The importance of water in pig farming

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Abstract. Water is an extremely important element of metabolism in the body of pigs during ontogenesis. It acts as a transport and solvent medium for nutrients and waste products; improves the digestive system; provides a normal balance of electrolytes and mobility of joints; regulates body temperature; serves as a conductor of biochemical reactions. Pigs' need for water depends on many factors, including feed type, ambient temperature, and general health. Observations of the water consumption of pregnant sows indicate that the ratio of water and feed is stable in sows of the first and second farrowing, and water consumption increases further with each farrowing. The lactating animal should consume up to 40 liters of water per day. In weaning pigs and pigs for fattening, the maximum consumption is noted at the beginning and at the end of the period. Ethological observations have found that animals imitate each other when drinking, showing a herd reflex. With population increase in the group, water consumption increases. The dynamics of the process is influenced by feed type and feeding method. Lack of water leads to dehydration, which affects the behavior of pigs.

1 Introduction

Water plays an important role as a substance that determines the existence possibility, and life on Earth. Water, as a physical substance, is a link at all stages of human development from food production and energy to recycling and sanitary provision of people. It is not subject to political borders, but is the cause of wars, fights, and disagreements between the states. Over the past centuries, with the increase in population in the world, the role of water has increased, and its amount per capita has significantly decreased [1]. This is especially noticeable with an increase in the consumption of animal products as an extremely necessary and intellectual food of people. Increasing the production of meat, milk, eggs requires more water consumption, which means that the question of its economy and cost per unit of production is becoming more and more urgent [2;3]. It is believed that water is an important and necessary element that is used in the national economy in the largest amount in comparison with other sources of raw materials.

Our country occupies one of the first places in the world in terms of fresh water availability, but its involvement in economic management rotation becomes more complicated every year due to consumptive use (unlike industry). It should be particularly noted here that animal husbandry mainly uses clean drinking water, which increases the

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economic value of finished products and requires careful and scientifically justified use without harm to animals [4;5].

When we use water, we practically do not think that somewhere there should be a well for water extracting and pumping, its purification, the necessary tanks for its storage, which cost certain funds for maintenance and servicing. The entire water management complex for the livestock manager is kind of secondary, and the main thing for him is to provide water in the necessary amount to the livestock of animals, to create an optimal microclimate and remove animal manure, which is impossible to do without water!

Water intended for drinking animals must meet the requirements of SanPiN 2.1.4.1074-01. In recent years, due to the increase in energy prices, the cost of water has increased, including in animal husbandry [6]. Therefore, managers, especially economists, have increased the requirements for water consumption, which, in general, is the right approach in organizing production, but sometimes leads to an unacceptable reduction in its consumption by animals.

Troughs with running water are a thing of the past, when pigs could "splash" in open troughs, especially in summer at an outdoor temperature of more than 27-30°C. Nevertheless, the animal body will not save on water, since it needs it to carry out basic physiological processes at all stages of ontogenesis: during growth and development, during lactation, as well as to ensure optimal disinfection and cleaning of the facility. It should be noted that drinking water is also used for sanitary and hygienic measures, since the costs of wastewater purchase, cleaning, and distribution are practically equal to the cost of water. Therefore, understanding the issue of providing animals with water requires a more detailed study to reach a consensus between the physiological needs of the animal and the costs of water [7].

Purpose of research: Study of drinking water consumption in pig farming in the context of different age and gender groups and development of proposals for water consumption optimization.

2 Methodology and objects of research

In the course of the research, general methods of scientific cognition were used to ensure the objectivity and reliability of the data obtained: statistical analysis, analogy, comparison, and systematization. The basis was the results of scientists and practitioners, as well as data from their own research.

3 Research results and their discussion

Water is an important and necessary element for the metabolism of pigs during their ontogenesis. It acts as a transport and solvent medium for nutrients and waste products; improves the digestive system; provides a normal balance of electrolytes and mobility of joints; regulates body temperature; serves as a conductor of biochemical reactions.

The main physiological processes in the body of pigs, including their reproduction, occur due to the water in the feed and the water that the animals consume during the diet during saturation with nutrients and during drinking [8]. Water enters the blood by osmosis at a concentration of salts in the intestine lower than in the blood. Reverse migration of water is also possible, as a result of which temporary dehydration of the body may occur. The thirst center, located in the middle group of hypothalamic nuclei, is very sensitive to osmotic pressure in the body [9]. It should be noted that lack of water leads to disruption of processes in the body much faster than starvation. Water is not only consumed by animals with food, but is also formed endogenously during the breakdown of carbohydrates, fats,

and proteins. 55 g of water is formed from 100 g of sugar, 41 g - from 100 g of proteins, and the oxidation of 100 g of fat releases 107 g of water.

Maintaining the water balance in the body of pigs is closely related to thermoregulation and nutrition. Young pigs start drinking almost immediately after birth. Pigs' need for water depends on many factors. It is quite obvious that the need of weanlings for water differs from the need of sows. In addition, the process of water consumption is also influenced by the recipe of combined feed, milk production in a sow, ambient temperature, and general health.

Data on water consumption during the day by animals of different ages are given in Table 1.

Table 1. Water consumption by pigs, per day

Group	Animal weight (kg)	Need (liter/day)
Pigs	5	0,7
	10	1
	20	2
Fattening	20 – 25	3 — 4
	50 – 80	5 — 8
	80 — 100	8 — 10
Open and 2/3 pregnant	130-180	20
Open sows. Third pregnancy	130-200	20-25
Sows, suckling	160-200	20-25 per sow + 1.5 per young pig
Boars	180-200	20-25

Now it has become obvious that water consumption is interrelated with animal health [10]. Lack of water leads to dehydration, which affects the behavior of pigs. Lack of access to fresh water can lead to so-called salt poisoning. Symptoms of dehydration in pigs may be lethargy, reduced feed intake, uneven unsteady gait. Animals have abdominal pain, vomiting, dark urine, diarrhea, retracted belly, etc.

In addition to acute dehydration, pigs may have chronic dehydration due, for example, to too low water pressure, a small number of troughs or poor quality of the water (polluted or unpleasant to taste), etc. The symptoms of chronic dehydration are similar to the symptoms of acute dehydration: drowsiness, apathy, diarrhea, and urinary tract infections [11].

It is important to note that today the water provision and control of its consumption by pregnant and lactating sows are among the most unresolved issues in pork production. In dairy cattle breeding, for example, there are whole areas of research that study the problems of water consumption by cows. Unfortunately, in pig breeding, much less attention is paid to this issue, especially when it comes to pregnant and lactating sows. Meanwhile, the organization of water supply and drinking is one of the most important tasks of ensuring the health and productivity of animals.

It should be noted that sows start drinking more when they come up in heat. At the same time, a pattern was revealed that limiting water consumption by sows during weaning leads to a decrease in the percentage of their coming up in heat. Therefore, it is very important to control the flow of sufficient volumes of clean water. Some reduction in water consumption is reduced when transferring sows from the insemination zone to the waiting area, which is associated with their adaptation in a new facility.

It is very responsible to provide water to lactating sows, since its deficiency leads to a decrease in milk production, and, therefore, to under-feeding of the animal yield, a decrease in its productivity, which will necessarily negatively affect the final stage of fattening pigs.

Scientists have proved a direct relationship between the volumes of feed and water consumed by pregnant sows, which undergoes some changes from farrowing to farrowing. Thus, in animals of the first and second farrowing, the ratio of consumed water and feed is stable, nevertheless, in subsequent farrowing, water consumption per 1 kg of eaten feed increases. In our opinion, this is due to the fact that in this way the sows compensate for esurience. On average, young sows consume 4 liters of water per 1 kg of feed, and after the third and subsequent farrowing — 7-8 liters of water, and their feed consumption reaches 8-10 kg per day [12].

An important point is the water temperature. +20°C are considered optimal, sows use cold water reluctantly, therefore, even during the construction of premises for animals, managers try to ensure that the water supply passes through certain technical warm facilities for preheating [13].

A lactating sow can be compared with a cow with an average milk yield by the amount of milk produced during the day. After all, to provide ten young pigs in the nest with an average daily gain of 250g, it must produce 10 kg of milk, which is 80% water. High-performance sows at the peak of lactation produce up to 20 kg of milk per day. To achieve such milk productivity, the animal must consume up to 40 liters of water per day. A high level of water consumption also leads to less weight loss of the sow during lactation. The better the sow condition after weaning, the more young pigs it will bring next time, and the insemination process will be better.

There are several watering systems for pregnant sows. This can be a regular nipple drinker when using a dry type of feeding. In case of moistened feed use, nipple drinkers are used, the water from which enters the joint trough and moistens the feed. With such a system, it is very important to correctly set the pressure in the water supply system (more often it is 0.5 atm, since greater water pressure leads to splashing and deterioration of the sanitary condition in the pen. In the conditions of industrial production, nipple drinkers are often used, different for each gender and age group.

At birth, the young pig body consists of 80% water [13]. Immediately after birth, the young pig body loses a large amount of water through the skin and with exhaled air and urine. Balance experiments conducted by I.V. Petrukhin showed that young pigs have a negative water balance before the age of 10 days, and at a more mature age - a positive one, while the unaccounted water difference does not exceed 0.5 ml per 1 kg of body. Lack of water causes young pigs to lose appetite and even refuse of the feed [14].

It should be noted that an increase in ambient temperature from 20 to 28°C leads to a fourfold increase in water demand in suckling pigs. At the same time, the pressure in the trough should be no more than 2-2.2 bar, since high pressure scares off young pigs. In weanlings, the need is 1 liter of water of a temperature of 20°C per 10 kg of live weight, and drinkers should be installed at the rate of 1 drinker for 12 heads.

Young pigs are born with 80-82% of water in the body, but with age and an increase in body weight, as well as by the end of fattening, its amount in the body decreases to 50-55%. Water is not only involved in providing mineral homeostasis, but also serves as a regulator of pig body temperature and ensures the removal of excess urea and other metabolic products from the body. It is water that helps to determine the satiety of animals when filling the intestines.

It is well known that one of the most crucial periods in the technological cycle is the suckling period. Various techniques are used to improve the safety of suckers. One of them is a robotic device for watering suckling pigs. By the method of mathematical modeling based on normative and statistical data, a model has been created that allows determining the required volume of feed mixture and drinking water depending on the day of the young pig life [15]. For different age and gender groups of pigs, water consumption will be different. For example, during rearing and fattening, the maximum consumption will be at

the beginning and at the end of pig feeding. The approximate water requirement for weanlings is 1 liter per 10 kg of live weight; one drinker is required for 12 heads, and the water temperature should be at least 20°C. Drinkers for fattening pigs are installed in such a way that pigs should raise their heads by 15 degrees. In winter, animals prefer warm water, and in summer – cold water. Technologists should take this feature into account purposefully to maximize feed intake. Ethological observations reliably show that due to the herd instinct, the feed consumption increases.

It should be said that in recent decades, pig farming has mainly begun to use nipple-type drinkers of various sizes, considering the age and weight of the livestock. As a rule, after the morning feeding, the maximum water consumption occurs after 1.5 hours, and the second peak occurs an hour after the evening (4-5 p.m.) feeding. The use of technology with darkened cultivation on rearing and fattening and with almost constant lighting (except at night) has convincingly shown that more water is consumed from 7 a.m. to 6 p.m. than in the period from 6 p.m. to 7 a.m.

Many authors associate water consumption with the quality of feed, the design of feeders, the number of animals in the kennel, etc., but the tendency to consume large amounts of water during the daytime in all cases persists. The study of periodization in water consumption is necessary with possible energy savings to ensure the necessary pressure in the water supply pipelines in the night and day.

The seasonality of liquid consumption is obvious due to differences in temperature conditions both indoors and outside the building. Pigs in the hot period, when the indoor temperature rises to 26-30°C, begin to drink more in the morning from 7-9 hours, and also in the evening from 17-19 hours. Such a rhythm of consumption in the summer lasts 4-5 days, which can serve as an indicator of the adaptation of animals to the temperature load.

For pigs, the concept of imitation of each other is quite suitable, especially in the summer, which greatly affects water consumption. This is especially noticeable with different numbers of pigs in groups. It was revealed that water consumption is always higher when the livestock in the pen is more than 10-12 heads. Nevertheless, if there are 35-40 heads in the kennel, then more water is consumed compared to 15-25 heads in the pen. When studying individual water consumption, it was found that the time of water consumption by each animal decreased with a smaller number of individuals in the pen. Spraying water by animals not only increases its consumption, but significantly humidifies the air and increases dampness on the flooring, especially if some of them are most in the form of the uniform coatings.

It should be noted that the type of feed and the feeding method have an impact on water consumption [16; 17; 18]. As it is known, three main types of feed are used in pig feeding: dry compound feeds with a moisture content of 14%, wet mixes with a moisture of 65-70%, liquid feed mixtures with a moisture of 72-85%. Depending on the type of feed, water consumption standards also change. Therefore, the regulatory document RD APK 1.10.02.04-12 provides for two sets of values: a larger one for rations with dry feed, and a smaller one for rations with liquid feed mixtures.

To stimulate feed consumption during the suckling period and immediately after weaning, it is advisable to use liquid feeding. The scientific and production experience conducted in the conditions of the EPC "Pyatachok" of the Kuban State Agrarian University clearly proved the advantage of liquid feeding using the Transition Feeder feeder, in which dry feed is mixed with water, followed by feeding warm feed gruel to young pigs. This technique facilitates the transition of babies from feeding sow milk to consuming solid/emi-solid feed.

4 Conclusions

Water is the main biological fluid and is actively involved in metabolic processes. Its content in animal tissues is closely related to the metabolism in the body, and its deficiency can lead to a disorder of physiological functions and even death. Water enters the body during drinking, as part of feed and, in part, due to the decomposition of organic substances. Pigs' need for water depends on many factors, including gender, age, feed type, ambient temperature, and general health. Observations of the water consumption of pregnant sows indicate that the ratio of water and feed in animals of the first and second farrowing is stable, and increases further with each farrowing. During rearing and fattening, the maximum consumption will be at the beginning and at the end of the period.

Lack of water leads to dehydration, which affects the behavior of pigs. Ethological observations have found that animals imitate each other when drinking, showing a herd reflex. With an increase in the group population, water consumption increases, while its dynamics are influenced by feed type and feeding method.

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