

PROMOTING HYDRATION IN HOT WEATHER

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At this time of year, it's common to see people out jogging, rollerblading or biking with their dogs. While most owners wouldn't dream of exercising without frequently taking fluids, often their dog's fluid requirements are overlooked. In hot weather and during periods of strenuous physical exertion, a dog's fluid requirements increase dramatically. This month's nutrition column is about the most important nutrient of all: water.

A dog can live for weeks without food but for no more than a few days, and in some circumstances for just a few hours without water. A dog can lose almost all of his body fat and more than half of his muscle tissue and still live, but a 10% loss of body water is usually fatal. A dog's body is more than 70% water and there are very few biological processes that don't involve and require water.

As the principal constituent of blood, water provides a vital transport medium, carrying oxygen and nutrients to tissues and carbon dioxide and metabolic waste products away from them. The water inside cells permits the free movement of molecules, facilitating the multitude of complex chemical interactions of cellular metabolism. Water is required for the digestion and metabolism of nutrients. Not only are digestive enzymes secreted into the gut in aqueous solution, but the process of nutrient digestion is itself dependent on water. During digestion, nutrients undergo "hydrolysis", a process in which water splits large molecules into smaller, more absorbable ones. Water, as the primary constituent of urine, is also necessary for the excretion of waste products from the body.

One of water's most important functions, and one that is particularly important in hot weather and during exercise, is its role in body temperature regulation. Water has a high "specific heat", which means it is able to absorb large quantities of heat energy without greatly increasing in temperature. This property of water explains, for example, why lakes and large bodies of water remain cold in

the summer despite persistently high air temperature. Similarly, body water can absorb the large quantities of heat generated in cellular metabolism without causing increases in body temperature. Water in blood further contributes to temperature regulation by transporting heat away from working tissues and organs, redirecting this heat to surface veins, where it can be lost to the environment.

The most significant mechanism for body heat loss is evaporation. When a dog loses water as sweat from the footpads or the skin, or when he loses water from the mouth by panting, he is losing body heat by evaporation. Since water is able to absorb and hold large quantities of heat, losing water from the body is an efficient way for an animal to eliminate heat from the body. It is estimated that every litre of fluid lost by sweating or panting represents 600 kilocalories of heat expelled from the body.

A non working dog housed in his thermo neutral zone (ie at comfortable room temperature) has a body water turnover of about 50 mL of water per kilogram of body weight per day. So a 20 kg dog will lose about one litre (1000 mL) of water a day and will need to consume one litre of water a day to replace this lost fluid. Water is primarily lost from the body in urine but water losses also occur in feces (which is typically 65-70% water) and breath vapour (which is about 5% water). Dehydration results when fluid losses exceed fluid intake and the degree of dehydration is directly proportional to the degree of disparity between the two.

Five factors can greatly increase water losses and hence water requirements in dogs. These are: environmental temperature, physical exertion, diet, lactation and illness.

A dog's water requirements increase when he is not in his thermo neutral zone. This is not only true for hot conditions, it also holds true for cold weather. When ambient temperature

is colder than ideal, more nutrients are burned as fuel to maintain body temperature and this intensified metabolic activity increases the dog's requirements for water. Animals housed in hot temperatures on the other hand, lose more water panting and sweating to dissipate excess body heat. In both these circumstances, dehydration can generally be avoided simply by providing the dog with unlimited access to fresh water and by offering housing which minimizes temperature stress (ie an insulated kennel, shelter from the elements, shade in the summer etc).

Strenuous physical exertion on the other hand is much more likely to result in fluid depletion even under ideal environmental conditions. This is true for four reasons. First, increased muscular activity greatly increases metabolic rate and the release of energy from nutrient metabolism. About 80% of the energy released during exercise is in the form of heat which must be eliminated from the body, largely by evaporation. Second, exercise increases respiration rate and since breath contains water, body water will be lost from the dog every time he exhales. Third, working dogs require more dietary energy and consume more food to meet these needs. Increased food consumption increases water losses, both in the urine and in the feces. Finally, depending on the duration of activity, dehydration may result from the dog not having an opportunity to drink during prolonged periods of exertion.

Even very mild dehydration can significantly impair athletic performance. Body water depletion reduces blood volume causing the blood to "thicken". This results in the heart having to work harder to pump it through the body, preventing the dog from achieving maximum cardiac output. If lost body fluids are not replenished, a dog will stop sweating and panting in order to conserve body fluids. This can dangerously inhibit the dog's ability to expel excess body heat. The dog's body

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temperature will rapidly rise, resulting in cramps, exhaustion and heat stroke.

Food consumption directly affects water requirements. Increased food consumption, even in the absence of temperature stress, can double or even triple the amount of water lost in a dog's urine and feces. Urine is required for the elimination of nitrogen from the body, so diets which are high in protein promote the production of a greater volume of urine. High fibre diets increase stool volume and therefore fecal water losses. High salt diets, while encouraging water consumption, also increase urine output and so can also lead to body water depletion. Diets which are moderate in protein but high in fat on the other hand tend to help conserve body fluids, in three ways. First, they minimize urine output by reducing the amount of nitrogen which must be eliminated from the body. Second, they provide a more concentrated source of nutrients, thereby minimizing stool volume and fecal water losses. Third, dietary fat contributes "metabolic water". Metabolic water is defined as water produced from the metabolism of nutrients. When 100g of fat, protein and carbohydrates are metabolized, approximately 107g, 40g and 55g of metabolic water are produced respectively. Dietary fat yields more than its weight in metabolic body water.

Two other situations which greatly increase water requirements are lactation and illness.

During lactation, large quantities of fluids are lost from the bitch as milk. If a lactating bitch becomes dehydrated, her milk production will decrease and this will affect the health of her puppies. It is therefore very important to ensure that a lactating bitch is consuming enough water to meet both her own needs as well as the needs of her litter.

Dehydration is a common side effect of many illnesses. Diarrhea and vomiting can very quickly lead to body fluid depletion and in many cases it's dehydration that is responsible for the death of a dog rather than whatever initiated the diarrhea or vomiting. Kidney disease impairs a dog's ability to retain body fluids. A dog with kidney disease will produce an excessive amount of urine and if

this dog is not allowed to freely consume water to compensate for these losses, he will very quickly become dehydrated. Poor appetite is also common in dogs that are ill and inadequate water intake can also quickly lead to dehydration.

SIGNS OF DEHYDRATION

In hot weather, and especially in dogs that are working or active, owners should check frequently for signs of dehydration. An easy way to do this is to observe the dog's urine. A well hydrated dog will produce a large volume of almost clear urine, while a dehydrated dog will produce a small amount of very dark urine or in the worst case scenario, no urine at all. Other signs of dehydration include rapid resting heart rate (greater than 140 beats per minute as compared to a normal resting heart rate of less than 100), dry, tacky gums (a well hydrated dog has slimy gums), slow capillary refill time (ie use your finger to apply pressure to the gum then release in a well hydrated dog, the gums will return to their normal pink colour in less than one second, in a dehydrated dog, this may take 2-3 seconds), and skin tenting (pinched skin should flatten back to normal within 2 seconds, in a dehydrated dog, it may take several seconds).

PREVENTING DEHYDRATION

The easiest way to prevent dehydration is to encourage adequate water intake at all times. Fluid intake can be encouraged by flavouring the dog's water (with beef broth for example), by adding water to the dog's food or by feeding canned foods.

Human marathon athletes are encouraged to drink several glasses of water a few hours before an endurance event and to keep drinking fluids throughout the activity. The same advice applies equally well to canine athletes. Providing drinks of cool water before and during prolonged activity will not only help prevent dehydration and heat stroke, it will also help maximize performance.

Owners should never underestimate the amount of water a working dog needs in order to stay hydrated. One researcher estimated that a typical working sled dog loses six litres of fluids every day. A dog working with

similar intensity in summer heat will lose substantially more.

During these warm, summer months, owners need to make a special effort to keep their canine companions happy, healthy... and hydrated.