Calf diarrhoea – prevention and the role of microbes

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Summary

- Diarrhoea or scour is the most common disease in calves under one month of age.
- Calf diarrhoea has many causes and it may be non-infectious (mainly due to nutrition) or infectious.
- Optimal colostrum management is essential for the development of the calf's immune system and supports calf gut health.
- A microbiome is a community of microorganisms in a particular environment.
- The "Holoruminant" EU-funded project is investigating the role of microbiomes in developing solutions to reduce early-life diseases including calf diarrhoea.

Introduction

The microbiome refers to the collection or community of microorganisms in a particular environment. Ruminants, have a complex microbiome consisting of bacteria, archaea, protozoa, fungi and viruses. The microorganisms that are present, for example bacteria, can either work with one another or compete with each other for a particular function. Diarrhoea is the most common cause of death in pre-ruminant calves (one month of age and younger). On-farm research by Teagasc Grange has shown an incident rate for diarrhoea of 8.7% in suckler calves and 25.5% in dairy calves. Non-infectious factors such as inadequate colostrum management, poor feeding environments and weaning stress can increase the risk of diarrhoea. *Cryptosporidium parvum*, rotavirus and coccidia are usually seen as the most common infectious causes of calf diarrhoea (Table 1). There is limited information on the contribution of the hindgut bacterial microbiota (community of microbes) to the incidence of diarrhoea in dairy calves. Therefore, the structure and functional roles of the microbiota in diarrheic calves requires further study.

Table 1. *Infectious causes of calf diarrhoea*

Type	Agent/disease	Calf age	Occurrence
Bacteria	*E. Coli* (ETEC)	1-5 days	Rare
	Salmonella spp.	4-28 days	Less common
Viruses	Rotavirus	5-14 days	Extremely common
	Coronavirus	5-30 days	Less common
Parasites (protozoa)	Cryptosporidiosis (*Cryptosporidium parvum*)	5-30 days	Extremely common
	Coccidiosis (*Eimeria* spp.)	Over 3 weeks	Common

Development of the lower gastrointestinal (GIT) microbiome and calf diarrhoea

During the neonatal period, calves are particularly susceptible to enteric disease due to immature immune function and naïve microbial communities that are not yet established. In turn, opportunistic pathogens can establish themselves and proliferate resulting in

diarrhoea. Research conducted as part of the EU funded HoloRuminant project, found that during the first week of life, when microbial colonisation of the lower GIT is underway, pathogenic microbes, such as Escherichia-Shigella, are more prevalent. The abundance of Escherichia-Shigella was reduced by the 2nd week of life with the overall microbiome of the young calf stabilising (i.e. all of the main microbes being present) within 3 weeks of life.

A recent study evaluated effect of colostrum source (CS) and calf breed (CB) on diarrhoea incidents in 51 spring born Holstein (HO; n=29, birth weight (BW) 34.7 kg) and Jersey (JE; n=22, BW 25.9 kg) heifer calves from birth (day (d) 0) to weaning (d83). Calves were fed 8.5% BW in colostrum, from either, the calf's dam (n=28) or a pooled source of colostrum (n=23) within 2 hours of birth. A modified Wisconsin-Madison calf health scoring system was used and rectal temperature (RT) measured for clinical assessment at d0, d7, d21, and day-of-diarrhoea incident, and day-of-weaning. Live weights were recorded at d0, d21, and weaning. Diarrhoea incident was assessed using faecal scores (0=normal, 1=semi-formed, 2=moderate, 3=severe diarrhoea), and health status was defined as calves having diarrhoea (n=27), or healthy (n=24). The mean day post-birth for diarrhoea was d23 and d22 for HO and JE calves, respectively; 53% of calves had a diarrhoea incident. On the day of diarrhoea detection, faecal scores were greater for diarrhoeic calves (median score 3) than healthy calves (0) while RT of diarrhoeic calves was elevated (+0.37°C). Health status had no effect on average daily gain from birth to weaning. Phases with high incidence of diarrhoea from birth to weaning, and the faecal microbiotas between healthy and diarrheic calves (pre-diarrhoea, diarrhoea and post-diarrhoea) were examined. Using next generation sequencing analysis, a significantly different bacterial community between healthy and diarrhoeic calves was detected. The results suggest that the dynamic changes of the calf gut microbiota and the interactions among some bacteria could influence diarrhoea onset and outcome.

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