



Dairy Pipeline

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The most important nutrient!

Authored by Jeremy Daubert, Dairy Extension Agent—
Rockingham County, Virginia Cooperative Extension;
jdaubert@vt.edu

What nutrient is the most important for your cows? What nutrient is most important for you, your family and your employees? The answer is the same for both: water! People and animals are made up of 60%-65% water on average. The importance of staying hydrated for both animals and people cannot be overstated. Dehydrated animals produce less milk, eat less feed, and have less growth. In extreme cases dehydration can cause death, especially in young calves. For people, dehydration can cause tiredness, headaches, dry skin, chapped lips, or muscle cramps. In all cases productivity is decreased in both humans and animals during a state of dehydration. Hydration is important to maintaining a healthy herd and workforce.

Animals must maintain the proper balance of water in their body for biological functions to happen efficiently. Cows lose water in a variety of ways including through respiration, perspiration, fecal and urinary losses, and in lactating cows primarily through milk production—which is approximately 87% water. Water intake must replace all of these losses either through moisture in feed or direct drinking of water. Young calves can also replace some of this through the intake of milk or milk replacer.

The recently updated Nutrient Requirements for Dairy Cattle (NRC) includes a few equations for calculating the water intake requirements for dairy cattle. The table below provides a simplified estimate of the drinking water requirements. As with any guide there are many factors that affect the actual requirements of an animal. Age, temperature and lactation status are primary factors in assessing water needs.

Table I. Drinking water requirements of dairy cattle.^{1,2}

Livestock class	Age or Production	Gallons/day ²
Calves	1 month	1.3 to 2.0
	2 months	1.5 to 2.4
	3 months	2.1 to 2.8
	4 months	3.0 to 3.5
Heifers	5 months	3.8 to 4.6
	15 to 18 months	5.9 to 7.1
	18 to 24 months	7.3 to 9.6
Holstein cows	Lactating	18.0 to 40.0
Dry cows	Pregnant, 6 to 9 months	9.0 to 13.0

Adapted from:
 1. Swistock, B. 2016. *Interpreting Drinking Water Tests for Dairy Cows*. Pennsylvania State University.
 2. Kononoff, et.al, 2017. *Water Quality and Requirements for Dairy Cattle*. University of Nebraska

Since so much of the cow’s health is dependent on water intake, it is extremely important that the cows have continual access to clean water. This

access should start the day the calf is born. Young calves should have access to clean water the entire time they are on milk. Some calves will drink more water than others, but it is important that they have access at all times.

Clean water is also really important, and this starts at the source. Water sources should be tested periodically to ensure good quality. Many quality problems with water cannot be seen and require laboratory analysis before a quality determination can be made. The water test should include: pH, total dissolved solids, bacteria and coliforms at a minimum. There are many minerals that can be found naturally occurring in water with the potential to affect cow health. If problems are suspected, water testing can be done for a wide variety of minerals, ions, and heavy metals. Contact your local extension office for a list of labs that can analyze water. In Virginia, well water testing is also offered in many localities through extension. Testing is the only way to make a determination on the safety of the water.

Having a safe and consistent water source available for animals is important, but don't forget to keep water troughs and fountains clean and maintained. If the water in them is not clean enough that you would drink out of them, then it is not clean enough for the animals. The troughs should be cleaned often. How often depends on several factors including the number of animals using it, size of the trough and the time of year. Some troughs may need to be cleaned every day, while others may only need to be cleaned once a week.

Don't forget to keep the people hydrated as well. It is easy to get busy on a farm and not drink enough water. By the time you feel thirsty, you are probably already dehydrated. Headaches and

muscle aches will likely show up later, but it takes longer to rehydrate enough to cure them. Severe dehydration can cause the loss of work hours and could land someone in the emergency room. There is a misconception that dehydration cannot happen in cold weather, but it is just as common in cold weather as it is in hot weather. Make sure clean fresh water is available at all times for all animals and people.

The role of adipose tissue in metabolic adaptation during the transition period of dairy cows

Authored by Ana Flavia Souza Lima, Ph.D. student with Johan Osorio, Assistant Professor, One Health, School of Animal Sciences, Virginia Tech; osorio@vt.edu

A critical phase on dairy farms is the transition period when cows move from pregnancy to lactation. This period occurs between 3 weeks before and 3 weeks after parturition. During this period, alterations in the metabolic processes and physiological functions prepare the cow for the onset of lactation, which can be especially challenging for high-yield cows. Among the alterations in metabolism is the negative energy balance (NEB). This condition occurs when a cow's energy demands, likely driven by milk production, are not met from energy intake from feed, causing fat mobilization. Depending on the severity of this fat mobilization, cows can become more vulnerable to other diseases and metabolic disorders. Poor management during the transition period can have various negative consequences, including reduced milk yield and poor reproductive performance, ultimately leading to decreased profit margins and sustainability. This

article aims to discuss the control of fat mobilization during NEB in transition dairy cows.

During the transition period, cows have a high demand for nutrients (e.g., energy and protein) for fetal growth, mammary gland development, colostrum production, and maintenance. However, dry matter intake (DMI) decreases significantly around calving, making it difficult to meet these nutritional demands. Consequently, cows often experience NEB during the transition period. The NEB usually starts a few days before calving but becomes more severe in the first few days after calving. In high-producing dairy cows, the NEB condition is further aggravated by the prioritization of energy for the mammary gland, which can affect the metabolism of various tissues.

Adipose tissue is susceptible to changes in metabolic function during this time. This tissue serves as a primary energy store in the form of triglycerides. When cows are in a positive energy balance (i.e., normal conditions), usually at the end of lactation, fat accumulates in the body through a process called lipogenesis. In contrast, when cows experience NEB, the process of lipolysis is initiated, which involves the breakdown and mobilization of stored triglycerides, also known as fat. Lipolysis is a critical metabolic mechanism that enables cows to express their genetic potential for milk production, especially during NEB.

The breakdown of fat is a process that involves three distinct enzymes: adipose triglyceride lipase (ATGL), hormone-sensitive lipase (HSL), and monoglyceride lipase (MGL). These enzymes coordinate a three-step breakdown of triglycerides, which is comprised of 1 glycerol molecule and 3 fatty acids. Initially, ATGL initiates triglyceride hydrolysis, resulting in the

formation of diacylglycerol. Subsequently, HSL breaks down diacylglycerol to form monoacylglycerol. Finally, MGL finishes the process by producing two molecules, a fatty acid [also known as NEFA] and a glycerol that is released in the bloodstream. In the blood NEFA can be transported and can enter the liver and undergo oxidation, leading to the generation of energy.

However, excessive fat mobilization can lead to serious metabolic disorders. With the increased mobilization of fat, there is a higher concentration of NEFA arriving in the liver, exceeding the organ's capacity to completely oxidize fatty acids to provide energy. As a result, there is an increase in the production of ketone bodies (mainly beta-hydroxybutyrate; BHB). Fatty acids can undergo reactions and esterify, forming triglycerides again, which accumulate in hepatocytes (liver cells), causing fatty liver which can negatively impact cow health and productivity. In this context, it is well known that the NEFA concentration in blood is a good indicator of adipose tissue mobilization during lipolysis.

The transition period is a critical phase in a dairy cow's life that demands careful attention and management. Understanding the metabolic adaptations and ensuring a balanced approach to nutrition are paramount. By prioritizing the well-being of dairy cows during this critical period, we not only safeguard their health but also enhance their productivity, ultimately contributing to the sustainability and profitability of dairy farming.

Upcoming Events

National 4-H Dairy Quiz Bowl
November 5, 2023
Louisville, KY

Southern Regional Dairy Challenge

November 16-18, 2023

Eatonton, GA

Hokie Dairy Day

December 2, 2023

Blacksburg, VA

VA WISE Cattle & Equipment

December 15-16, 2023

Grave's Mountain Lodge

If you are a person with a disability and require any auxiliary aids, services or other accommodations for any Extension event, please discuss your accommodation needs with the Extension staff at your local Extension office at least 1 week prior to the event.

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Dr. Christina Petersson-Wolfe,
Dairy Extension Coordinator &
Extension Dairy Scientist,
Milk Quality & Milking Management

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