find competent therapists from the Sanoanimal network through office@sanoanimal.com.

3. Feed Management Optimization

The first priority is always optimizing the feeding regime. This includes providing 24-hour access to good, stemmy hay to nourish the hindgut microbiome. Forced pauses from forage must be avoided as they cause significant stress in horses. Haylage and other fermented products need to be eliminated from the feeding plan. The same applies to poorly tolerated feeds such as bread, bananas, large amounts of carrots or apples, large quantities of apple pomace, beet pulp and chaff – the green stems or husks in concentrate feed.

4. Gut Restoration and Support

Colon restoration is necessary to bring the hindgut microbiome back into balance. This involves a 6-week treatment with **OKAPI Bitter Herbs** in parallel with 6 weeks of **OKAPI Lapacho Bark**. During the first and last two weeks of this treatment, **OKAPI Liquorice Extract** can be added.

Note: Liquorice extract should not be used in horses with a history of laminitis. If the horse has digestive issues such as fecal water syndrome, bloating or others, the therapist should adjust the colon restoration protocol.

5. KPU Therapy

KPU-affected horses must receive essential B vitamins and zinc supplementation. Both are contained in **OKAPI Hepar-KPU forte**, along with plant-based compounds that inhibit hindgut dysbiosis. Depending on case history and other therapeutic measures, this should be administered for at least 6-18 months. If the horse has been fed haylage or beet pulp, additional pH stabilization is necessary. For this, administer **OKAPI Prodic** every other week for at least 3 months.

A course of **OKAPI Spirulina** (available as powder or pellets) should always be included in the treatment. This helps to remove toxins from the body, relieving stress on the liver and kidneys. It can be administered during the weeks when **OKAPI Prodic** is paused.

Long-Term Support

After gut restoration, horses with KPU also benefit from continuous metabolic support until their body regains balance. We recommend **OKAPI Four Seasons Feed** as a healthy herbal basic supplement suitable for all horses. **OKAPI Sainfoin** is the perfect grain-free concentrate alternative for sport horses, used in combination with an appropriate **OKAPI mineral supplement**. For leisure horses, we recommend **OKAPI Ration Balancer**, which provides all necessary amino acids and minerals. Any therapeutic measures should be implemented in consultation with your therapist.

Step 1: KPU Diagnosis

Via urine analysis or symptom assessment

Step 2: Consult a Therapist

Contact Sanoanimal to find a qualified therapist: office@sanoanimal.com

Step 3: Optimize Feeding

Provide stemmy hay at 2-3 kg per 100 kg body weight over 24 hours (use slowfeeders if necessary), plus mineral supplements. Reduce or phase out concentrates, significantly limit carrots, apples, and other treats.

Step 4: Colon Restoration

Administer **OKAPI Lapacho Bark** and **OKAPI Bitter Herbs**. Additional measures as indicated.

Step 5: KPU Treatment

Supplement deficient micronutrients to restart natural biotransformation, e.g. using **OKAPI HeparKPU forte**.

Please contact us before starting any therapy.

We will be happy to connect you with a qualified therapist from the Sanoanimal network who can create an individualized treatment plan for your horse: office@sanoanimal.com.

