Q&A

Dr. Jean Baptiste Daniel – Ca homeostasis relative to calving

1. Why do you think CaCl2 boluses require repeated application and CaCO3 based applications not?

Ca chloride ($CaCl_2$) is highly soluble in the rumen and, when administered, induces a rapid increase in blood Ca concentrations. This rapid rise may signal Ca abundance, potentially interfering with the physiological adaptation required to upregulate Ca mobilization from bone and absorption from the diet. This mechanism is supported by the reduced blood Ca concentrations observed 24 h after administration of a bolus containing approximately 45 g of $CaCl_2$ as the main Ca source. To prevent this decline, manufacturers typically recommend repeated administration, which effectively maintains blood Ca concentrations.

In contrast, a single dose of 45 g of $CaCO_3$ sustains elevated blood Ca concentrations for up to 48 h. This effect is explained by the low ruminal solubility of $CaCO_3$, which allows Ca to reach the small intestine at a rate dependent on liquid passage (approximately 8–10%/h). Once in the post-ruminal sections of the gastrointestinal tract, Ca is solubilized and becomes available for absorption. This supports additional availability of Ca at a critical time without interfering negatively in the physiological adaption.

2. What are other advantages of CaCO3 compared to CaCl2?

Calcium chloride is characterized by a high ionic concentration and osmolarity, which may irritate the mucosal lining of the gastrointestinal tract. Consequently, it is considered a poorly palatable Ca source, limiting voluntary consumption. In contrast, $CaCO_3$ does not pose a risk of irritating the gastrointestinal mucosa and is highly palatable, offering the possibility to avoid drenching during administration.

3. Dry cow management of jersey cows vs holsteins - anything you would do differently to prevent milk fever in jersey cows?

Nutritional management strategies effective in preventing milk fever in Holstein cows are also applicable to Jersey cows. Nevertheless, due to physiological differences, such as higher dry matter intake relative to body size in Jersey cows, optimal inclusion levels of Ca or anionic salts in the dry-cow diet may differ slightly between breeds. Indeed, studies have shown that when Jersey and Holstein cows

are fed the same diet, Jerseys exhibit lower plasma total and ionized Ca concentrations at calving compared to Holsteins.

4. **Assuming the immune system is upregulated, which uses glucose and calcium, what impact would a negative DCAD have on whole body calcium status? Secondarily, what level of dietary calcium would you encourage in this situation for the close-up ration?**

Feeding a negative DCAD during the dry period induces a state of metabolic acidosis, which alters the functionality of TRPV5, a renal Ca transporter responsible for Ca reabsorption. As a consequence of this reduced activity, urinary Ca excretion increases, creating an ''artificial'' increase in net Ca requirement. This stimulates an increase in intestinal Ca absorption efficiency. Such early adaptation allows the cow to better maintain Ca homeostasis postpartum, regardless of inflammatory status.

Dietary Ca concentrations in the dry cow ration at or below 3 g/kg DM may be sufficiently low to prime the cow to respond efficiently to sudden changes in Ca status. However, when Ca is fed at these levels, it is important to ensure adequate forage NDF to prevent excessive dry matter intake. Diets based on corn silage, barley straw, and a protein source are generally effective in supporting early metabolic adaptation for both energy and Ca metabolism.

Dr. Juliette Willms – Diarrheic calves

1. **What impact do you feel including a butyric acid product during this hydration time of the calf would have upon health?**

Butyrate is highly effective for improving calf gut health and supporting overall immunity. However, it delivers the greatest benefits when incorporated into milk replacer fed from birth at sufficient volumes. When included in oral rehydration solutions (ORS) administered twice daily for a maximum of 3 days, the resulting butyrate intake would be marginal and unlikely to provide meaningful benefits to the calf.

In addition, many butyrate products have strong olfactory constraints that may compromise palatability, which is a critical factor when treating diarrheic calves. Sick calves require highly palatable solutions to ensure adequate voluntary intake. For these reasons, butyrate is better positioned as a preventive strategy when included in milk replacer rather than as a therapeutic component of ORS.

Alternatively, research has identified lactoferrin as a promising candidate for inclusion in ORS formulations. However, sourcing lactoferrin in the volumes required for commercial-scale production remains challenging.
Ultimately, the efficacy of an ORS product depends primarily on achieving the correct balance between osmolality and strong ion difference (SID), as this balance is what will have the most significant impact on calf recovery.

2. Some oral rehydration solution (ORS) products contain fiber sources such as psyllium husk. Does their inclusion improve fecal consistency?

There is no strong supportive literature demonstrating that fiber sources such as psyllium effectively slow gastrointestinal transit in diarrheic calves or meaningfully improve fecal consistency. On the contrary, psyllium has been shown to interfere with glucose absorption in diarrheic calves when included in ORS. Because glucose is essential for sodium and water absorption via sodium–glucose co-transport mechanisms, reducing its absorption may impair the overall ORS efficacy.

Moreover, unabsorbed glucose is osmotically active and can draw water into the intestinal lumen, potentially resulting in more watery feces. In human nutrition, psyllium is sometimes used in specific dietary applications to modulate carbohydrate absorption. It is also widely used as a laxative in humans, which further questions its suitability in ORS formulations for diarrheic calves. Recent research has shown that calves receiving an ORS containing psyllium produced more watery feces. Consequently, most experts in calf ORS formulation do not recommend the inclusion of psyllium in these products.

Finally, using fiber to absorb water in the gut and make feces appear less liquid does not improve the hydration status or recovery of a diarrheic calf. The water retained within the fecal mass is still lost from the animal's body and therefore does not contribute to rehydration.

3. Can I provide ORS right after a milk meal? Can it interfere with digestion?

Mixing ORS with whole milk or milk replacer should be prohibited, as it significantly increases the risk of hypernatremia and abomasal bloating. Furthermore, some studies indicate that high bicarbonate concentrations in ORS can cause a prolonged increase in abomasal pH. This elevation in pH may reduce the calf's natural defense against certain enteric pathogens and potentially interfere with normal milk digestion.

When a calf develops diarrhea, total daily fluid intake must be increased to prevent dehydration. If labor constraints make it difficult to return later in the day, offering an ORS feeding immediately after a milk meal is an acceptable strategy. However, this ORS feeding should be offered for voluntary consumption rather than

administered by drenching. If the calf has not voluntarily consumed the ORS later in the day, the remaining solution can then be administered by drenching to ensure adequate fluid intake.

4. Can I drench ORS to calves?

Ideally, ORS should be offered to diarrheic calves in the early stages of the disease, while they still retain a strong suckling reflex. When a diarrheic calf refuses both milk and ORS and exhibits clinical signs of dehydration and/or metabolic acidosis, drenching 2.0 L of an ORS formulated with a high strong ion difference (SID) can be critical. This intervention may help correct metabolic acidosis and restore hydration status, ultimately allowing the calf to resume milk feeding.

Milk, however, should never be administered by drench. Subsequent ORS feedings should ideally be consumed voluntarily to minimize the need for repeated drenching.

5. What are the advantages of providing an ORS with a high SID and low osmolality?

ORS with a high SID (strong ion difference) and low osmolality are absorbed more efficiently by calves and provides a greater alkalinizing ability compared with a hypertonic ORS (high sugar and salt) with the same SID. In practical terms, this means that smaller volumes of ORS are required to achieve the same correction of metabolic acidosis.

For example, when using an ORS product with low alkalinizing capacity, calves may need up to 4 L per day to achieve the desired effect. In contrast, an ORS with high SID and low osmolality can provide the same benefit with just 2 L per day.

Similarly, in critical situations where a calf is recumbent and IV therapy is unavailable, drenching 2 L of a highly effective ORS can be lifesaving.

6. Does the type of diarrhea matter?

Once a calf has been diagnosed with diarrhea, the treatment protocol should be consistent, including the provision of 2.0 L of ORS in between milk meals during the early stages of the disease. However, when diarrhea occurs in the first days of life and is caused by E. coli K99, it is important to review the colostrum management protocol. ORS remains effective for rehydrating calves with E. coli diarrhea, but because fluid loss can be very rapid, larger ORS volumes may be required, sometimes even at night, which can be labor-intensive. Regardless of the diarrhea etiology, the usual milk allowance should be maintained, with ORS provided as an additional volume, and calves should have ad libitum access to clean water from birth. Regarding the type of diarrhea, most calves are affected by *Cryptosporidium* and rotavirus, which cause diarrhea by malabsorption. This makes them particularly sensitive to hypertonic solutions, as they cannot efficiently absorb

solutes and nutrients due to damage to the gut mucosa. In these cases, low-osmolality ORS with a high SID are likely the most effective solution.

7. Is fecal consistency a good predictor of diarrhea severity in calves?

Fecal consistency alone is not a reliable predictor of diarrhea severity, as fecal dry matter is not linearly correlated with total fecal volume per kilogram of body weight. A calf may produce watery feces without necessarily losing a large volume of fluid if the total fecal output is not excessive.
For this reason, clinical signs should always be considered when assessing diarrheic calves. Indicators of dehydration include reduced skin turgor and the degree of enophthalmos (sunken eyes). Signs of D-lactate–associated metabolic acidosis may include an inability to stand steadily and incomplete eyelid closure. In addition, decreased appetite, a weakened suckling reflex, and slower drinking speed can also be present. In cases of uncertainty, any calf presenting with wet to watery feces may benefit from one administration of an effective ORS per day. Early intervention significantly increases the likelihood of preventing severe dehydration and metabolic acidosis.

8. What's best transition practice of transition from colostrum to CMR? how much role transition milk plays in immunity of calf?

Transition milk (TM) primarily supports local immunity in the gut rather than systemic immunity or transfer of antibodies. Feeding TM to calves has been shown in research settings to enhance intestinal development, reduce the incidence of diarrhea, and improve growth. It can also contribute to the transfer of immunity (locally), particularly when dry cows have been vaccinated against specific pathogens like Cryptosporidium. However, much depends on how TM is defined and managed.

Transition milk should never be mixed with waste milk and fed to calves. It is generally defined as milkings 2-6 after calving, which corresponds to approximately 2 to 3 days of feeding for a newborn calf. Transition milk contains elevated levels of bioactive compounds compared to whole milk. Strict hygiene is essential to ensure that TM provides added value rather than increasing disease risk. If hygiene cannot be adequately guaranteed, a practical alternative is to supplement milk replacer with colostrum replacer. For example, feeding a mixture of 10% colostrum replacer and 90% milk replacer from 2-14 days after birth has been associated with increased body weight, higher average daily gain, and a reduced risk of mortality.

Overall, when clearly defined and properly managed, TM can provide significant health and performance benefits to young calves. If proper TM management cannot be implemented, it is preferable to move calves directly from colostrum to milk replacer.