

# Water consumption and control in farm animals

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**Abstract.** Water is vital for farm animals, as it is for all creatures. Water consumption in animals varies depending on factors such as species, age, production type, yield, environmental temperature, feed consumption, feed type, ration composition and water quality. Failure to provide sufficient quantity and quality of water causes deterioration in the health of animals, decrease in productivity and product quality, and even death. Approximately 80% of the Earth's surface consists of water, and 97% of this water found in seas and oceans. The rate of fresh water is below 3% and only 0.5% is usable. However, with the increasing population and agricultural irrigation activities, access to water resources is becoming more difficult day by day. For this reason, studies have been focused on the controlled use of water, which is essential for the continuity of life, in both plant and animal production. This study includes information about the importance of water for farm animals, water quality and control of water consumption.

## 1 Introduction

Although water is the most important nutrient in the diet of farm animals, it is often overlooked. However, depending on the species and age, 60-70% of the animal's body consists of water (Table 1). If it falls below this level, some biochemical disruptions occur and productivity, product quality and animal health are negatively affected. Although approximately 80% of the earth consists of water, the amount of usable water is only 0.5% of the total water. While water use for agricultural purposes constitutes 72% of total fresh water; 1/3 of this rate is used in animal production [1]. The rapidly increasing human population, together with the pressure it puts on animal and plant production, directly and indirectly affects the need for water. Researchers state that the amount of water required to produce 1 kg of meat is 15,400 liters for cattle, 10,400 liters for sheep, 6,000 liters for pigs, 5,500 liters for goats and 4,300 liters for chickens [2]. In addition, insufficiency of precipitation due to global warming causes more intensive use of existing water resources. For this reason, in recent years, studies on plant and animal species with high tolerance to water limitation have been concentrated.

**Table 1.** Body composition of some species (%)

Species	Water	Protein	Fat	Ash
Human	60	18	18	4
Chicken	57	21	19	3
Sheep	60	16	21	3
Cattle	64	19	12	5
Calf	74	19	3	4
Horse	60	18	18	4
Rabbit	69	18	8	5

### 1.1 The importance of water in farm animals

The most important nutrient in the nutrition of farm animals is water. Generally, farm animals can survive starvation for up to 60 days. However, their tolerance to thirst is not that high and although it varies depending on the species, this period is between 2 days and 3 weeks. People can remain dehydrated for a maximum of 3 days and die if they lose 12% of their body fluids. Water, one of the important building blocks of the body, constitutes 83% of the blood, 22% of the bones, and 75% of the brain and muscles. It maintains body temperature by providing thermoregulation and creates an environment for biochemical events in the body. It also serves to transport nutrients to cells and remove metabolic waste from the body.

### 1.2 Water resources

Farm animals meet their water needs from 3 sources. These;

- a. Drinking water
- b. water in feed
- c. It is metabolic water.

Animals meet the majority of their water needs from natural water in pastures or from drinkers in shelters. Although water consumption in farm animals is affected by different factors, on average it is 2-3 times the dry matter consumption. The quality of water, which is extremely important, is also an issue that must be taken into consideration. Water to be given to animals; It should be clean and clear, its temperature should be between 10-15 °C, it should be free from harmful pathogens, its pH should be in the range of 7.0-7.2, it should not contain iron

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and sulfur compounds that cause bad smells, its hardness level should not be more than 20 mg/L, and its salinity should not be more than 1000 mg/L. should be small. After drinking water, water in the feed consumed by animals is another important source. Depending on the raw materials used, the ration can contain between 10-90% water. While even dry grass and straw contain between 10-12% water; Green feeds and food industry residues can contain up to 90% water. During the breakdown of feed in the digestive system, water is formed in varying amounts depending on the type of food. This water meets the needs of animals, albeit in limited quantities. 60% of the carbohydrates, 40% of the proteins and 113% of the fats found and broken down in feed are released as metabolic water.

### 1.3 Water loss

Farm animals remove the water they obtain in different ways from the body through the excretory system in the form of urine and feces. Poultry produce feces equal to 3-4% of their live weight [3]. Considering that a chicken defecates an average of 60-70 g per day, water loss through feces alone is approximately 2-2.5 g. An adult cattle can produce between 1.75-2.60 kg of feces and urine per day for 1 kg of milk [4]. Small cattle excrete around 4-5 kg of solid feces and around 0.5-1 kg of urine per day [5]. These values may vary depending on the animal's productivity level and feed consumption. Chicken eggs have a water content of 88%, cow's milk 88%, chicken meat 75%, goat's milk 86%, and sheep's milk 81%. With the productivity of the animals, water loss will occur as much as the amount of water in the product composition. In addition, animals lose water from the skin and lungs through sweating and respiration.

### 1.4 Factors affecting water consumption

The consumption of water, which is of vital importance such as transporting nutrients to cells, removing metabolic wastes from the body and ensuring thermoregulation, is controlled by some factors. The most important factor affecting water consumption is environmental temperature. Increasing the temperature of the environment in which animals live means that their body temperature also increases with more heat load. In order to ensure thermoregulation, the animal increases its water consumption, puts the high temperature in the body into this water and removes it from the body through sweating, respiration or urine. The thermoneutral zone in poultry is between 14-25 °C. Each degree above this temperature causes the body temperature, which is around 41 °C, to increase further and causes the animal to experience heat stress. Birds that do not have sweat glands are more affected by environmental temperature than other species. In case of heat stress, they try to remove excess heat from the body in the form of water vapor by increasing water consumption and breathing more frequently. In mammals, their body temperature is lower than in birds and their tolerance to heat is higher thanks to their sweat glands. It is stated that environmental temperatures above 27 °C

begin to affect water consumption in cattle [6]. The presence of high humidity along with the ambient temperature increases the perceived temperature, making heat stress more severe and increasing the need for water. Another factor that affects water consumption is the animal type. While cattle need approximately 30 kg of water per day, this value is about 4 kg for sheep and goats. Sheeps; They are more resistant to thirst than cattle due to reasons such as their metabolic activity, fatty tails, less water loss through feces and more saliva secretion. The fat in sheep's tail consists of fatty acid and glycerol. Glycerol is essentially a carbohydrate, and the hydrogen ions released as a result of its breakdown combine with oxygen in the circulatory system and meet the animal's needs in the form of metabolic water. Some sheep, on the other hand, prefer to graze perpendicular to the sun, especially during periods when the water content in the pastures is low. In this way, they are less exposed to sunlight and reduce water loss. Water requirements may vary depending on different ages within the same species. While newborns have 75% water in their bodies; With age, this ratio is replaced first by protein and then by fat. Therefore, the need for water changes with age, depending on the water level in the body. The yield obtained from animals and the amount of water in the product are directly related to water consumption. Considering that milk and eggs, which are among the most basic animal foods, contain 80-90% water, the amount of water excreted from the body will increase with the increase in productivity. Animals will tend to increase water consumption in order to keep the level of water in the body constant, which is important for vital functions. Nutritional factors such as feed consumption, ration composition and nutrient content are other factors that play a role in water consumption. In monogastric and poultry fed mainly with dense feeds, the moisture content of the feed is around 85-90% and this rate does not change significantly. However, moisture content in ruminant rations fed with rough and concentrated feeds in different proportions has a wide range between 10-90%. In addition, the high content of fibers, which are difficult to digest, in ruminant feeds strains the metabolism, causes an increase in body temperature and increases water consumption for thermoregulation. Similarly, water is needed for the digestion of proteins that cause an increase in body temperature and for the removal of urea, a product of anabolism, from the body. The use of sodium chloride as a salt source in the diet increases the need for water and water consumption to excrete excess sodium. The use of feed in pellet form, which absorbs water in the digestive system so that the pellet loses its integrity and turns into powder, is another issue that affects the animals' need for water. In addition, water consumption varies depending on feed consumption, as the consumed feed moves through the digestive system and creates an environment for easy digestion. Since ruminants secrete a lot of saliva during feed consumption, their water consumption is higher than monogastric animals.

### 1.5 Water restriction in farm animals

The rapid increase in human population and the intensification of agricultural production also increase the demand for water. However, the gradual decrease in water reserves due to the effect of global warming has made the economic use of water resources inevitable. For this reason, water restriction practices have recently been focused on in animal production as well as in plant production. It has been observed that feed consumption, live weight gain and milk yield decrease in dairy cattle if the daily water requirement is restricted by 25% or 50%. It has been observed that plasma sodium and hematocrit levels increase with urea in milk and blood [7]. It has been determined that water restriction (10, 20, 30, 40%) in broiler chickens seriously worsens feed consumption, live weight gain and feed conversion rate [8]. Similarly, limited water use in laying hens affects feed consumption [9] and egg production [10]. It has been stated that it reduces. In fact, feed consumption and water consumption are two parameters that affect each other. Just as the change in feed consumption affects water consumption, the change in water consumption also affects feed consumption. Therefore, the decrease in water consumption will reduce feed consumption in all farm animals and worsen productivity and feed utilization. Water restriction affects not only performance but also product quality. It has been observed that under limited water application of broiler chickens, there is a thinning in the breast muscle thickness and a decrease in the amount of fat in the muscles [11; 12]. It has also been found that the meat of these animals after slaughter is paler [12] or redder [11]. It has been stated that these changes in carcasses occur due to the consumption of glycogen and fat tissues and the activity of alkaline phosphatase (ALP), alanine transaminase (ALT) and aspartate transaminase (AST) enzymes [1]. It has also been reported that laying hens produce smaller and thinner-shelled eggs when water is restricted [13].

## 2 Conclusion

Water, which is essential for the continuity of vital functions in the body, is the most important nutrient that must be paid careful attention to due to the gradual decrease in resources. Although the majority of the earth consists of water, it should always be taken into consideration that the amount of usable water is at very low levels. In order to transfer these resources to future generations, plant varieties with high tolerance to drought need to be developed. Likewise, in animal production, it should be continued with species with low water needs, and the productivity levels of local breeds with high tolerance to drought should be increased and their dissemination should be ensured. Besides; When planning shelters, places where animals will be minimally affected by the heat should be preferred, and optimum temperature conditions should be provided in the enterprises. In addition, feeds with high digestibility should be preferred in the ration instead of raw materials that will strain the

metabolism, and attention should be paid to the use of salt, which increases water consumption.

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