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Lecture title: **Animal nutrition: Water in animal nutrition**

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Summary:

The aim of lecture is to introduce the importance of water requirement, and quality of water for supporting animal health and productivity, most of the water in the body is present inside the cells (intracellular water), but a significant proportion of water is outside the cells (extracellular water). Intracellular water, interstitial water, and blood-plasma water account for 50%, 15%, and 5% of the BW, respectively. Water is the most important nutrient in the animal body. It is essential for all metabolic processes, chemical reactions, temperature regulation, eliminating waste from the body, and health and survival. It makes up about one-half to two-thirds of the body mass of adult animals and up to 90% of those newborn animals.

Sources of water

- drinking water
- metabolic water (produced during catabolism of carbohydrates, fats, and proteins).
- the water that presents as moisture in different feed ingredients it differs according to type of crops e.g., Grain 9-12%, Hay 15-20% and green grass 75-80%.
  Metabolic water serves as the sole source of water in desert and hibernating animals, and feed water is the major water source for marine animals. The importance of these different sources varies among species, habitat, and diet. Metabolic water depends on the type of nutrient catabolized that the oxidation of fat produces the greatest amount of metabolic water compared to carbohydrates and proteins. The water content of feed consumed by ruminant and non ruminant animals vary highly. Forages consumed by ruminant animals vary from 5% - 7% for mature plant products, such as hay, to more than 90% for young lush green vegetation.

Water functions:

- Water is an essential constituent of all secretions of the body.
- Water is a universal solvent that facilitates cellular biochemical reactions involving digestion, absorption, and transportation of nutrients.

- The aqueous medium of water helps different digestives juices and food components interact, enhancing digestion, and helps in the excretion of waste products in the form of urine, feces, perspiration and sweat from the animal body.
- Because of the high specific heat of water, it helps in regulating body temperature, by absorbing the heat generated through different metabolic reactions.
- Water also regulates body temperature through evaporation as sweat or transports heat away from organs through blood.
- Water provides shape to body cells.
- Water helps in supporting the acid-base balance of the body.
- Water acts as a cushion for tissue cells and the nervous system and protects the various vital organs against shocks and injuries.

Therefore, animals must consume sufficient water for health and production. This is particularly important for:
(1) lactating dams
(2) young mammals within the first week after weaning
(3) all animals living at high ambient temperatures
(4) all sick animals with fever and an elevated body temperature. Thus, severe dehydration in animals results in their death.

Water loss

Animals' daily loss water through different routes such as urine, feces, sweat, saliva, evaporation from the lungs through respiration, and milk in lactating animals. urinary loss accounts for the major loss. Water lost through urine serves as a tool to dispose of the toxic products of metabolism. Some animals such as poultry are capable of concentrating urine and excreting it as uric acid instead of urea and thus conserving water**.** Urinary water loss depends on the weather and the type of food consumed. Consumption of excess water during heat stress can increase urinary volume. Animals that consume high fibrous diets excrete more water in their feces. Fecal water excretion is higher in cows (30%–32%) compared to sheep (13%–24%). Sweating is a means to dissipate body heat. In animals such as horses, loss of water through sweating is high. Animals such as chickens and dogs have very poorly developed sweat glands and compensate for heat loss by panting and increasing water intake. Daily clean water consumption is important during periods of heat stress, especially in animals such as poultry.

Water requirements

An animal’s water requirement depends on several factors such as:

- Season (In winter the water intake decreases while in summer water intake increase).
- Feed dry matter intake (energy level, fiber content, salt)
- The amount of fat in the tissues.

- physiological state (growth, pregnancy, lactation)
- Age of animal (In suckling animal water intake less than adult)
- Level of exercise
- health.

Environmental temperature (and associated humidity) is a major factor contributing to water intake. Water consumption, when expressed by unit of body weight for non-heat-stressed, non lactating cattle, is around 5% - 6% of the body weight / day (or 2–5 kg of water for every kg of dry feed consumed) and can go up to 12% or more under heat stress.
Water intake increases with higher environmental temperatures and increasing physical activity because of water lost through evaporative loss**.**

Animal	L/day
Beef cattle	26-66
Dairy cattle	38-110
Horses	30-45
Sheep and goats	4-15

Water restrictions
To keeps all related physiological functions, animals should have access to a clean supply of water. Lack of enough water could lead to:

- A reduction in feed intake and productivity.
- Dehydration of the body leads to a reduction in body weight
- Dehydration is accompanied by a loss of electrolytes, an increase in body temperature, and an increase in respiratory rate.
- Animals become highly irritable, and death follow severe water deprivation.

Water intoxication
Water intoxication may occur as a result of a sudden ingestion of large amounts of water after a short period of deprivation and is due to the slow adaptation of the kidneys to the high-water load.

Water quality

- Water quality affects animal health. Substances such as salts, pathogenic organisms, algae, and pesticides pollute water supplies and can affect palatability.
- Mineral salts include carbonate and bicarbonates, sulfates, and chlorides of Ca, Mg, Na, and K. Other toxic substances in water include nitrate, iron salts, and hydrocarbons.
- Pesticides such as malathion and organophosphates may get into water systems and can be toxic.
- Certain blue-green algae (cyanogenic) in lakes can produce toxic substances.