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Calf Note #68 – Predicting water intake in young calves

Introduction

Why do calves drink water? Over the past two years, we have measured daily water intake in calves as part of our normal research program. We measure water intake to determine important factors that influence the nutrition and health of young animals. In addition, we measure many other variables that may be related to why calves drink water. This Calf Note is intended to identify some important relationships between water intake and some other variables.

First a disclaimer...

The measurements that we made were part of research conducted at the APC Calf Research Unit in Ames Iowa (see photo). The studies were conducted during 1999 and 2000. It is important to note that the data shown here may not relate to calves in other parts of the world where environmental conditions vary



dramatically. The table can give you an idea of the range in which these data were collected. It is important to understand that when conditions are outside of this range

The conditions

Calves used in this study were primarily Holstein bull calves purchased from local auctions or dairy farms. However, a small number of heifer calves were included, as were some beef by Holstein crosses.

Calves were usually 3 to 5 days of age at the start of the studies, but the actual birth dates were usually not determined. We started

studies one or two days after the calves arrived at the Unit. Water (6 L) was offered every day and the amount remaining was measured. We assumed

Description of experiments used to predict water intake.

Experiment no.	No. of calves	Date start	Date End
JDQ9905	120	23 Apr 1999	25 Jun 1999
JDQ9909	120	02 Aug 1999	22 Sep 1999
JDQ9910	72	11 Oct 1999	06 Dec 1999
JDQ0002	120	04 Mar 2000	06 May 2000
JDQ0006	120	27 May 2000	28 Jul 2000
JDQ0009	120	11 Aug 2000	12 Oct 2000

that the difference between the amount offered and the amount remaining was consumed by the calf. In some studies, some calves drank > 6L/day, so an additional water feeding (6 L) was offered

in a second (or even third) feeding at the end of the day. We worked to make sure that water was always available to the calves

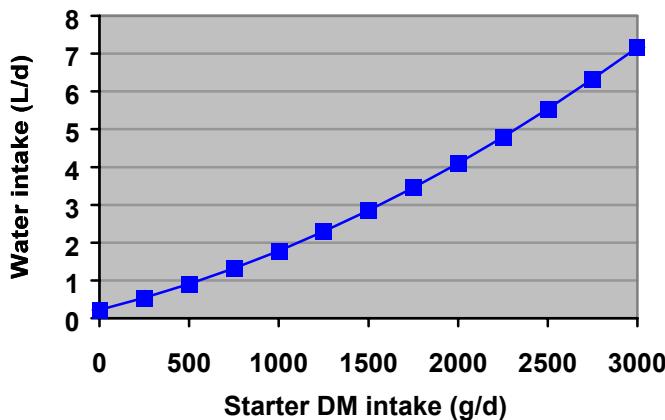
Calves were offered a number of different types of milk replacer during the studies. Typically, calves were fed approximately 440 grams of dry matter per day in 3.9 L/day in two equal feedings. However, some calves were offered amounts of milk replacer that varied both in concentration and quantity. Depending on the study, calves were weaned at 28, 42 or 56 days after the start of the study. Calves were offered a commercial textured calf starter beginning at 0 or 29 days of the study. The product was a textured starter (50% pellets, 25% rolled oats and 25% flaked corn) that was offered for ad libitum consumption.

The environmental data (temperature, humidity and radiation) were obtained from the Iowa State Campbell Network. This system monitors environmental conditions continuously and is a great asset, particularly since the meteorological station is located close to the Calf Research Unit.

Descriptive statistics of data used to predict water intake.				
Item	N	Minimum	Maximum	Mean
Calves	672
Water intake, L/day	33,652	0	18	2.3
Initial body weight, kg	672	34.5	62.6	46.3
Total DM intake, g/d	33,488	0	4367	1071
Starter DM intake, g/d	33,490	0	4116	672
Milk DM intake, g/d	33,524	0	771	393
Milk intake, L/d	33,524	0	6.6	3.3
Calves with scours, %	32,512	0	100	13.7
High temperature, C	357	1.4	37.0	21.4
Low temperature, C	357	-8.3	23.1	9.3
Humidity, %	357	28.0	98.7	69.9

The prediction

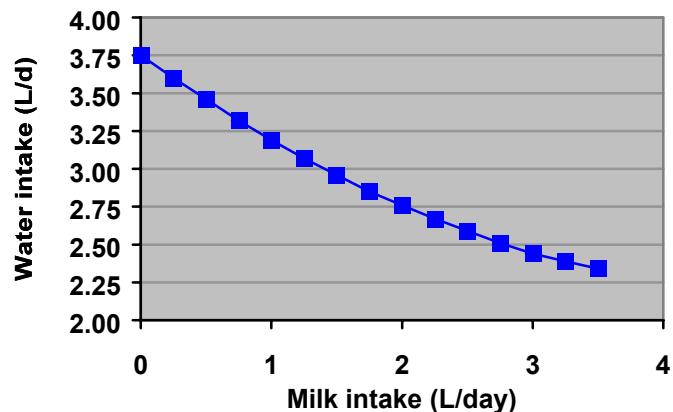
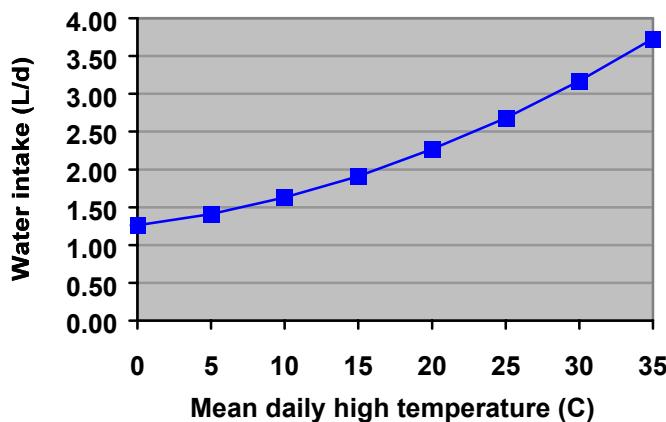
A number of statistical approaches were taken to determine the relationships between water intake and various descriptor variables. We developed several experimental models. While these are beyond the scope of this Calf Note, there were two that were used in our experimental work. The first was a “full” model, which included more than 20 different variables, all of which influenced water intake. This model was obviously not useful in allowing us to reasonably predict water intake, but it did indicate that many factors contribute to determining how much a calf will drink. For example, solar radiation, amount of total dry matter consumed, and whether a calf was scouring all influenced the prediction of water intake.



On the other hand, we developed a “reduced” model that allowed us to reasonably predict daily water intake. This equation used just three variables, all of which significantly affected water intake – they were starter DM intake, mean daily high temperature, and amount of liquid milk replacer consumed by calves.

There were several important observations related to each of these variables:

- Water intake was VERY closely correlated with starter intake. Basically, the more starter the calves ate, the more water they drank. Daily starter intake explained more than 60% of the variation in daily water intake. Surprised? You shouldn't be. The relationship between water intake and starter intake is fundamental to proper calf growth. Intake of starter drives rumen development, which allows early weaning and rapid growth. Therefore, making sure that calves have access to fresh, clean water is essential to proper calf management
- The greater the environmental temperature, the more water the calves drank. Figure 2 shows the predicted water intake in calves consuming 1 kg of starter DM per day. At zero degrees, calves will drink approximately 1.4 L of water per day. At 15°C, calves drink almost 2 L/day. By the time the temperature reaches 30°C, intake exceeds 3 L/day. This is another obvious conclusion of the study, but it often bears repeating. Calves need greater amounts of water as the temperature increases. Additionally, the amount of water increases in an *exponential* fashion – it is not a linear function. This means that the need for water is greater when the temperature increases from 20 to 25°C compared to the increase from 5 to 10°C.
- The amount of liquid in milk replacer fed also affects the amount of water consumed. It is very possible that this relationship is due to the fact that increased water in milk replacer will reduce the need for additional water to be fed as liquid or “free” water. In figure 3, calves consuming 1 kg of calf starter at 21°C will consume 3.75 L/day when calves were fed no liquid milk replacer. On the other hand, under the same conditions, calves fed 3 L of liquid milk replacer will consume slightly less than 2.5 L/day.



Summary

Calves have a need for free water. It is responsible for improving the age at which calves begin eating dry feed. Make liquid water available to calves from 1 day of age. Keep it fresh, clean and change it often. The APC Calf Research Unit changes water daily and washes buckets whenever they become soiled. This promotes early dry feed intake and allows the calves to achieve their genetic potential.

Our research indicates that the most important factor affecting water intake is calf starter intake (and vice versa). Additional factors included mean high environmental temperature and amount of liquid water consumed.

Written by Dr. Jim Quigley (11 November 2000).
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