Protexin® VETERINARY | Smarter pet care, powered by biotics.

Gastrointestinal for Rabbits

Products to support rabbit gastrointestinal health.

PETBIOTIX® GOOD GUT HEALTH
✓PROBIOTICS
✓PREBIOTICS

The rabbit gastrointestinal system

As hindgut fermenters, the gastrointestinal system of a rabbit is specialised and adapted to their herbivorous diet, which is mainly composed of low-quality, high-fibre content.[1] Their digestive tract consists of a simple stomach and small intestine followed by a sacculated hindgut (comprising the caecum and colon).[1,2]

The rabbit's digestive tract allows a high volume of food intake. It separates out the digestible and easily fermentable components of the diet to utilise, and rapidly eliminates the slowly fermentable fibrous waste.[2,3]

The stomach and small intestine

Adult rabbits have a low gastric pH of 1-2 which maintains an almost sterile stomach and small intestine as it destroys most microbial organisms.[2-5] The stomach acts as a storage organ, controlling the flow of ingesta into the small intestine. It is never truly empty and even after a 24-hour fast is more than half full.[2,5]

The small intestine is the primary site of nutrient absorption. Small intestinal digestion and absorption in the rabbit are similar to other species.[2,4] Secretions in the duodenum neutralise the acidity of the stomach chyme, and most of the digestion of carbohydrates and simple proteins takes place in the duodenum and jejunum.[3,5] The ileum helps to regulate and recycle electrolytes secreted by both the stomach and proximal small intestine by reabsorbing the bicarbonate ions which helped to neutralise the stomach acid further up the digestive tract.[3]

The large intestine

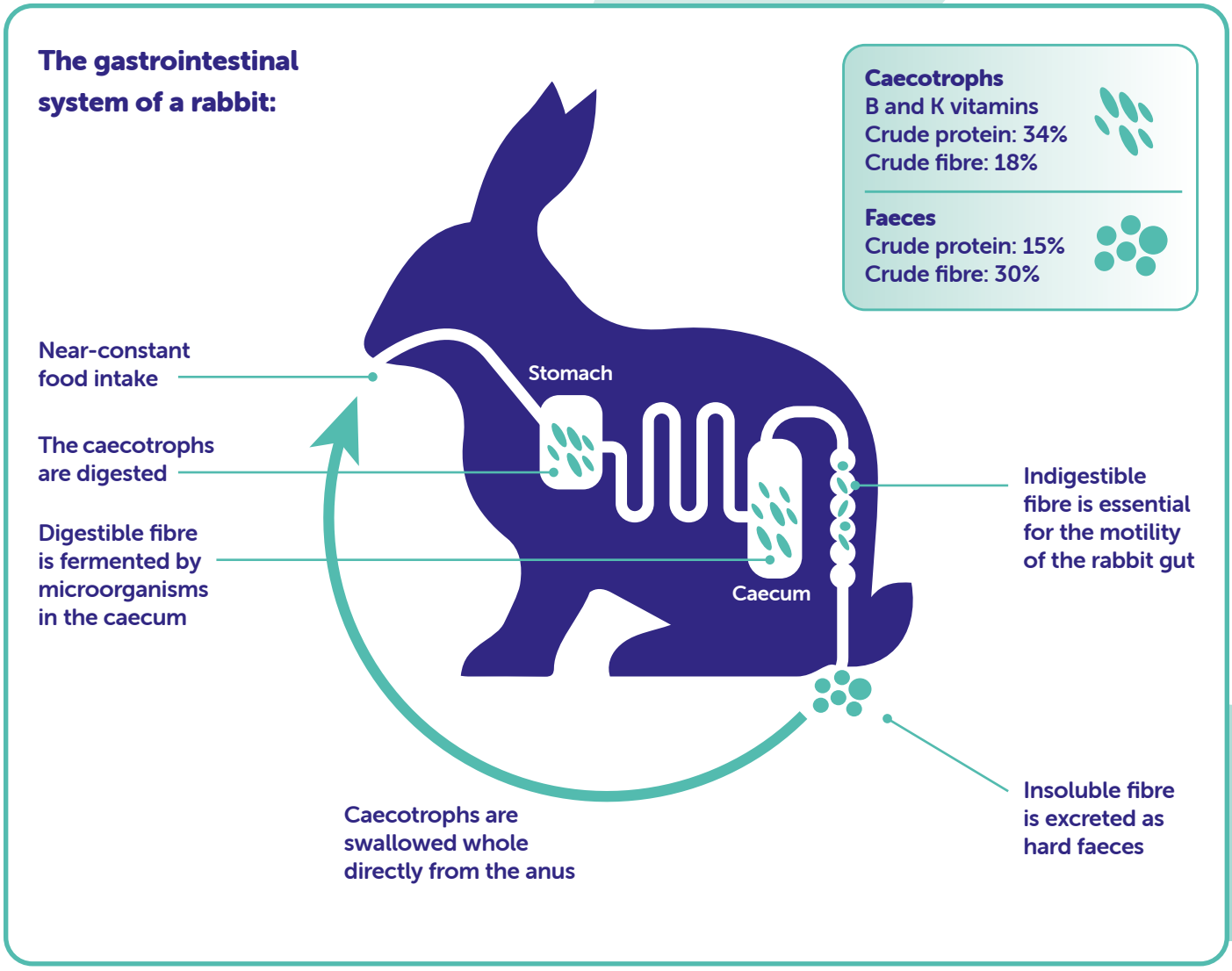
Proportionally, rabbits have the largest caecum of any mammal; it accounts for 40-60% of the total volume of their gastrointestinal tract.[1,3,4]

The caecum acts as an anaerobic fermentation chamber with ingesta and goblet-cell-produced mucopolysaccharides as the main carbohydrate sources for fermentation.[3,6,7]

The caecal contents that are evacuated in the colon consist primarily of ingesta that has not been broken down yet (both large and small particles) and caecal microbes.[4]

Colonic and caecal motility allow rabbits to separate intestinal contents into fermentable substrates during a 'caecotroph production' phase, and indigestible waste during a 'hard faeces' phase.[1,3,8]

The hard faeces phase consists of ingesta passing through the ileocaecal valve and sacculus rotundus and being evenly distributed in the caecum and proximal colon. These contents, through a series of contractions, are consistently churned. This process allows indigestible fibrous particles over 0.5mm in length to accumulate in the proximal colon and form hard pellets. The smaller, digestible particles and liquid contents are passed by



retrograde peristalsis back up into the caecum for fermentation.[3,4,9]

The caecotroph production phase (also known as 'soft faeces') is when the fermented, semi-digested ingesta together with microbes from the caecum are passed rapidly through the colon.[1,9] Colonic transit time for this phase is 1.5-2.5 times faster than for the hard faeces phase, and the contractions of the colon are softer, reducing the amount of liquid being expelled from the pellets. In the distal colon lysozyme is added and mucus secreted by the goblet cells coats the soft pellet.[3,4]

Caecotrophy

As discussed above, caecotrophs are pellets produced from partially fermented matter, as opposed to the hard faecal pellets which primarily consist of unwanted fibre. Caecotrophs are swallowed whole, directly from the anus, with their mucus covering intact. This protects the caecal material and microbes from the acidity of the stomach and allows for further fermentation of the digesta during the 6-8 hours that they sit in the stomach post-ingestion.[3-5]

Digestion and absorption of caecotroph contents such as amino acids, fatty acids, vitamins and digested microbes take place in the duodenum and jejunum, with the digestion of microbial protein being aided by the addition of lysozyme as they pass through the large intestine during formation (see above).[3,4,7]

The microbiome in rabbits

The caecum hosts the majority of the rabbit's gastrointestinal microbiome. The microbiome is particularly important for rabbits as it is crucial for a substantial portion of nutrient extraction from their diet, as well as the maintenance of general health.[7,10,11] The microbial contents of the caecum include bacteria, protozoa, fungi and archaea.[11] A symbiotic relationship between this microbial flora and the rabbit allows the breakdown and metabolism of otherwise indigestible food, as well as supporting the immune system and gastrointestinal health, while the host provides a suitable environment for the microorganisms' survival.[1,3,7,10,11] Short-chain fatty acids (SCFAs), which are by-products of microbial fermentation, are actively absorbed through the caecal and colonic walls. They are utilised by the rabbit as an energy source, as well as supporting gut health and the innate immune system.[3,7]

A rabbit's normal gastrointestinal health and motility relies on their diet consisting of a high volume of fibre of varying lengths.[1,3,12] Longer pieces of fibre (>0.5mm) are necessary to maintain motility of the caecum and colon and smaller pieces of fibre are digested by microbes, contributing to the health of the microbiome as well as the host.[3] Rabbits need a minimum dietary fibre level of 20 to 25% to maintain gut health. Low-fibre diets can cause gut hypomotility, reduced caecotroph formation and prolonged retention time in the hindgut.[1]

Due to the importance of the gastrointestinal microbiome in rabbits, it is essential to support it during times of potential disturbance such as weaning, altered diet, hypomotility, stress, pain or antibiotic use.[1,13,14]

Petbiotix®

Our Petbiotix have been expertly developed to support a healthy microbiome. The microbiome is essential for the normal functioning of the gastrointestinal tract and for the gut's interaction with the rest of the body. Our Petbiotix help support the natural balance in the animal's gut and keep them at their best.

All three of our rabbit products contain both prebiotics and probiotics.

Probiotics

Probiotics are live microorganisms shown to support the microbiome.

Our rabbit products contain the probiotic *Saccharomyces cerevisiae* (CNCM I-4407) 4b1702 which is the only probiotic registered for use in rabbits in the EU.[15] The *S. cerevisiae* in our products is a live yeast which is microencapsulated. It has been shown to survive exposure to a low pH, in a study intended to mimic the acidic stomach environment,[16] allowing it to reach and affect the caecal microbiome.[17]

Prebiotics

Prebiotics selectively feed beneficial bacteria, supporting a diverse and healthy microbiome.

Prebiotics resist being broken down by the host; instead they reach the distal intestine where they are fermented by beneficial bacteria to produce SCFAs which have been shown to provide many health benefits in humans.[18-20] In rabbits, prebiotics have been found to help maintain the health status of the rabbit. SCFAs produced by fermentation provide around 30% of a rabbit's energy requirements, as well as supporting gut health and the innate immune system.[3,7,14,21]

Preplex®

Preplex prebiotic is a combination of oligofructose (also known as fructo-oligosaccharide, FOS) and acacia (gum arabic). Oligofructose is a short-chain molecule. Generally, short-chain molecules are fermented fairly rapidly, whereas longer-chain structures, like acacia, would be expected to undergo slower fermentation.[18] This combination allows our products to support the growth of beneficial bacteria throughout the colon.[22-24]

Fibreplex

Protexin Fibreplex is a carrot-flavoured, high-fibre, energy-dense paste, formulated to support normal gut motility. Fibreplex also includes Petbiotix to support a healthy gut and microbiome.

Fibreplex includes:

- Probiotics (*S. cerevisiae*)
- Prebiotics (Preplex)
- Fibre to support normal gut motility
- Provides ¼ of the daily resting energy requirement (RER)
- Useful for animals with low appetite
- Carrot-flavoured paste to aid palatability

Instructions for use:

- Give 1ml/kg by mouth, 2-3 times daily for as long as considered necessary
  - Formulated for short-term use
- Easy-to-use syringe
- Available in 15ml syringe

Bio-Lapis

Protexin Bio-Lapis is a dandelion-flavoured powder containing electrolytes and vitamins to aid oral hydration, as well as Petbiotix to support a healthy gut and microbiome.

Bio-Lapis includes:

- Probiotics (*S. cerevisiae*)
- Prebiotics (Preplex)
- Electrolytes
  - Mg^{2+}, Na^{+}, K^{+}, Ca^{2+}
- Vitamins
  - A, B2, C, D3, E
- Dandelion-flavoured to aid palatability

Instructions for use:

- Use one sachet per day for as long as considered necessary
  - Formulated for short-term use
- To create an isotonic solution add one sachet to 50ml of water
- It is advisable to provide an alternative source of water alongside Bio-Lapis
- May be added to drinking water

Pro-Fibre for rabbits

Protexin Pro-Fibre for rabbits is a dandelion-flavoured pellet containing high levels of insoluble and soluble fibre to support efficient digestion and motility, as well as Petbiotix to support a healthy gut and microbiome.

Pro-Fibre for rabbits includes:

- Probiotics (*S. cerevisiae*)
- Prebiotics (Preplex)
- Mixed insoluble and soluble fibres
  - Wheat feed
  - Soya bean hulls
  - Oat feed
  - Wheat bran
  - Grass meal
  - Sugar beet pulp
  - Cellulose
- Dandelion-flavoured to aid palatability

Instructions for use:

- Sprinkle liberally over normal food or make available *ad libitum* in a separate container
- Formulated for long-term use
- Available in 800g tub

Protexin® VETERINARY

Smarter pet care, powered by biotics.

GASTROINTESTINAL | DERMATOLOGY | URINARY | CALMING | HEPATIC | JOINT

For information on our full range of products for dogs, cats and rabbits, please visit our website.

For references please visit protexinvet.com/rabbit-range-refs or scan

Manufactured by:
ADM Protexin Ltd. Lopen Head, Somerset, TA13 5JH, United Kingdom
+44 (0)1460 243230 | info@protexin.com | protexinvet.com

M0510-01