Electrolyte Review & Information Package

TruVital ANIMAL HEALTH

“Oral fluid therapy – Electrolyte features to look for”

By: Geof Smith DVM, NC State

- Supply enough sodium to rehydrate the calf
- Provide glycine, propionate or acetate to help with the absorption of sodium in the intestine
- Provide an alkalinizing agent / buffer that will correct the drop in blood pH (acidosis) that happens when calves develop diarrhea
- Provide energy, as most calves with diarrhea are in a state of negative energy balance
- Balanced Strong Ion Difference of 60-80

Electrolyte Uses & Options

Cheap Salt Electrolyte (CSE)

- Price $0.40 - $0.80 dose
- Encourages water intake
- Decreases stress (movement, transport, vaccination, hot climate, birth) by replacing basic electrolytes and lost fluids
- Provides little energy
- Little or no buffers – only sodium bicarbonate less than 50 mmol/L
- No glycine for sodium and glucose absorption
- Unbalanced strong ion difference (SID)

Summary: Products are cheap and available and may be adequate for reducing stress and encouraging water intake. Attractive based on price but will not properly rehydrate calves adequately and is not acceptable for oral rehydration therapy.

Premium Mixed Buffer Electrolytes (MBE) - Truvitalyte

- Price $1.75 - $2.25 dose
- Includes glycine for proper glucose, sodium & potassium absorption
- Aids in successful recovery of metabolic acidosis in dehydrated calves
- Provides potassium to replenish depleted body stores form diarrhea
- Blood buffers consist of sodium acetate, sodium bicarbonate, sodium citrate, potassium citrate
- Greater than 50mmol/L buffers
- Properly balanced SID of 75
- Stable and does not harden like sodium acetate electrolytes when exposed to moisture or humid environments

Summary: Contain essential criteria for rehydrating calves. A good choice for oral rehydration therapy on dehydrated calves. Equivalent in performance to expensive single buffer sodium acetate based electrolytes.

Sodium Acetate Buffer Electrolyte (SAE)

- Price $2.20 - $4.00 dose
- Includes glycine for proper glucose, sodium & potassium absorption
- Aids in successful recovery of metabolic acidosis in dehydrated calves
- Provides potassium to restore depleted body stores form diarrhea but less potassium than MBE
- Single source blood buffer consists of sodium acetate
- Greater than 50mmol/L buffers
- Slightly higher SID of 86, but out of recommended range
- Summary: Expensive electrolyte but still contains essential criteria for proper rehydration via oral therapy. Risk of product hardening when exposed to moisture or humidity in storage. Adequate electrolyte choice but not necessarily economically beneficial.

The Strong Ion Difference is the difference between the sums of concentrations of the strong cations and strong anions:

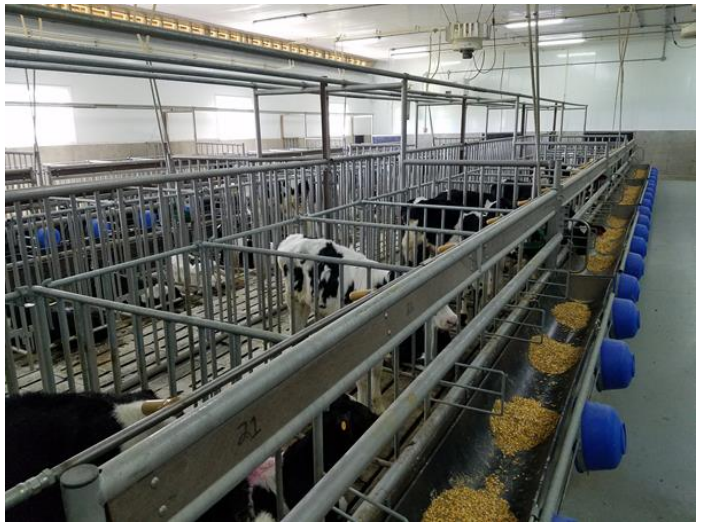
$$[SID] = [Na^+] + [K^+] + [Ca^{2+}] + [MG^{2+}] - [CL^-] - [\text{Other Strong Anions}].$$

Electrolyte Study at Mapleview Agri Ltd.

- n= 45 calves
- Calves were enrolled in study when they had diarrhea classified as 2 consecutive fecal scores of 2 (runny, spreads easily) or one day of 3 (Liquid, void of solid material)
- Electrolyte administered until fecal score returned to 1(semi formed or pasty) or 0 (normal consistency)
- Upon enrollment calves were administered either a powdered "Basic Bicarbonate" (BBP), powdered "Premium Mixed Buffer" (MBP), or a liquid "High Sodium Acetate" (HAL) based
- All electrolytes had 50 mmol/L of blood buffers and included glycine
- Blood measurements were taken and assessed at enrollment (first electrolyte administration),1, 8, and 24 hr following first treatment of electrolyte

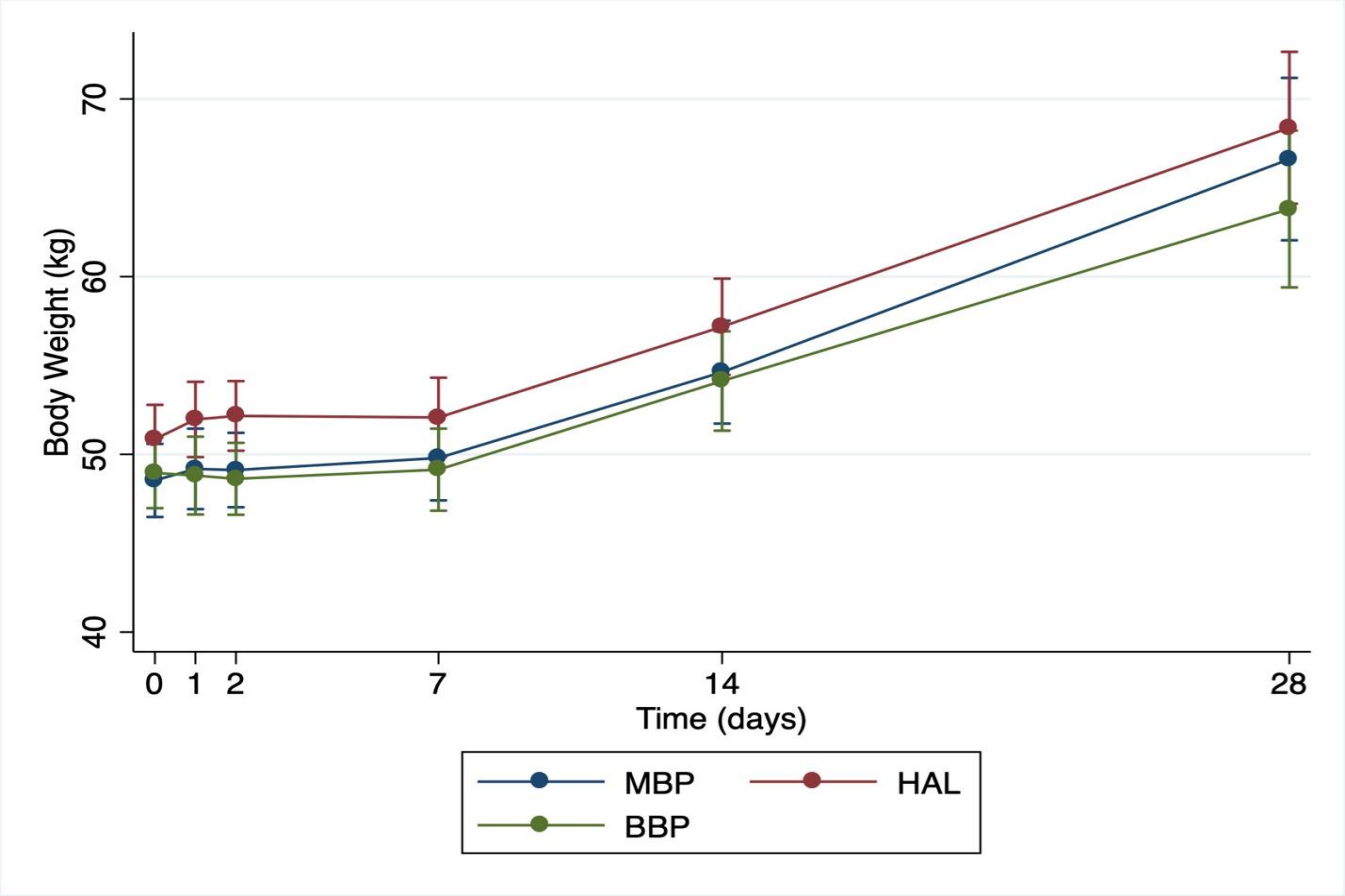
Buffers (mmol/L)	BBP	MBP	HAL
Sodium Bicarbonate	50.7	33.8	
Sodium Citrate		8.4	
Sodium Acetate		6.3	50.1
Potassium Citrate		1.9	
Total	50.7	50.4	50.1

**Note: The BBP is not equivalent to cheap salt electrolyte listed in the prior slide and did contain, glycine, adequate buffers, and balanced SID. This study was to compare the buffers listed above.



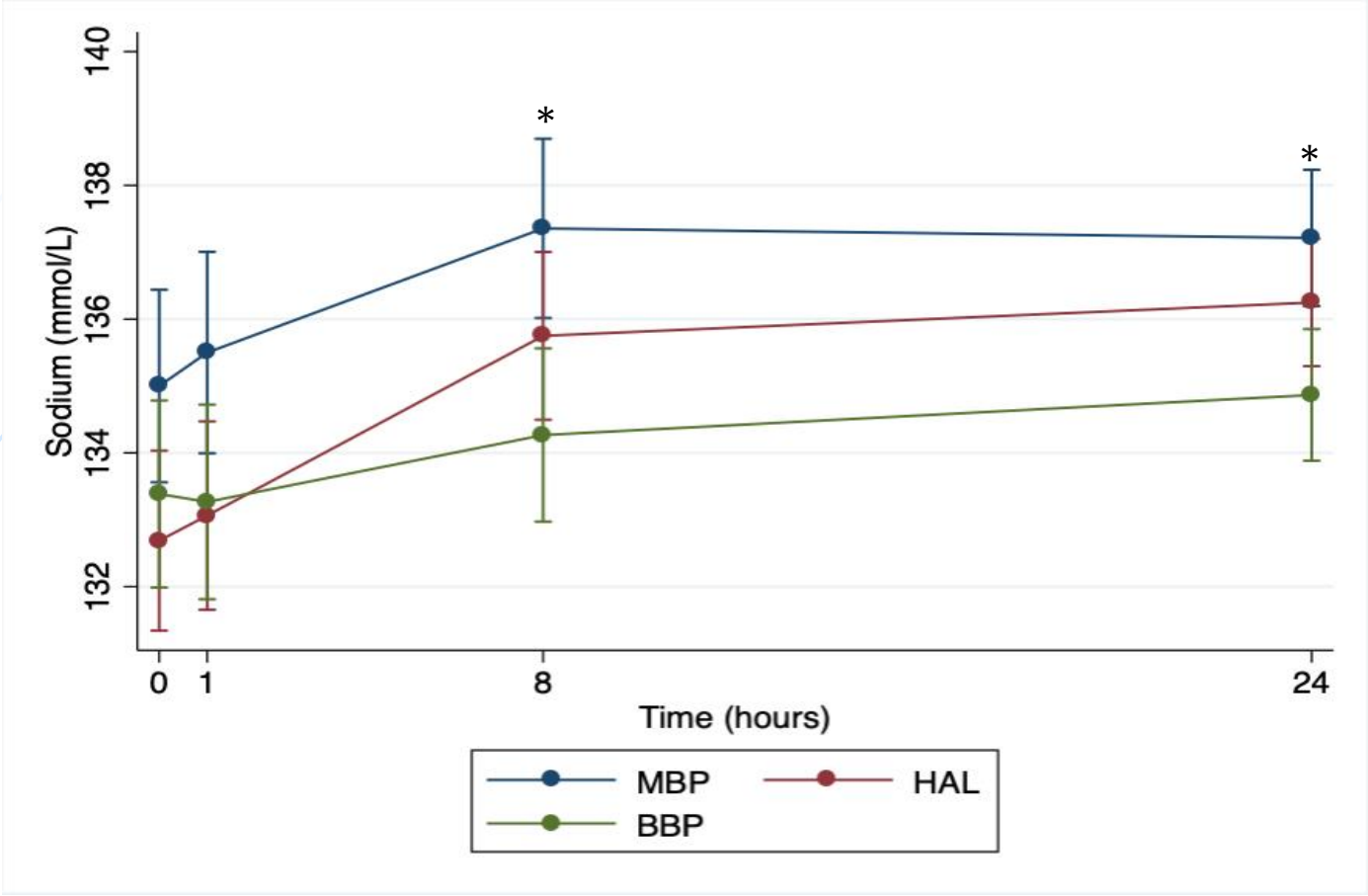
Results – Body Weight

No significant differences were observed between groups although the HAL group calves were enrolled numerically heavier



Results – Sodium

Predicted sodium means by electrolyte groups from mixed repeated measures linear regression model.

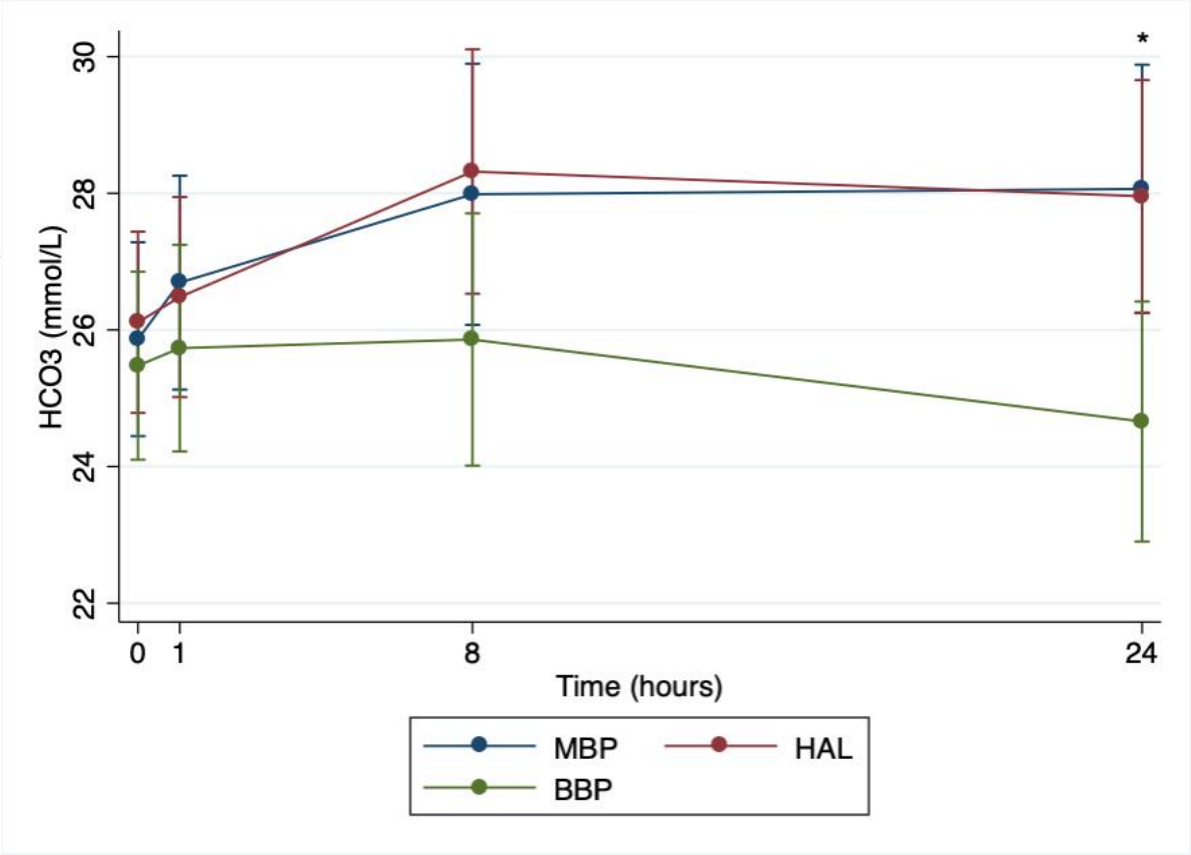


Normal Sodium ranges for healthy neonatal calves is 133.3 to 140.2 mmol/L (Dillane et al., 2018)

* denotes a significant difference between the BBP and MBP group

Results - Bicarbonate

Predicted total bicarbonate means by electrolyte groups from mixed repeated measures linear regression model on 45 calves.

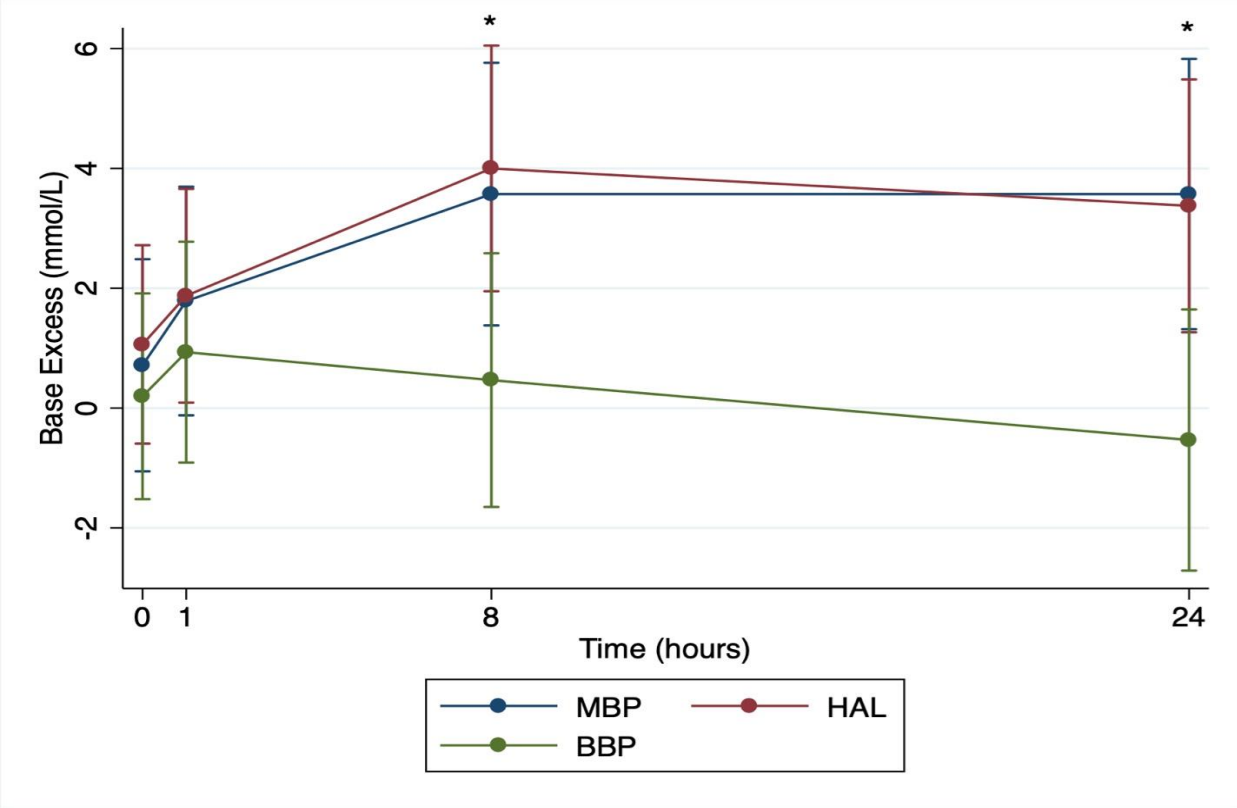


Normal Bicarbonate ranges for healthy neonatal calves is 26.3 to 34.1 mmol/L (Dillane et al., 2018)

* denotes a significant difference between the BBP and MBP group

Results – Base Excess

Predicted Base Excess means by electrolyte groups from mixed repeated measures linear regression model on 45 calves

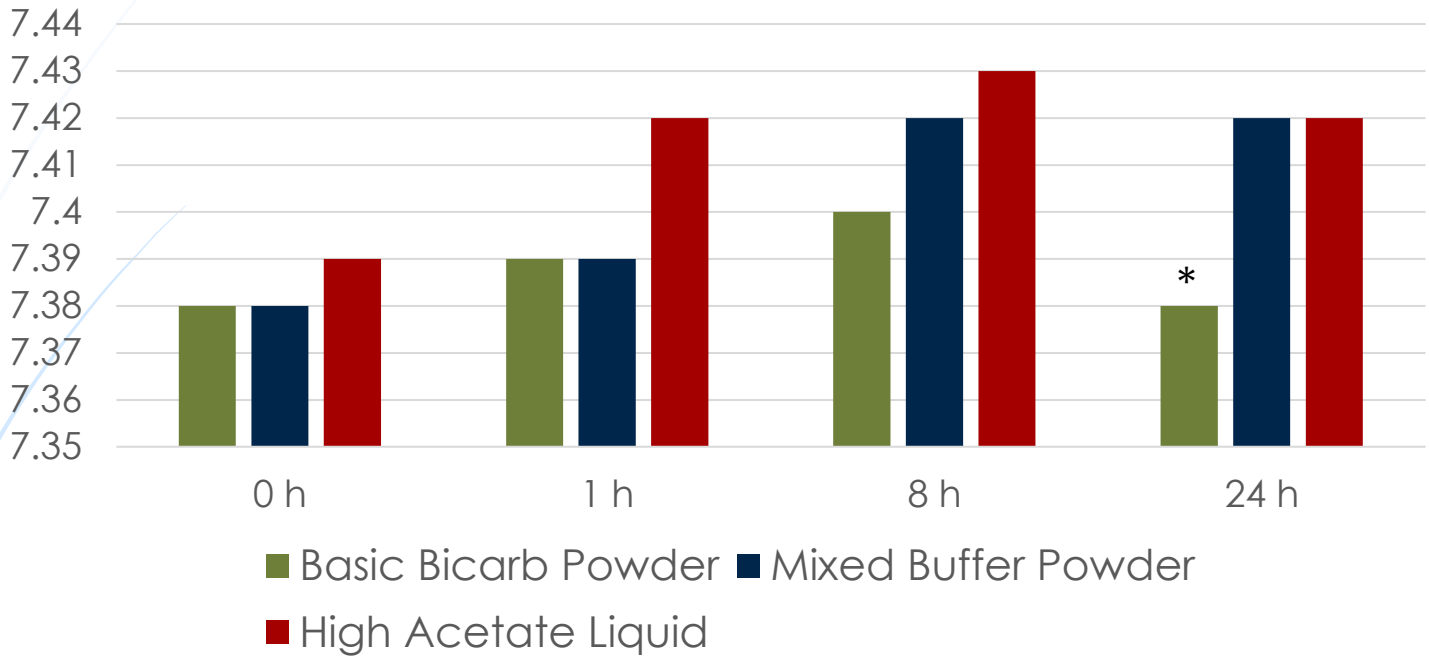


Normal Base Excess ranges for healthy neonatal calves is 2.6 to 10.8 mmol/L (Dillane et al., 2018)

* denotes a significant difference between the BBP and MBP group

Results – Blood pH

No statistical differences were observed although a numerical difference was noted at 24 hr between MBP and BBP.



Normal blood ph range for healthy neonatal calves is 7.37 to 7.47 mmol/L (Dillane et al., 2018)

* denotes a tendency for a difference between the MBP and BBP (P = 0.06)

Project Conclusions

- Sodium levels were greater at 8, and 24 hrs, ($P < 0.05$) post enrollment for calves fed MBP vs BBP
- Calves fed the BBP had lower Bicarbonate levels 24 hr post administration than MBP and HAL($P < 0.05$)
- Base excess was lower in the BBP vs the MBP ($P<0.05$) indicating metabolic acidosis
- No statistical differences were observed in regards to pH although the BBP took numerically longer to raise pH vs MBP

Take away messages:

1. *Sodium acetate electrolytes are the most commonly found electrolyte in the North American market*
2. *High acetate electrolytes are a more expensive option than this new concept of mixed buffer electrolytes*
3. *Mixed buffer electrolytes can be just as effective and in some cases a more effective form of oral rehydration therapy*

INTRODUCING

Truvitalyte

INNOVATIVE NEW
CALF ELECTROLYTE

Truvitalyte is a scientifically formulated electrolyte powder with a validated blend of mixed buffers, amino acids, and energy sources, that effectively support sodium and water absorption in dehydrated calves.

Truvitalyte

FOR USE IN MAINTAINING PROPER ELECTROLYTE BALANCE IN CALVES

Instructions: Mix 115 grams (1 level scoop) of Truvitalyte electrolytes into 2L of warm water and administer orally, twice daily. Administer by bottle or esophageal tube feeder. For use in dairy or beef calves.

Instructions: Mélanger 115 grammes (1 cuillère de niveau) d'électrolytes Truvitalyte dans 2 L d'eau tiède et administrer par voie orale deux fois par jour. À administrer au biberon ou au tube oesophagien. Pour veaux laitiers ou de boucherie.

Net Contents: 5kg (43 Doses)

Expiry: 16 months from manufacture date
Expiration: 16 mois à compter de la date de fabrication

#36407A
NN.X8F4

Veterinary Health Product /
Produit de santé animale

Veterinary Product Registered By:
TruVital Animal Health
8610 Concession 12
Palmerston, ON N0G 2P0

TruVital
ANIMAL HEALTH

Active ingredients per dose

Dextrose	77.7230g
Sodium Chloride	8.3470g
Glycine L	6.9140g
Sodium Bicarbonate	5.6750g
Sodium Citrate	4.9250g
Potassium Chloride	3.6860g
Citric Acid	2.2700g
Sodium Acetate	1.7020g
Potassium Citrate	1.1350g
Magnesium Sulfate	0.1720g

Excipient Ingredients

Saccharin Sodium, Silicon Dioxide

Ingrédients actifs par dose

Dextrose	77.7230g
Chlorure de sodium	8.3470g
Glycine L	6.9140g
Bicarbonate de sodium	5.6750g
Citrate de potassium	4.9250g
Chlorure de potassium	3.6860g
Acide citrique	2.2700g
Acétate de sodium	1.7020g
Citrate de potassium	1.1350g
Sulfate de magnésium	0.1720g

Ingredients non médicinaux

Saccharine sodique, dioxyde de silicium

Storage: Protect from moisture. Keep opened pail tightly closed when not in use.

Entreposage: Protéger contre l'humidité. Refermer hermétiquement le sceau après usage.

Warning: Keep out of reach of children

Mise en garde: Garder hors de la portee des enfants

What's in it?

- 50 mmol/L of mixed blood buffers or alkalizing agents for correcting metabolic acidosis
- Glycine: for proper sodium and glucose absorption in the intestine
- Potassium: helps restore depleted bodily stores as a result of fluid loss
- Dextrose: energy is required to correct a negative energy balance
- Sodium: required to correct dehydration as a result of fluid loss

Benefits:

Water soluble, economical, scientifically proven, contains all critical components of effective electrolytes

References:

- Heinrichs, A j. "Effects of Mannan Oligosaccharide or Antibiotics in Neonatal Diets on Health and Growth of Dairy Calves." *Journal of Dairy Science*, vol. 86, no. 12, 1 Dec. 2003, pp. 4064–4069., https://www.journalofdairyscience.org/article/S0022-0302(03)74018-1/fulltext
- Magalhães, V J.A. "Effect of Feeding Yeast Culture on Performance, Health, and Immunocompetence of Dairy Calves." *Journal of Dairy Science*, vol. 91, no. 4, 1 Apr. 2008, pp. 1497–1509.,
- Eicher, S D. "Vitamin Concentration and Function of Leukocytes from Dairy Calves Supplemented with Vitamin A, Vitamin E, and β-Carotene In Vitro1." *Journal of Dairy Science*, www.journalofdairyscience.org/article/S0022-0302(94)76984-8/abstract.
- Torsein, M. *α-Tocopherol and β-Carotene Concentrations in Feed, Colostrum, Cow and Calf Serum in Swedish Dairy Herds with High or Low Calf Mortality*. 12 Dec. 2007, www.ncbi.nlm.nih.gov/pmc/articles/PMC5796441/
- Nonnecke, B J. "Fat-Soluble Vitamin and Mineral Status of Milk Replacer-Fed Dairy Calves: Effect of Growth Rate during the Preruminant Period." *Journal of Dairy Science*, 1 June 2010, www.journalofdairyscience.org/article/S0022-0302(10)00272-9/fulltext
- Girard, C L. *Dietary Supplements of Folic Acid: Blood and Growth Responses of White Veal Calves*. Mar. 1993, www.sciencedirect.com/science/article/abs/pii/030162269390036H
- Eicher, S D, and J L Morrill. *Leukocyte Functions of Young Dairy Calves Fed Milk Replacers Supplemented with Vitamins A and E1*. 1994, www.journalofdairyscience.org/article/S0022-0302(94)77078-8/pdf
- Smith, G. W. (2009). Treatment of Calf Diarrhea: Oral Fluid Therapy. *Veterinary Clinics of North America: Food Animal Practice*, *25*(1), 55–72. doi: 10.1016/j.cvfa.2008.10.006
- Sahinduran, S. *Supplemental Ascorbic Acid and Prevention of Neonatal Calf Diarrhoea*. 17 June 2004, actavet.vfu.cz/73/2/0221/.
- Seife, H A. *The Effectiveness of Ascorbic Acid in the Prevention of Calf Neonatal Diarrhoea*. 1996, onlinelibrary.wiley.com/doi/abs/10.1111/j.1439-0450.1996.tb00304.x.
- Heinrichs, J., Tools, Apps Colostrometer Adjustment Spreadsheet Tools, Dairy Herd Management, Jud Heinrichs Tools, & Sylvia Kehoe Associate Professor University of Wisconsin-River Falls. (2020, February 23). Electrolytes for Dairy Calves.
- Dillane, P. (2018, April 1). Establishing blood gas ranges in healthy bovine neonates differentiated by age, sex, and breed type. Retrieved April 23, 2020, from https://www.journalofdairyscience.org/article/S0022-0302(18)30031-6/fulltext
- Wood et al., 2020. Submitted to Journal of Dairy Science. Effects of different blood buffers administered in electrolyte solution to grain-fed veal calves experiencing diarrhea