Diet is probably the most important factor in maintaining rabbit health

- Anatomy and physiology of the gut
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- The ideal diet
- Muesli and pellets
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Anatomy and physiology of the rabbit gastrointestinal tract GIT

Rabbits are hindgut fermenters and to understand the dietary requirements of rabbits it’s useful to know how their gastrointestinal system functions.

Neonatal rabbits have a relatively high stomach pH of 5 to 6.5, to allow bacteria to pass through and colonise the caecum. After weaning, food is effectively sterilised in the stomach where the normal pH is around 1 to 2, before it passes into the small intestine. The stomach should always contain ingesta and has a transit time of three to six hours. The jejunum is long and convoluted and occupies the dorsal left flank; the ileum is similarly shaped and forms an ileocaecocolic complex that ends in the sacculus rotundus. The sacculus rotundus is unique to rabbits and has a thick wall containing many macrophages and lymphoid tissue. An ileocolic valve controls the entry of gut contents into the sacculus rotundus, whilst also preventing reflux back into the small intestine, see Fig 1.

The rabbits proximal colon is able to mix and separate gut contents. Large indigestible fibre particles, >0.5mm are separated out from ingesta and sent distally into the colon. Smaller digestible fibre particles and fluid are sent via reverse peristalsis into the caecum where they undergo bacterial fermentation. This releases essential nutrients for absorption such as volatile fatty acids and microbial proteins. The caecum comprises almost a fifth of a rabbit’s total bodyweight and is the largest of any mammal relative to their size.
The proximal colon ends in a highly muscular section of gut called the fusis coli. In here water is squeezed out of the contents and hard faecal pellets are formed, which are then moved on and stored in the distal colon before being expelled. A different set of caecal and proximal colon contractions are required to move caecal contents into the fusis coli, where soft mucous covered caecotrophs are formed. These then pass into the distal colon where they trigger ingestion by the rabbit, directly from the anus. When food is scarce all caecotrophs are eaten, however where food is in abundance they can build up and cause soiling around the anus. Caecotrophs slowly dissolve in the stomach and their nutrients absorbed in the small intestine.

Dietary Fibre

It is important that a diet contains a high proportion of fermentable (insoluble, large) fibre as well as a variety of different sized soluble fibre particles, as both are required for stimulating and maintaining normal gut function, preventing ileus and maintaining normal dentition.

A high fibre diet is essential for

- Stimulating normal gastrointestinal function
- Maintaining dentition

Dietary fibre plays an essential role in GIT function because:

- Fibre stimulates caeco-colic motility and helps prevent caecal impaction
- Fibre stimulates the production of motilin, a prokinetic enzyme secreted in the small intestine
- Fibre increases overall food intake, resulting in longer gut-transit time and better food conversion efficiency
- Fibre particles over 0.5mm in length are required to stimulate the fusis coli

In addition:

- Dietary fibre has been shown to decrease hair accumulation in the gut and help prevent formation of hair balls
- Fibre is required to help induce the drive to eat caecotrophs
- Rabbits in the wild spend a high proportion of the day eating. Diets that are low in fibre are eaten too quickly, leading to boredom and vices such as fur chewing and barbering.
A high fibre diet is also essential to maintain normal dentition:
On average incisors grow at 2mm per week whilst cheek teeth grow on average at 2mm per month. A high amount of dietary fibre is therefore required to provide enough abrasion to wear down teeth sufficiently to avoid overgrowth and malocclusion (which predispose to infection and facial abscesses). Prolonged periods of grinding fibrous food also provides mechanical stresses required for the maintenance of good mandible and maxilla bone quality.

Dietary Carbohydrate

Ideally rabbit diets should be both high in fibre, low in carbohydrate and without added sugar. Sugar is added to some commercial rabbit food in the form of fruit pulp, syrups and molasses – a practice that Supreme has campaigned against. Carbohydrates are digested and absorbed primarily in the stomach and small intestine; they tend to have a rapid gut transit time, especially if there is little accompanying fibre. An overload of carbohydrates can result in incomplete digestion and any residual starch is passed into the caecum and becomes a substrate for caecal bacteria. This can then lead to a rapid bacterial overgrowth, diarrhoea and enterotoxaemia. Newly weaned rabbits are particularly susceptible to this when they are moved (e.g. from breeder to pet shop) and they have a diet change with little hay available.

High carbohydrate, low fibre diets can cause the following problems:
- Predisposition to dental caries
- Disruption of normal caecal bacteria required for fermentation
- Predisposition to over-eating and obesity

Dietary Calcium

The main pathway that rabbits acquire calcium is by passive absorption across the intestinal mucosa, which is poorly controlled. Therefore the total serum calcium levels of rabbits usually reflect dietary intake. However when the diet contains low levels of calcium the rabbit can also actively uptake it from the gut using activated vitamin D3 and ultraviolet light, as in other mammals. Excess calcium is excreted by the kidneys, which is why rabbit urine is often cloudy due to the presence of precipitated calcium carbonate. Excessive dietary calcium must be avoided as high calcium levels in urine can cause irritation and skin scalding or urolithiasis. The dietary requirement for calcium is 0.6 to 1%.

Calcium and vitamin D deficiency have been implicated in dental disease, by causing underlying metabolic bone disease. The alveolar bone surrounding teeth can demineralise, allowing apical elongation and widening of periodontal spaces which can lead to tooth rotation and infection. The theory is that rabbits fed incorrectly on muesli type diets can selectively feed, leaving the components rich in calcium, resulting in an overall deficiency. In addition it's known that the calcium content of grass and hay can be highly variable. Calcium deficiency may be more likely to occur if the rabbit is also deficient in vitamin D due to a lack of exposure to sunlight. In such cases the active uptake of calcium may be insufficient to compensate for the lack of dietary calcium. Good quality concentrate ingredients and a balanced diet should provide optimal levels of calcium. It is also important to provide a suitable ratio of calcium to phosphorus in the diet. A ratio of 1.5 :1, or 2:1 is recommended. Rabbits are more tolerant of high calcium to phosphorus ratios than low ones.

- Excess dietary calcium can cause urolithiasis
- Low dietary calcium and lack of sunlight may cause
  - metabolic bone disease
  - dental disease
VetCarePlus Digestive Health Formula

Digestive disturbance is one of the most common reasons for presentation of small furry species, such as rabbits and guinea pigs, to a vet. Caused by a wide range of disease processes, diarrhoea, gut stasis and/or bloat are commonly encountered clinical signs and can be rapidly life threatening as metabolic disturbances and physical compromise of the gut quickly escalates. Typically, patients have a reduced or altered appetite which can make it difficult for the veterinary team to ensure adequate and appropriate food intake for their patients. With these species so heavily reliant on normal digestive function, ensuring a rapid return to normality is of paramount importance. That is why Supreme developed VetCarePlus Digestive Health Formula to offer nutritional support and targeted relief during digestive upset.

Combination Action

Balanced and nutritionally complete, the formula provides quality nutrition at a time when it is absolutely critical. Containing absolutely no artificial colours, flavours or added sugars VetCarePlus Digestive Health is designed to be gentle on the digestive system, helped by the added blend of herbal supplements, carefully selected for their beneficial properties. There is also no wheat in the recipe – important at a time when carbohydrate digestion may be impaired. High levels of natural anti-oxidants and pre-biotics help to offset the effects of caecal flora disturbance and promote a return to bacterial population balance and health. Providing a super-high crude fibre level of 32%, thanks to unique Monoforage™ technology, the formula is targeted at addressing the common consequences of digestive upset and promoting a return to normal digestive function.

Fibre Is Key

Combining Timothy hay and Lucerne, Digestive Health Formula not only provides a high level of crude fibre but is also rich in long fibre, which is important for normal gut function and motility. A direct correlation between an increase in the risk of rabbits developing potentially fatal diarrhoea and decreased fibre content of their diet has been demonstrated.1,2

It is the presence of adequate fibre in the digestive tract that stimulates the production of motilin – an enzyme that is involved in regulating gut motility. High fibre levels also extend gut transit time and so increase food conversion efficiency – vital after a period of potential poor nutrition due to digestive disturbance. The profound effect of fibre on gut function is of prime importance in helping to alleviate diarrhoea or bloat due to hyper and hypo-motility of the gut.

High fibre also extends chewing times which further encourages normal gut motility, provides essential dental wear and more closely emulates the natural feeding behaviour of individuals in the wild.
Herbal Power

Peppermint is traditionally known to soothe the digestive tract in humans, with studies showing a significant positive effect on sufferers of IBS. This is thought to be down to the effect menthol has on smooth muscle. In rabbits and guinea pigs, peppermint has been shown to relax gastrointestinal smooth muscle by reducing calcium influx in the jejunum. It is also believed to have an anti-foaming effect on the gut contents as a result of stimulation of gastric and intestinal secretions - helping to prevent gas formation in the intestine - as well as exerting a mild local anaesthetic effect. Fennel has been shown to have a similar carminative (gas reducing) effect and so also aids with the prevention of bloating, which in species such as rabbits and guinea pigs is not only painful but also very dangerous.

Chamomile is associated with a calming effect in humans. In studies on rats and mice, various chemical constituents extracted from chamomile decreased stress induced increase of plasma ACTH and showed a clear affinity for central benzodiazepine receptors. Anxiolytic activity increased in mice that had received chamomile extract with elevated doses even producing mild sedation. A lot of the chemical constituents of chamomile have been shown to have anti-inflammatory, carminative and anti-spasmodic properties. In vitro studies on guinea pigs demonstrated inhibition of induced spasm of guinea pig ilium and in humans, chamomile has been shown to reduce the duration of diarrhoea and eliminate colic.

VetCarePlus Digestive Health Formula

- 32% fibre
- Unique long fibre
- Wheat free
- Natural prebiotics
- High levels of natural antioxidants
- Contains peppermint, fennel and chamomile

References

4. The Longwood Herbal Task Force (http://www.mcp.edu/herbal/default.htm) and The Center for Holistic Pediatric Education and Research (http://www.childrenshospital.org/holistic/)
6. The Longwood Herbal Task Force (http://www.mcp.edu/herbal/default.htm) and The Center for Holistic Pediatric Education and Research (http://www.childrenshospital.org/holistic/)

Chamomile (Matricaria recutita, Anthemis nobilis) Paula Gardiner

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