
DIETARY FACTORS INFLUENCING WATER CONSUMPTION

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Introduction

Water is often referred to as ‘the forgotten nutrient’, even though it is essential to biological functioning and required by animals in greater quantity than any other nutrient. Unlike other nutrient sources, water is abundant, inexpensive and usually given ad libitum to pigs in commercial production units. However concern relating to environmental pollution and the cost of storing, hauling and spreading manure is leading to greater interest in water consumption patterns in pigs.

Water makes up about 70% of the lean adult body, and some tissues contain up to 90% water (Maynard et al., 1979). Water is essential for the processes of growth, reproduction and lactation. A wide variety of functions in the body require water including nutrient transport, waste excretion and body temperature regulation.

The water requirements of pigs have been estimated on the basis of feed intake: Yang et al. (1981) gave a minimum water to feed ratio of 1.6, while Bigelow and Houpt (1987) suggested a 1.5-2.0 water to feed ratio. Therefore, when given free access to feed, water intake will increase with increased feed consumption. It is important to note that these estimates are given with the assumption of a thermoneutral environment. In situations of high environmental temperature, for example, water intake will increase as the animal attempts to maintain constant internal body temperature. Water consumption includes intake related to stress, boredom or hunger – pigs may drink water in an attempt to fill their gut when on a restricted ration of feed. In addition, wastage must be taken into account to avoid exaggeration of water consumption measurements. Overall, free access to water is recommended to prevent deprivation due to individual or environmental variation.

Many factors affect water intake by the pig, including environmental temperature and humidity, social conditions and diet composition. The purpose of this paper is to highlight the impact of diet on water consumption. Understanding how diet formulation affects water demand by the pig will aid in the development of management strategies to reduce water consumption without compromising optimum performance and animal well-being.

Water Consumption and Protein

The kidneys are responsible for filtering and removing toxins and waste products from the body. If the amount of available drinking water is constant, the kidneys are able to concentrate the urine more and more as the waste to be excreted increases. This ability to concentrate urine is limited, however, and varies among species. For example, the desert camel can produce urine that is over three times as concentrated as what the pig’s kidneys are able to produce; the camel therefore requires less available drinking water for the excretion of waste products than does the pig.

When an animal ingests protein in excess of the body’s requirements for growth and other physiological functions, the excess is removed from the body mainly in the form of urea in the urine. Amino acids contain nitrogen and are the building blocks of protein. Often included in the diet are synthetic amino acids such as lysine or threonine; the dietary supply of amino acids can be unbalanced with respect to the animal’s requirement, creating an excess of nitrogen in the digestive tract. Water intake may increase in response to the excess nitrogen so that a dilute urine may be produced.

Studies designed to investigate the effect of level of crude protein in the diet on water utilisation patterns have shown that both water intake and urinary output increase as protein level increases. For example, Wahlstrom et al. (1970) found that pigs fed 12% crude protein consumed 3.90 litres of water per day, while those fed a diet of 16% protein increased their water consumption to 5.26 l/d. Close et al. (1983) found that water intake was significantly increased when pigs were given a high protein diet. Similarly, increasing the protein content of the diet from 319 to 433g resulted in an increased urine output, from 1873 to 2893g per animal per day (Pfeiffer and Henkel, 1991). This study showed that it was not necessary for pigs to lower their water intake in response to lower protein content of the diet, but it is essential to increase daily water consumption when protein levels in the diet are raised. This in turn leads to increased urine production as the excess nitrogen is excreted via the kidneys.

Adequate water is essential with high-protein diets.

Water Consumption and Minerals

Electrolytes such as sodium, chloride and potassium are among dietary factors known to be related to water intake by pigs. Sodium and chloride associate as NaCl, or table salt, a prevalent additive in swine diet formulation. In pigs, adding dietary salt at a rate of 1 g/kg increases the average daily water intake by 0.10 – 1.0 l/d (Mroz et al., 1995). Hagsten and Perry (1976) found that water intake decreased by 10-20% on a low salt diet compared to one containing adequate salt. Electrolytes can be added to the diet in forms other than salt; supplementation with sodium bicarbonate (2.6%) and potassium carbonate (3.0%) had the effect of increasing urine volume by 0.63 and 1.03 l/d respectively (Patience et al., 1986).

Water Consumption and Fibre

Fibre is hygroscopic in nature; in other words, fibre in the diet has the effect of drawing water as it passes through the digestive tract (Brooks and Carpenter, 1990). In addition, feedstuffs containing a large proportion of fibrous material pass more quickly through the digestive tract, allowing less time for water to be reabsorbed into the body's tissues. These factors combine to increase the animal's requirement for water when a diet high in fibre is provided.

Summary

Dietary factors play a key role in the water use patterns of pigs. To avoid deprivation and related impaired performance due to individual or environmental factors, animals in commercial pig barns are usually given free access to water. Efforts to reduce water wastage have the potential to minimize the impact that large scale pig production units have on the supply of groundwater, a valuable natural resource. Manure produced by intensive hog farming contributes to operating costs related to the storing and hauling of slurry. A clear understanding of the relationship between diet composition and water intake therefore has practical implications for minimizing costs and addressing environmental concerns associated with large scale pork production.

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