



BestBETS for Vets

Supporting veterinary clinicians in making evidence-based decisions



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Nottingham

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Dairy calves with diarrhoea - does giving milk and rehydration fluids in combination result in a faster recovery?

Clinical Scenario

You receive a phone call from one of your routine clients. They are worried about a few calves starting to scour in the preweaned calf shed. After discussing possible causes of diarrhoea and preventative measures, the farmer asks you whether or not he should keep feeding milk to these calves or if the oral rehydration fluids (electrolytes) alone will be sufficient. He is worried the milk will “feed the scour” and has received conflicting advice. You advise him to keep feeding milk as well as oral rehydration fluids but wonder whether there is any evidence to support these calves recovering faster compared with calves that are offered oral rehydration fluids alone...

3-Part Question (PICO)

In [dairy calves with diarrhoea] does [feeding milk and rehydration fluids as compared to rehydration fluids alone] lead to a [faster recovery time]?

Search Strategy

MEDLINE(R) In-Process & Other Non-Indexed Citations and MEDLINE(R) 1946 to Present using the OVID interface

(calf.mp. OR calves.mp. OR young bovine.mp. OR young bovines.mp. OR young stock.mp. OR youngstock.mp. OR young cattle.mp. OR bos.mp. OR exp Cattle/)

AND

(scour.mp. OR scours.mp. OR scouring.mp. OR diarrhoea.mp. OR diarrhea.mp. OR exp Diarrhea/)

AND

(oral rehydration.mp. OR oral replacement.mp. OR oral therapy.mp. OR electrolyte.mp. OR electrolytes.mp. OR fluid therapy.mp. OR fluid therapies.mp. OR fluid replacement.mp. OR fluids.mp. OR ORT.mp. OR ORS.mp. OR exp Fluid Therapy/ OR exp Electrolytes/ OR exp Rehydration Solutions/)

CAB Abstracts 1910 to Present using the OVID interface

(calf.mp. OR calves.mp. OR young bovine.mp. OR young bovines.mp. OR young stock.mp. OR youngstock.mp. OR young cattle.mp. OR bos.mp. OR exp cattle/)

AND

(scour.mp. OR scours.mp. OR scouring.mp. OR diarrhoea.mp. OR diarrhea.mp. OR exp diarrhoea/)

AND

(oral rehydration.mp. OR oral replacement.mp. OR oral therapy.mp. OR electrolyte.mp. OR electrolytes.mp. OR fluid therapy.mp. OR fluid therapies.mp. OR fluid replacement.mp. OR fluids.mp. OR ORT.mp. OR ORS.mp. OR exp fluid therapy/ OR exp oral rehydration solutions/ OR oral rehydration therapy/ OR exp electrolytes/)

Search Outcome

MEDLINE

- **384** papers found in MEDLINE search
- **371** papers excluded as they don't meet the PICO question
- **0** papers excluded as they are in a non-English language
- **10** papers excluded as they are review articles/in vitro research/conference proceedings
- **3 total relevant papers from MEDLINE**

CAB Abstracts

- **836** papers found in CAB search
- **817** papers excluded as they don't meet the PICO question
- **1** papers excluded as they are in a non-English language
- **15** papers excluded as they are review articles/in vitro research/conference proceedings
- **3 total relevant papers from CAB**

Total relevant papers

3 relevant papers from both MEDLINE and CAB Abstracts

Comments

Other papers considered in more detail but discounted were as follows:

- Bywater, R.J. (1980). 'Comparison between milk deprivation and oral rehydration with glucose-glycine-electrolyte formulation in diarrhoeic and transported calves.' *Vet. Rec.* 107(24), 549-551.

Bywater et al. (1980) was excluded due to the treatment groups not fitting the PICO question. In this study, oral electrolytes in water were compared with a milk replacer control; no direct comparison with oral electrolyte solution and milk was made available.

- Wilms et al (2020). 'Short communication: Hyponatremia in diarrheic calves associated with oral electrolyte administration in water and milk replacer in absence of access to water.' *JDS*. 103(6), 5495-5500.

Wilms et al. (2020) similarly was excluded based on treatment groups not fitting the PICO question. In this study, calves had no access to water and were either given an oral electrolyte solution or low dose whey powder.

Summary of Evidence

Heath et al. (1989) Canada

Title: The effects of feeding milk to diarrheic calves supplemented with oral electrolytes

Patient group: 19 healthy Holstein bull calves aged between 5 and 8 days of age; 13 sourced from local auction mart and 6 from local dairy farms.

Study Type: Randomised controlled trial

- Demeanor and hydration, twice daily
- Faecal consistency and estimated volume - clinical diarrhoea was defined as a score >2.5
- Body weight at arrival and days 2, 4, 6, 8 and 10 (each calf was weighed four times on each weigh day)

Outcomes:

- Blood gas on calves euthanased before the end of the trial
- Pathological features at post mortem (e.g. weights of the carcass, small and large intestines, liver, left quadriceps muscle, thymus; densities of omental, perirenal, coronary and left femoral marrow fat; histological examination of thymus, duodenum, jejunum and liver)

Key Results:

- At the end of the trial, all calves were still mildly depressed, diarrhoeic (mean score 3.3) and dehydrated
- Progression of the mean daily faecal score was similar across the time period for all groups (all p-values >0.1)

Study Weaknesses:

- Small sample size (n=19) with no power calculation so likely to be significantly underpowered
- Calves did not have naturally occurring diarrhoea, they were fed an inoculum positive for multiple pathogens
- Very limited information available on the four calves euthanased and those that received antibiotics; the BET authors had difficulty following the exclusions from the study and whether these were separate to the 19 sample calves
- No side effects were discussed however, five calves received antimicrobials and had evidence of concurrent disease at necropsy, four calves were treated with antimicrobials and didn't have evidence of concurrent disease at necropsy (euthanased before end of experiment) and four calves had evidence of concurrent disease at necropsy but were not treated with antimicrobials

- Limited information given on blinding of assessors and no information given on how subjects were randomly assigned to treatment groups
- Some detail within the methodology was missing making it difficult to repeat the study
- Basic data was not adequately described
- The limitations of the study were not discussed

Attachment:

Evidence appraisal (/soe_attachments/518/3898-Heath et al. appraisal.pdf)

Garthwaite et al. (1993) USA

Title: Whole milk and oral rehydration solution for calves with diarrhea of spontaneous origin

Patient group: Forty two calves of mixed sex and breed (all dairy), average age was ten days old.

Study Type: Cohort study

- Outcomes:**
- Body weight measured 5 hours before treatment started and on day 3 and 7
 - Faecal consistency determined at each feeding
 - Rectal temperature taken when calves were weighed
 - Packed cell volume of whole blood - blood taken when calves were weighed
 - Concentration of electrolytes (Ca, Cl, K, Na, and P) and glucose in serum
 - Intestinal colonization – swab taken when calves were weighed

Key Results:

- All calves appeared to have recovered fully by day seven of therapy
- Overall affect of treatment was not significant, maintaining calves on milk plus oral electrolyte solution did not worsen or prolong incidence of diarrhoea
- No significant difference between groups for faecal score ($p=0.68$)

Study Weaknesses:

- Small sample size ($n=42$) with no power calculation so likely to be underpowered
- Measurements carried out within the study were not clear and the methods are not in sufficient detail to be able to repeat the study
- No information on blinding of assessors, and method of alternate assignment for allocation to treatment groups is not clear
- P values above the author's chosen cut off value for statistical significance were sometimes discussed as having "tendancies" towards statistical significance
- Not possible to determine if groups were comparable before intervention and only aggregated results were given so somewhat difficult to interpret; group sizes were not stated
- It was not stated whether ethical approval was sought and approved
- No discussion regarding the use of non-saleable mastitis milk and any implications this might have
- The authors hint at demonstrating equivalence. If the aim was to demonstrate equivalence then ideally a non-inferiority trial would have been designed and executed

Attachment:



Evidence appraisal (/soe_attachments/518/4150-Garthwaite et al. appraisal.pdf)

Goodell et al. (2012) USA

Title: An alkalinizing oral rehydration solution containing lecithin-coated citrus fiber is superior to a nonalkalinizing solution in treating 360 calves with naturally acquired diarrhea.

Patient group: 360 Holstein-Friesian calves from one dairy unit in northern Colorado

Study Type: Randomised controlled trial

- Consumption of electrolyte solution – amount suckled within 10 mins was estimated (0, 25, 50, 75, 100% of allocated volume); calves unable to suckle their allotted volume within 10 mins received the remainder of the fluid by oroesophageal intubation

- Mortality rate

Outcomes: • Treatment failure rate (those calves with persistent diarrhoea at 8 days)

- Days of treatment
- Faecal score (0-4) with scores 2-4 indicating diarrhoea
- Hydration score status via score (0-3) with scores 1-3 indicating a level of dehydration
- Average daily weight gain and weight at weaning

Key Results:

- There were no significant differences between the groups in relation to treatment failure or mortality rate. Overall, the treatment failure rate (those calves that still had diarrhoea at day 8) was similar between the two groups and isn't statistically significantly different (BET author's calculation).
- Calves in Group D achieved a 'normal' faecal score by a median of 7 days (95% confidence interval 6.5-8 days) of treatment which was statistically significantly different to the calves in Group R who achieved a 'normal' faecal score by a median of 8 days (95% CI 7.5-8 days)

Study Weaknesses:

- No power calculation was carried out to support the sample size
- Difference between the mean serum total protein between the two groups indicating that more calves in group D received adequate passive transfer than in group R
- All calves were given antibiotics and activated charcoal - treatment was discontinued when the stool returned to normal after day 2 in group D and after day 4 in group R or when a calf reached day 8 of treatment. Calves that were designated as treatment failures were removed from the study as were those that developed concurrent disease.
- The BET authors found it difficult to identify how the calves included in the study related to the number of calves that were eligible for inclusion in the study (i.e. there appeared to be some calves unaccounted for)
- Methods are not described in adequate detail for the trial to be repeated
- It is not stated whether ethical approval was obtained

Attachment:



Evidence appraisal (/soe_attachments/518/4152-goodell et al. appraisal.pdf)

Comments

Two of the papers appraised are more than 25 years old, however, they were still deemed relevant. There was no power calculation to support sample size in any of the studies and both Garthwaite et al. (1994) and Heath et al. (1989) are likely to be underpowered which makes it difficult to draw definitive conclusions. An inoculum of pathogens was given to calves in Heath et al. (1989) rather than calves being exposed to pathogens via other animals and the environment; experimentally induced diarrhoea may not be directly comparable to naturally occurring diarrhoea and cause of diarrhoea was not considered in all of the papers.

The types of oral electrolyte solution administered and the length of time solutions were given for, and the length of time that milk was withheld were different between the three studies making them difficult to directly compare. Two of the papers also oro-gastrically tube fed any of the allocated solutions (milk or oral electrolyte solutions) if they were not drunk within allotted time periods. Whilst oro-gastric tube feeding is common practice in commercial farm settings, this is not entirely reflective of what is usually actioned.

There were many other types of literature, particularly expert opinion, that were excluded during the search. The two older studies were often cited as supporting evidence for continued feeding of milk when treating diarrhoeic calves with oral electrolyte solutions; this could possibly be as a result of other outcomes of the papers not studied in this BestBET (e.g. weight gain). Currently there is academic discussion surrounding the osmolality of milk replacer and the effect that oral electrolyte solution has on this (compared with adding additional electrolyte feeds separately), however, this falls outside of the scope of this BestBET.

Bottom line

Feeding milk in addition to oral electrolyte solution might help calves recover faster from diarrhoea when compared with oral electrolyte solution alone, however the evidence supporting this is weak.

Disclaimer

The BETs on this website are a summary of the evidence found on a topic and are not clinical guidelines. It is the responsibility of the individual veterinary surgeon to ensure appropriate decisions are made based on the specific circumstances of patients under their care, taking into account other factors such as local licensing regulations. **Read small print (/disclaimer)**

References

- Heath SE, Naylor JM, Guedo BL, Petrie L, Rousseaux CG, Radostits OM, (1989). The effects of feeding milk to diarrhoeic calves supplemented with oral electrolytes. *Canadian Veterinary Journal*. **53**: 477-485.
- Garthwaite BD, Drackley JK, McCoy GC, Jaster EH, (1994). Whole milk and oral rehydration solution for calves with diarrhea of spontaneous origin. *Journal of Dairy Science*. **77**: 835-843.

- Goodell GM, Campbell J, Hoejvang-Nielsen L, Stansen W, Constable PD, (2012). An alkalinizing oral rehydration solution containing lecithin-coated citrus fibre is superior to a nonalkalinizing solution in treating 360 calves with naturally acquired diarrhoea. *Journal of Dairy Science*. **95**: 6677-6686.

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