

Behaviour

In terms of the effect of food on behaviour, I have an advantage. My doctorate was in behaviour, specifically studying the effect of diet on the behaviour and gut morphology of group living animals (I used deer as my test subject). I love the subject. I'm also a guide dog trainer so I have a fair idea what to look for in terms of positive or negative behavioural changes. It may have been the positive behavioural change following my first few experiments that first really attracted me to raw. In fact, I'm yet to meet a trainer that has worked with dogs on both diet types to say any different.

To me, good behaviour begins in the gut. A happy gut is a happy head and we know raw makes for a happier gut. Algya *et al.* (2018)¹⁰ took four types of pet food diets including dry kibble, two types of cooked tray products and raw dog food, and compared them for macronutrient digestibility, serum chemistry, urinalysis and faecal characteristics, including metabolites and microbiota. They found that raw diets were highly palatable and highly digestible. Crude protein was better digested when presented raw than dry; raw-fed dogs exhibited reduced blood triglycerides (fat in the blood), maintained faecal quality and serum chemistry, and adapted their faecal microbial community to their new diet.

A stable, healthy gut flora is central to your health. It's incredible to think you are more bacteria cells than human cells; in fact, on a DnA basis, they outnumber you 10 to 1. You have around 1.5-2 kg of them happily living in your gut. They do the house cleaning, consuming not only all the undigested food and symbiotically providing for us some vitamins and useful by-products, but also sloughed epithelial cells and mucus that lines our guts. But we now know their role goes far beyond simply providing us with vital nutrition. They are a defensive barrier from pathogens, educating and working alongside our immune system from the time we are born to keep us and ultimately themselves in business. They can interfere with the adherence of pathogens to the intestinal mucosa by signaling for more mucous production. Their by-products reduce the growth of potential pathogens. They fix up any gaps in the gut membrane, prevent leaky gut and reduce our susceptibility to food allergies. The gut flora is now known to play roles in a myriad of diseases from weight gain and diabetes to heart disease and cancer. But it's their role in behaviour that personally interests me the most.

You have two wolves constantly battling inside you, one is bad and one is good. Which one wins?
The one you feed.

Adapted from a Cherokee Native American Proverb

When we think of the gut flora, we assume it is simply bacteria. However, in there you have a myriad of bacterial communities, fungi, all sorts of single-celled protozoans and numerous viruses all whizzing around, living in something close to harmony, a harmony brought about by competition. When all is well, the good guys (commensal microbes) keep the bad guys (pathogenic microbes) in check. The payoff for feeding them has positive repercussions for your health – a perfect symbiotic relationship carefully developed since you first crawled from the primordial ooze. However, should something upset that balance (dysbiosis), and the bad guys have a chance to flourish, their presence and by-products tend to come at the expense of host fitness. The disruption of normal digestion alone can result in a myriad of health issues for the animal. There will be less house cleaning, less gut repair, more inflammation. You will suffer less protection from pathogenic bacteria. Above all, you will absorb less of the beneficial by-products normally produced by the commensals. As your gut flora is responsible for more than 90% of the feel-good hormone serotonin in the body, the inevitable consequence is a negative impact on behaviour. Studies show disrupting the gut flora has negative psychological consequences in practically every animal studied, including dogs.^{11,12}

The good news is we can eat our way out of a funk, too. We know the consumption of probiotic yoghurts, fermented vegetables and kefir, foods that contain life, has enormous physical and mental health benefits, that's why we call them probiotics, which is Latin meaning "for-life". Behaviour in rats and humans can be significantly improved in the low individual by feeding probiotics.^{13,14} While kibble manufacturers boast their products are chemically barren of any life whatsoever, whole food proudly contains life. Animals on dry food will never enjoy the obvious health benefits of consuming probiotics from their food.

Nor is it simply the chemical anti-life in kibble negatively impacting the dry-fed dog's biome. harsh processing measures denatures protein, making it more resilient to digestion. Different bacterial communities now thrive on this new food source, fueling dysbiosis in cats.^{15,16} Section 2 reveals how fibre, both soluble and insoluble, slows the passage of digesta and feeds certain bacterial groups, radically shifting the gut flora of dogs.

Kichoff et al. (2019)¹⁷ compared the faecal biome of 31 dogs rescued from a dog fighting ring, 21 of whom were displaying problem behaviours. Analysis revealed an association between gut biome and aggression. Feeding raw dog food results in a more balanced growth of bacterial communities and a positive change in the readouts of healthy gut functions in comparison to extruded diet in eight boxers¹⁸. These changes are expected to be good but measuring that is complex. Sandri *et al.* (2016)¹⁸ noted a high correlation for short-chain fatty acids (SCFA's) in the stools of meat-fed dogs, in particular butyrate. Largely produced by the microbiota, butyrate has

been shown to have profound central nervous system effects on mood and behaviour in mice, acting like an antidepressant.¹⁹ Similarly, BARF diets have been found to increase faecal levels of gammaaminobutyric acid (GABA) in dogs.²⁰ GABA is a major inhibitory neurotransmitter of the mammalian central nervous system. It decreases certain activity in your brain, turning certain processes off, calming you down. It follows that decreased levels of GABA are implicated in the pathophysiology of several neuropsychiatric disorders, including hyperactivity and attention deficit disorder, anxiety and depression.

Nor are these the only behavioral concerns with feeding kibble. Vitamin B₆ (pyridoxine) is required for the conversion of tryptophan to serotonin (a now-famous relaxing neurotransmitter) and melatonin (a nice, relaxing hormone). Other B vitamins are required for the efficient absorption of B₆. So, vitamin B complex is very important for a calm mind. Processing, certainly extrusion, destroys heat liable vitamins such as B complex. Hoffmann LaRoche (1995)²¹ examined the effect of dry food storage times of just six months, vitamin B₁ fell by more than 57%, Vitamin B₂ fell by more than 32%, Vitamin B₁₂ fell by 34%. But unbelievably, they noted a Vitamin B₆ loss of 89% in canned dog foods. Mooney (2010)²² noted serious vitamin B losses after just 6 weeks of stressed shelf-life testing.

Then there is the power of fat. Omega-3, in particular EPA and DHA, are essential for normal brain development, playing a pivotal role in the regulation of synaptic plasticity and neurogenesis as well as dopamine neurotransmission. rat diets deficient in omega 3's result in aggression and stress behaviours, while decreasing learning ability²³. It's the same in dogs. A study of 18 aggressive German Shepherds showed lower omega-3 concentrations and higher omega-6 concentrations (from the copious plant ingredients), resulting in a higher omega-6/omega-3 ratio.²⁴ Despite this, hadley *et al.* (2017)²⁵ found one in four best-selling, 'complete' dry foods tested contain zero or practically zero EPA and DHA. DHA deficiency in pregnant and lactating bitches affects the brain development of puppies²³. Simply supplementing dry diets with fish oil containing high levels of DHA improves the learning capability of puppies compared to those fed low-level DHA fish oil.^{25,26}

And what of carbohydrates? Kids after a birthday party – is it the sugar or the chemicals? It's hard to say. Cereal-based pet food, with its high carbohydrate load and rapid digestion, is a very high glycaemic food, not unlike a children's breakfast cereal. A study measured the impact of breakfast cereals of different glycaemic loads on the mental performance of children (where high glycaemic foods contain a lot of carbohydrates that are easily digested, delivering their sugar payload rapidly into the blood). Memory was assessed by asking the candidates to recall a series of objects. The ability to sustain attention was measured by asking for a response after various delays.

The incidence of negative behaviour was recorded when playing a video game that was too difficult to allow success. It was found that a low glycaemic load breakfast resulted in better memory and attention spans, with fewer signs of frustration, and more time was spent on task.¹³

There are also many known unknowns in this field, such as the effects of wheat gluten, surely the most common and indeed commonly-fed causes of food intolerance in dogs. Psychodietetics is a relatively new science. It is the study of the effects on behaviour of particles such as gluteomorphins (from the digestion of gluten) and casomorphins (from casein) entering the blood through a leaky gut. Gluteomorphins, as you may guess by their name, are morphine-derived compounds and, together with their cousins the casomorphins (from the incomplete breakdown of casein in milk), will wreak havoc on reaching the brain. These substances are known to result in and exacerbate a variety of brain disorders including epilepsy, autism, attention deficit hyperactive disorder, bipolar disease, Multiple Sclerosis, Alzheimer's, Parkinson's and schizophrenia.²⁷⁻²⁹ These molecules are further seen to have a negative effect on attention, brain maturation, social interaction and learning in susceptible children. Symptoms are significantly reduced with a combined gluten- and-casein-free diet.³⁰⁻³³ In fact, the absence of gluten and casein from a population is often characterised by a lack of these diseases. Braly and Hoggan (2002) demonstrate how schizophrenia incidence decreased significantly during World War II in European populations suffering grain shortages.

Even blood has much to offer in the head-calming department. Haemoglobin, the red protein in blood, contains biologically active peptides with an affinity for opioid receptors.^{34,35} These opioid peptides, such as endorphins, enkephalin and prodynorphin (opioid polypeptide hormone involved in cell communication), can induce opiate-like effects in animals, affecting the nervous system as well as gastrointestinal functions.³⁶

Then there is the behavioural enrichment slant – such as the satisfaction of chewing on a fresh bone, something we afford great time to in our zoo animals. There is not a single study of this effect in dogs in this respect.

Why we do know is that behaviour is often one of the first improvements noted by owners when changing from kibble to fresh, species-appropriate dog food (author comment). This crucial facet of health appears to be of zero concern to the pet food or veterinary industry. It does not factor in pet food formulation, regulation or manufacturing. Thus, in terms of revealing literature, we have little to go by. Published in the *Journal of Small Animal Practice*, Mugford (1987)³⁷ noted how eight agitated Golden retrievers that changed from commercial dry or canned diets to home-prepared meals made of beef and rice showed improvements in behaviour. The authors concluded that in most cases, people who have dogs with behavioural problems should move their pets from a normal

commercial diet toward a home-prepared one.

Anderson and Mariner (1971)³⁸, of the university of Durban-Westville, South Africa, studies 100 dogs exhibiting negative behaviours, of which 86% were dry-fed. The dogs were permitted to feed *ad lib* on fresh meat (minced offal, beef, chicken, tripe) and cooked vegetables. Raw meaty bones were provided two to three times per week. of these clients, 98% reported ‘dramatic’ improvement. The authors concluded that an appropriate diet (coupled with restricted exercise, in the case of hyperactivity) is ‘unequivocally therapeutic in treating a wide cross-section of behaviour problems’.

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