A LOOK INSIDE CANINE PERFORMANCE DIETS

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Police and military working dog handlers know the importance of keeping their dog in tip-top shape better than anybody. A healthy, well-trained dog can mean the difference between apprehension or escape, interdiction or circumvention. Proper nutrition prolongs your K-9's life and increases operational successes.

THE WORKING DOG DIET

Like humans, the ideal diet of working canines is based on a variety of factors, including the intensity and duration of activity, desired outcomes, environment and the individual energetic requirement of the dog. In all cases, it's vital to assess the overall performance requirements of the canine and tailor the diet – and more specifically, certain nutrients – to meet the needs of the dog.

The main contributors of energy to a dog's diet are protein, fat and carbohydrates. Together, they make up the major energetic constituents in any food and their variable contributions affect the overall performance of an animal.

If the major energy contributions come from protein, fat and carbohydrates in a canine diet, what is the relative energetic value of each? In canines, fat contributes 8.5 kcal/g and protein and carbohydrates contribute 3.5 kcal/g each. Despite the energetic contribution of protein and carbohydrates being equal, they each play different roles for canine performance.

PROTEIN: Proteins are involved in EVERYTHING in the canine body, from muscle development and recovery, to cell wall structure, to enzymatic reactions. The building blocks of protein are amino acids, some of which can be synthesized by the body of the dog, but 10 of them cannot. These are your essential amino acids and they must be ingested in the dog's diet.

FAT: Fats, having a higher caloric contribution than the other constituents, are the major energetic driver in athletic dogs. Fats are made up of fatty acids that can be directly utilized as a source of energy. There are several classifications of fatty acids, such as saturated and non-saturated and poly unsaturated fatty acids (PUFAs), essential fatty acids and omega 3s and 6s, all of which play different structural and functional roles within the body. Similar to protein, fats play pivotal roles throughout the body of the dog, encompassing a wide range of functions from insulation, to vitamin absorption, to proper functioning of the central nervous system. We will discuss these a little more later.

CARBOHYDRATES: Although carbohydrates have a place in the canine diet, dogs utilize different energetic pathways to fuel their bodies than humans do. The role of carbohydrates in the dog diet depends on activity intensity and endurance. The base unit of a carbohydrate is glucose, a readily accessible form of energy. As carbohydrates play a purely energetic role in a dog's diet, carbohydrate requirement is determined by activity level. Interestingly, high levels of carbohydrates commonly found in commercial canine diets are not necessarily what is best for working dogs.

Research shows different canine activities require different combinations of protein, fats and carbohydrates. As you might imagine, the requirements of a racing greyhound vary greatly from that of an Iditarod sled dog, which varies again from the requirements of a detection canine, who must also rely on its senses for task completion on top of the energetic demands of a search. Even then, the search is a mixed activity that might consist of both sprinting and endurance. Simply put, increases in energy expenditure and carbohydrate requirement is based on duration of exercise, not the intensity.

DIETS OF ENDURANCE DOGS

Most research on the canine athlete has been performed on sled dogs, i.e. endurance dogs. In humans, the length of time we can exercise at a low intensity is related to glucose and glycogen depletion time (hence why we carbo-load). This is not the case in dogs. The skeletal muscle makeup of canines is different from ours. These muscles contain unique fibers not typical of many mammalian species that allow fat to be turned directly into energy, primarily during activities that are low-to-moderate in intensity but longer in duration.[1]

Fat, and to be more specific, free fatty acids, are used to fuel canines by increasing aerobic work capacity. In extremely high endurance dogs, diets containing 60-70% of Metabolizable Energy (ME) from fat is required to fuel these sustained periods of activity.[2] This level of fat-derived calories increases oxygen consumption, ultimately leading to an increase in available energy by as much as 50%.

The estimated caloric requirement for endurance dogs is dependent on duration but can be two to ten times that which is required for a typical active adult dog. The diet of these animals also requires a substantial amount of protein to maintain muscle mass. But, what about carbohydrates? Some studies[3] have found that performance was maintained in endurance canines at low-moderate carbohydrate diets (less than 20% as read on a dog food bag), as glycogen/carbohydrate stores were only used for a short time period before fat reserves become the primary source of fuel.

So, what does one of these diets look like in terms of dog food packaging? An endurance dog would do well on a food with >30% crude protein as dry matter (DM), >20% crude fat DM and restricting carbohydrates to less than 30%[1], with some studies suggesting carbohydrates can go as low as 10% of ME.[4,5] A quick and easy way to determine carbohydrate content of a dog food on a DM basis is:

Carbohydrate content (as % DM) = 100 – (% Crude Protein + % Crude Fat + % Crude Fiber + % Moisture + % Ash)

It is suggested that for these types of athletes, 26-35% of ME come from highly digestible animal-based protein, as this helps with muscle maintenance, recovery[6,7,8] and allows for the required increased cardiovascular stamina.[8] 60-70% ME should come from fat and a low level should come from carbohydrates.[1] Although carbohydrate inclusion can be unnecessary, some research suggests it can be beneficial for freeing fatty acids so that they can be used for energy.[2]

THESE DOGS, DUE TO THE SHORT DURATION OF THE ACTIVITY, PRIMARILY USE CARBOHYDRATES FOR ENERGY WHILE SPRINTING, AS IT IS READILY ACCESSIBLE FOR A FAST SPRINT.

DIETS OF SPRINT DOGS

The energetic requirements of sprint dogs are often overestimated. Due to the short duration of the activity, the increase in energetic requirement is often <25% over the maintenance requirement. Canines that fall into this category are agility dogs, racing greyhounds and some service dogs. These dogs, due to the short duration of the activity, primarily use carbohydrates for energy while sprinting, as it is readily accessible for a fast sprint. In greyhound racing, it has been found that diets that with 43% ME from carbohydrates outperform dogs on lower carbohydrate diets.[9] In a commercial dog food, this roughly translates to 24-28% crude protein as DM, 12-14% crude fat DM and 45-50% DM carbohydrate, similar to a typical adult maintenance kibble.[1]

DIETS OF MIDRANGE DOGS, INCLUDING SEARCH & RESCUE AND HIGH-ACTIVITY SERVICE DOGS

Somewhere between the high protein endurance diet required for mushing dogs and the carbo-loading that can be used in racing dogs, lies the activity level of our detection canines. These dogs have the additional requirement of focus and skill. The maintenance energy level required for these types of dogs has been found to be approximately two times that of average adult dogs.[6,10] This has been found to be consistent across breeds, age and sex of the dog. This implies there is an increased energy requirement associated with the mental focus necessary for working canines that has yet to be fully explained. This energy requirement only increases when the number of searches (i.e. exercise level) increases.[10] So, what is the best fuel for these types of activities? Well, the average working level is within 30-70% of their range of aerobic scope, meaning their energetic base comes from a mixture of carbohydrate and fatty acids. When a dog is operating within this range, the breakdown of fats for energy begins within minutes but will not become the dominant fuel until roughly 30 minutes into the exercise.[1]

The level of protein required for the working dog group is a hot topic. A study looking at detection dogs[8] found that protein contribution as low as 18% of ME was adequate over a 12-week period in an otherwise high-fat diet. As pointed out in a review by Wakshlag & Shmaberg, this level is below the recommended AAFCO standards but remains above the stated NRC requirement.[6] Other studies have found the opposite; where low protein diets (18% of ME) saw signs of slower muscle and blood recovery in mid-endurance canines.[11] Until more is known, a protein level >24% of ME is probably a safe protein level to prevent injury and maintain muscle mass. As these dogs tend to be intermediate distance and duration athletes that utilize fats and carbohydrates as fuel sources, a 50% ME from fat and 20% ME from carbohydrate is probably a reasonable diet.[1]

THE HIGH FAT ADVANTAGE

A high fat diet can benefit K-9s in a number of ways, including weight maintenance, increased palatability of food, decreased food volume for satiation and increased energy levels. That said, research into the effect of diet on a dog's nose is relatively complex. Some studies have found that fatty acid composition can have an influence on the detection ability in scent-trained dogs, from foxhounds to hunting dogs and service dogs. Unsaturated fats, oftentimes rich in Omega 3s and 6s, such as PUFAs, have shown to increase the rate of detection thresholds in Labradors given a diet topped with Maize oil.[8]

Likewise, hunting English Pointers fed a diet rich in PUFAs had a more successful rate of bird finds than their counterparts fed regular maintenance foods.[12] Studies with dogs on treadmills have shown that endurance performance and olfactory sensitivity increase with increasing intake of dietary fat. This means that as dietary fat goes up, as will a dog's physical stamina and scent ability, particularly when fed diets rich in animal-based fats.[12] Why is this? It is believed that the PUFAs alter the membranes of the olfactory organs in a canine's nose, making the dog more sensitive to scents.[13] Further research suggests increasing the level of unsaturated fats and decreasing the level of saturated fats in a dog's diet could heighten a his ability for detection.[13]

Interestingly, regular exercise has also been found to play a role, by increasing "scent stamina."[13,14] Overall diet affects the core body temperature, with some indication that diets rich in PUFAs allow canines to return to normal body temperature faster than those higher in saturated fats.[11] Other factors that can influence a dog's ability to detect smell range from the microbes that live in the gut and nasal cavity of the dog to serotonin levels in the body. There is still much to learn about the intricate workings of a dog's sense of smell.[14]

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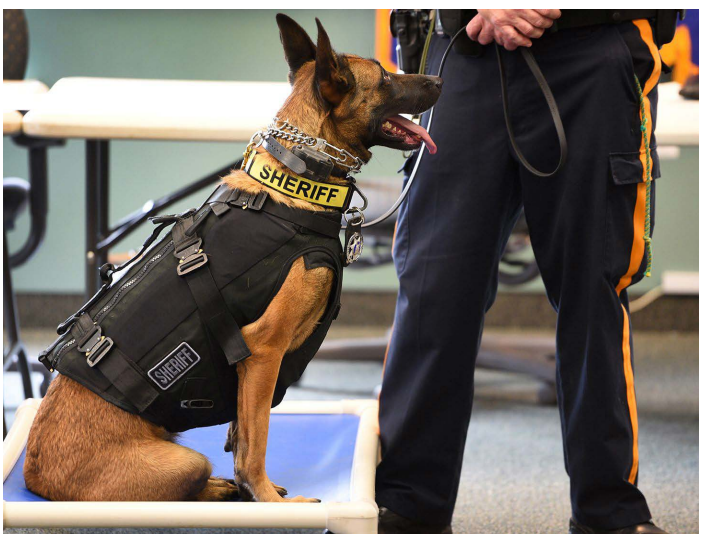

WORKING DOGS AND THE ENVIRONMENT

All this good news about high levels of unsaturated fats increasing olfactory performance doesn't mean common factors that reduce sniff ability disappear. Exercise has an influence on the ability of dog to detect scent. It is theorized that this might be because a dog pants to help decrease its body temperature, and this panting action drastically reduces the ability for dogs to smell, as a dog's mouth must be closed for precise scent detection.[13]

This gets more complicated when you take a dog out of a laboratory and put it in the field, where scents are plenty and weather comes into effect. Environmental condition increases the metabolic requirement of a working canine, where activity outside the "thermoneutral zone" of 20-30˚C (68-86˚F) increases the energetic requirement.[2] The environment also plays a role in a dog's ability to scent. Factors such as relative humid-

ity, wind and barometric pressure affect not only a dog's ability to smell but it also affects how odors move in the landscape.[14] The more humid an environment, the better a dog can smell, until it rains, and detection ability drastically drops off.

Temperature can greatly influence a dog's ability to detect, as does terrain, poor acclimation to new environment, ventilation and dehydration. These can cause an increase in energy expenditure and leads to panting and a reduction in performance.[14]

HYDRATION, HYDRATION, HYDRATION

Adequate water is one of the major influencers on a dog's ability to smell. By keeping the nose moist, neural scent signals are better able to travel to the brain.[13] The quantity required depends on these mentioned environmental factors: temperature, humidity, barometric pressure, the canine's ability to cool off by panting and the duration of exercise.[1]

WHAT TO LOOK FOR IN A CANINE FOOD

Protein & Fat: Sources, Quality and Inclusion

- Look for a diet high in animal-based protein. Multiple protein sources are ideal, as it allows for the body to select what it needs from a wide-range of naturally sourced amino acids.
- Look for a level of protein that is sufficient to meet the needs of the dog for both exercise stamina and recovery. Greater than 24% of ME, or > 28% of DM
- Multiple animal-based fat sources are optimal. Having a range of fats allows the body to select which fatty acids are most necessary for the animal at the time of feeding. Animal fats are helpful, as they are highly digestible to the dog and are often more palatable.
- Higher fat diets = more energy in less food. This is especially important for high-energy K-9s that have a difficult time keeping weight (Belgian Malinois are a great example). Not only will it allow the dog to obtain more PUFAs to help with olfaction, it will get more calories into the dog in less volume. More fuel = better energy and a better likelihood of weight maintenance.
- Omega ratios matter. Look for a diet with a 5:1 to 10:1 Omega-6 to -3 ratio.
- DHA/EPA/linolenic/linoleic acids are constituents of your Omega-3s and 6s. Omega-3 fatty acids, in particular the PUFAs, EPA and DHA (fish oils are a great source!), have been found to help maintain joint flexibility and deter and reduce symptoms of osteoarthritis in dogs more effectively than chondroitin, glucosamine and green lipped mussel.1,15,16 These good fats also play a structural role in cell walls, proper nerve/brain functioning and immune responses. When it comes to EPA and DHAs, fish oils and algae-based oils trump many vegetable-based oils (such as flax).

Carbohydrates and the Working Dog

- Remember: sprinters use carbs; endurance athletes use fats. Find a food that best suits the activity level of your dog. This is largely based on the duration of activity, not the intensity.

Specialized Ingredients

- Lecithin: Helps to transport fatty acids across cell membranes/walls, increasing fatty acid uptake and use as fuel. It also helps maintain the fluidity of the olfactory membrane and the sensitivity of a dog's nose.
- L-Carnitine: Helps canines burn fatty acids for energy and supports lean body mass.
- Glucosamine and Chondroitin: These are commonly used to promote joint health in working dogs and help to maintain flexibility and elasticity in cartilage.[17]
- Semi-fermentable fibers: Examples of these are beet pulp and psyllium husk, however many are found in whole grains such as oats and barley. These fibers provide no energy to the diet but they feed the good bacteria that live naturally in the gut. These bacteria help with nutrient absorption. Many diets mix fibers and oligosaccharides (such as chicory) to help with fecal quality. Psyllium husk is a good supplement for dogs prone to stress diarrhea.[1]

Other Tips:

- Look for a food with finely ground ingredients. Why? The finer the grind, the better the digestibility of the food.
- When possible, purchase from a primary manufacturer. Quality is more likely to be continually and consistently monitored by people who really know the product.
- Packaging matters. Do your best to maintain food in airtight conditions. If you use a reusable food container, wash it between uses. Oxygen exposure breaks down fats used for detection and energy.

[1]Wakshlag & Shmalberg. 2014.
[2]Case, Daristole, Hayek, & Raasch. 2011.
[3]Kronfeld et al., 1977.
[4]Reinhart, 1998.
[5]Hill, et al. 2001.
[6]National Research Council. 2006.
[7]Reynolds et al. 1999.
[8]Angle et al. 2014.
[9]Hill et al. 2001.
[10]Mullens, Witzel, & Price. 2015.
[11]Ober et al. 2016.
[12]Davenport et al. 2001.
[13]Altom et al. 2003.
[14]Jenkins et al. 2018.
[15]Perea. 2012.
[16]Wandel et al. 2010.
[17]Vandeweerd et al. 2012.

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