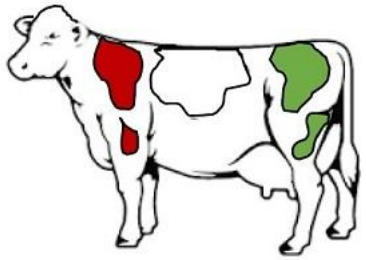
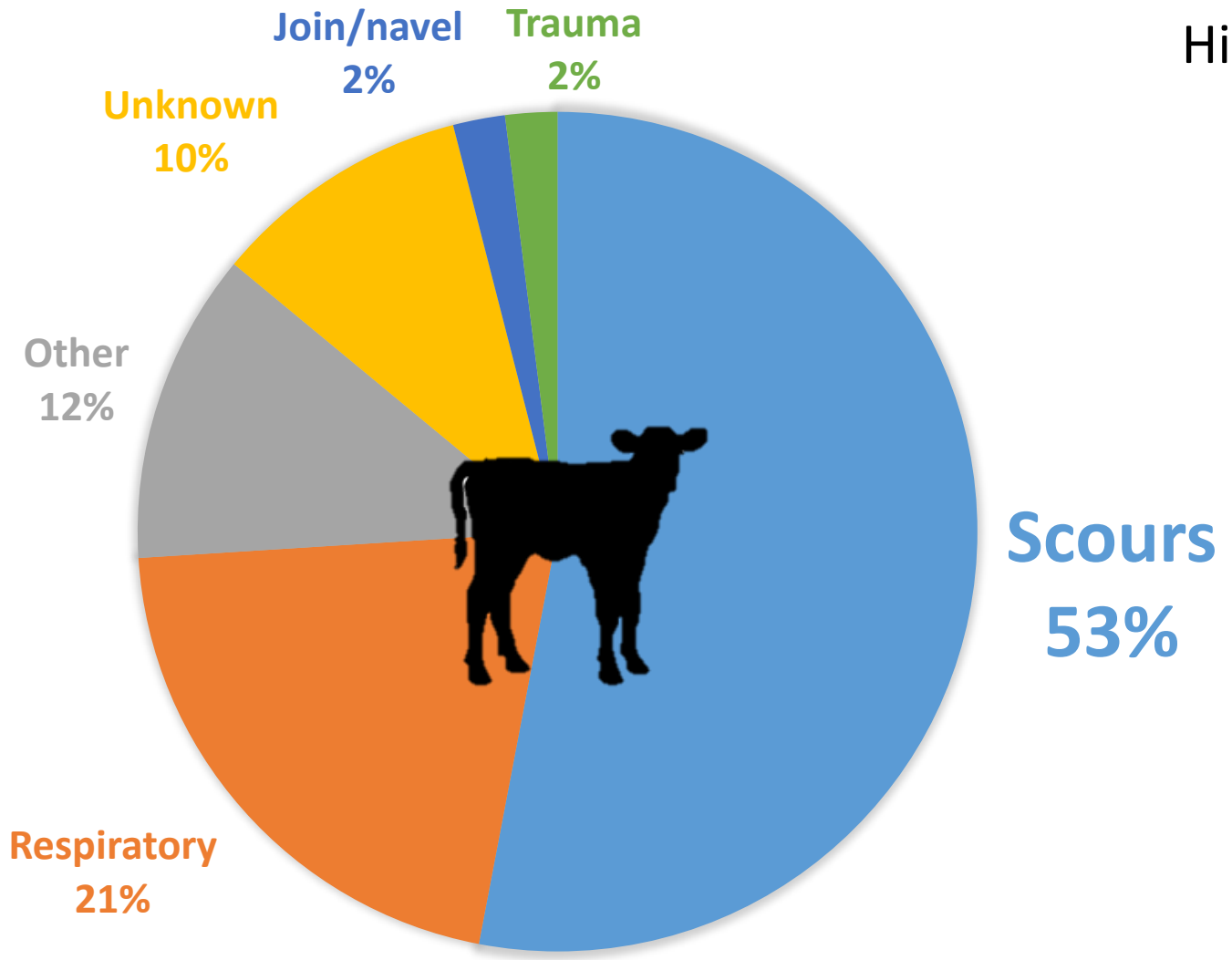
CALVES NUTRITION AND MANAGEMENT TO PREVENT DIARRHEA

Elena Bonfante, DVM, PhD



DAIRY INNOVATIONS ITALIA

CALF MORTALITY



Highest mortality and morbidity

From birth to weaning

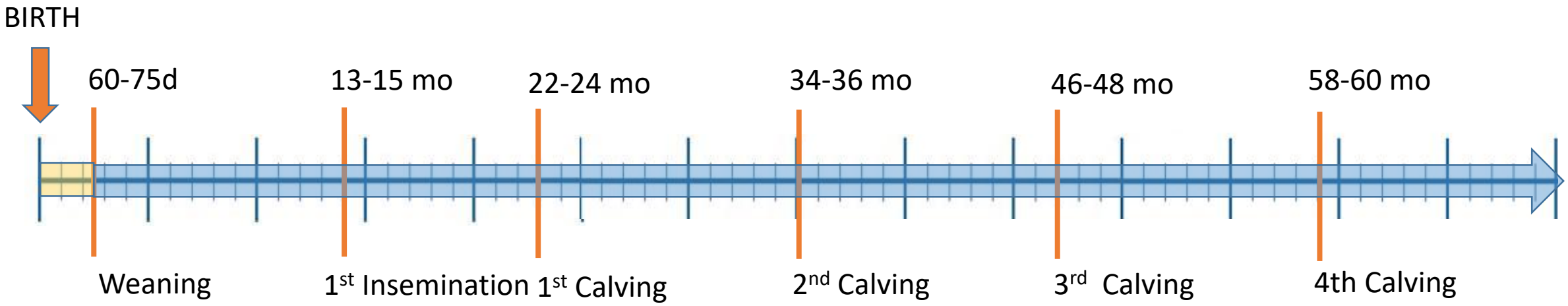
CAUSES OF DIARRHEA

Most Common Infectious Organisms and the Age of Diarrhea	
Organism	Age of Diarrhea
E. Coli	First 3 days
Salmonella	Day 5 – 14
Corona Virus	Day 3 – 7
Rotavirus	Day 3 – 7
Eimeria spp. (coccodiosis)	Day 7 – 4 to 6 months
Cryptosporidium parvum (parasite)	Day 5 – 7
Giardia spp. (protozoa)	Day 14 – 21

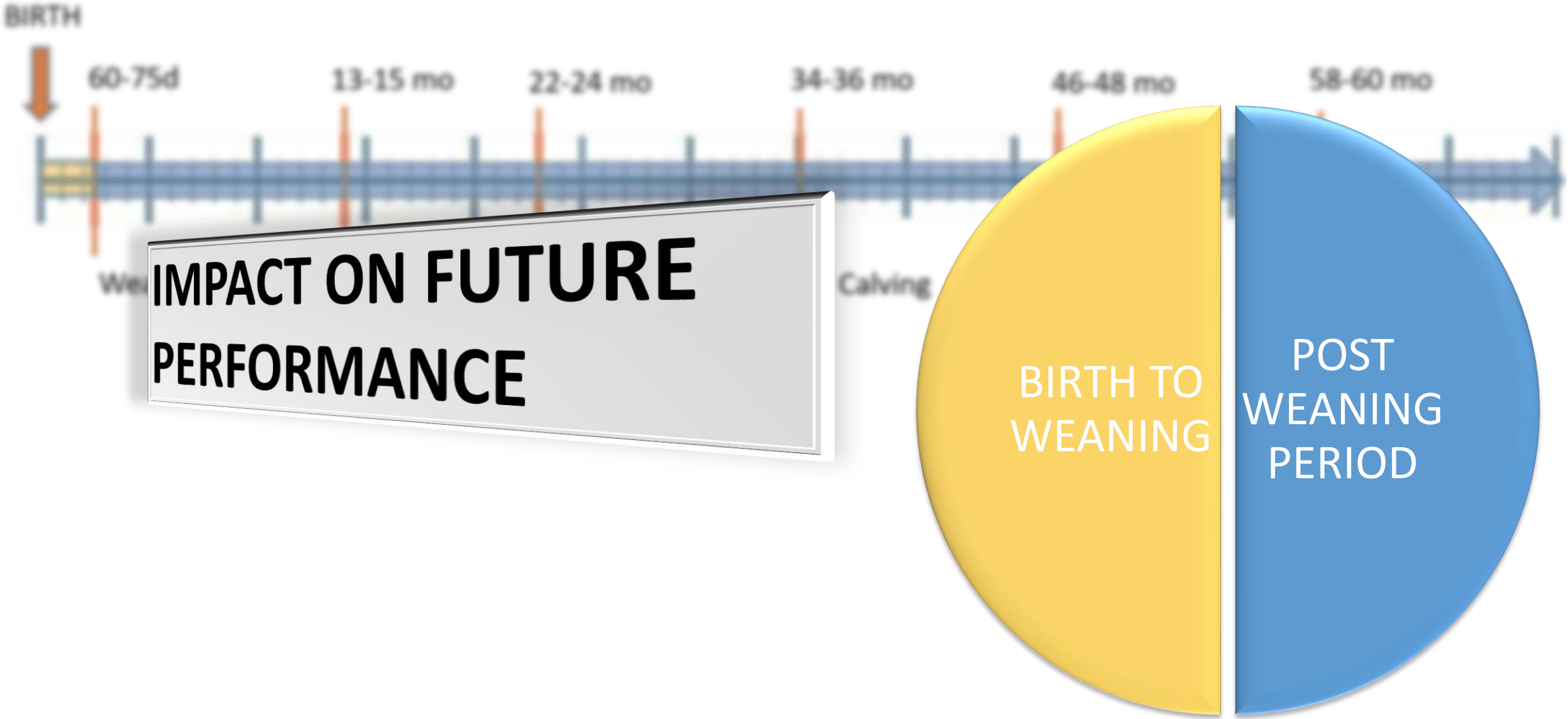
Dairy and Veal Healthy Calf Conference, 2007

http://calfcare.ca/disease-control/neonatal-calf-diarrhea/

DAIRY COW LIFETIME



DAIRY COW LIFETIME



GOALS

Morbidity **< 10%** from birth to weaning

Death loss **<5%** from birth to weaning

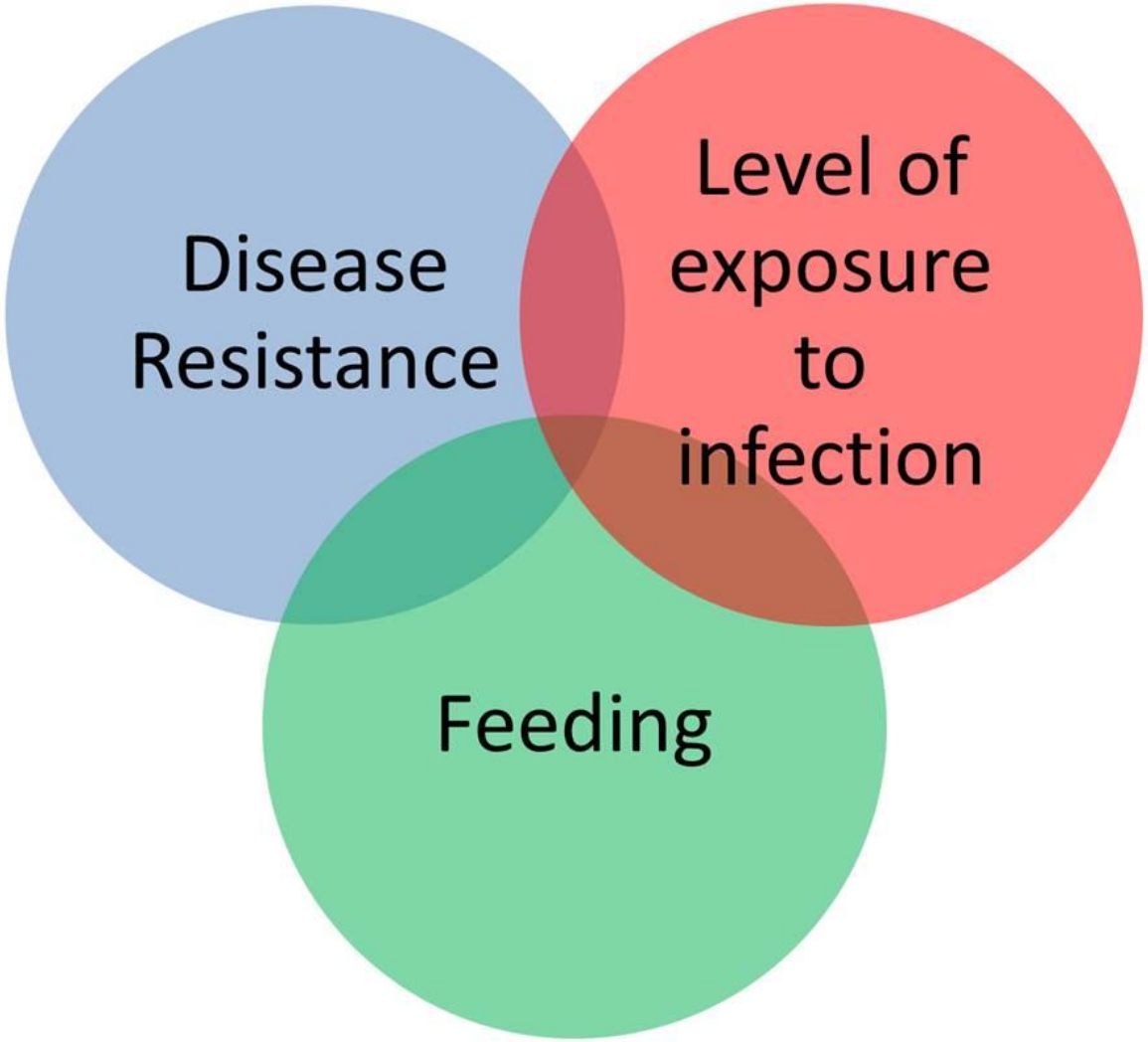
< 2% from weaning to freshening

Double the birth weight at weaning

22-24 months freshening

Reduction of
Antimicrobial use

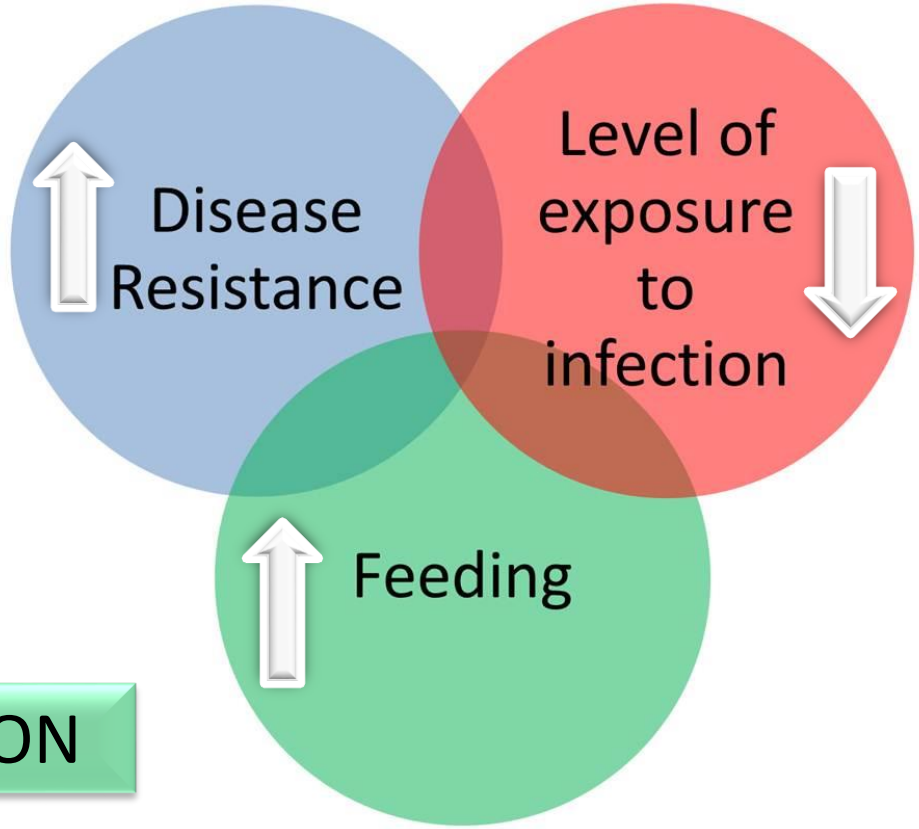
FACTORS INVOLVED



OBJECTIVE TO REDUCE SCOUR INCIDENCE

COLOSTRUM

Maximize the level of immunity



NUTRITION

ENVIROMENT & MANAGEMENT

Cleanliness

Cleanliness

Cleanliness

ENVIRONMENT & MANAGEMENT

Clean calving pen

Bedding: clean, soft, dry;
Ventilation
Sunlight
Water and feed always available

COLOSTRUM

COLOSTRUM

- **Nutrients**
- **Antibodies**
  - **IgG 85-90%**
  - **IgA 5%**
  - **IgM 7%**

Composition of colostrum, and whole milk of Holstein cows

Parameter	Colostrum 1	Milk 6
Specific gravity	1.056	1.032
Total solids (%)	23.9	12.9
Fat (%)	6.7	4.0
Total protein (%)	14.0	3.1
Casein (%)	4.8	2.5
Albumin (%)	6.0	0.5
Immunoglobulins (%)	6.0	0.09
IgG (g/100 mL)	3.2	0.06
Lactose (%)	2.7	5.0
IGF-I (μg/L)	341	15
Insulin (μg/L)	65.9	1.1
Ash (%)	1.11	0.74
Calcium (%)	0.26	0.13
Magnesium (%)	0.04	0.01
Zinc (mg/100 mL)	1.22	0.3
Manganese (mg/100 mL)	0.02	0.004
Iron (mg/100 g)	0.20	0.05
Cobalt (μg/100 g)	0.5	0.10
Vitamin A (μg/100 mL)	295	34
Vitamin E (μg/g fat)	84	15
Riboflavin (μg/mL)	4.83	1.47
Vitamin B_{12} (μg/100 mL)	4.9	0.6
Folic acid (μg/100 mL)	0.8	0.2
Choline (mg/mL)	0.7	0.13

Critic for thermogenesis and body temperature regulation

Godden, 2008

COLOSTRUM QUALITY

How to measure it

REFRACTOMETER

Protein reflection = % Brix

Estimates IgG content **85-90% of tot Ig**

Threshold **>22%**

Colostrum

- Nutrients
- Antibodies
  - IgG 85-90%
  - IgA 5%
  - IgM 7%
- **Cytochynes & Growth Factor**

Composition of colostrum, and whole milk of Holstein cows

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Godden, 2008

Colostrum

- **Cytochynes & Growth Factor**

Antimicrobial activity.

Regulator for:
- gastrointestinal tracts development;
- mucosal growth;
- increased villus size;
- Increased glucose uptake.

Growth factors.

	Cholostrum	Milk
Lactoferrina g/L	**1.5-5**	**0.1-0.3**
Lactoperoxidasa, mg/L	30	20
Lisozima, mg/L	**0.14-0.7**	**0.07-0.6**
IL-1β, ug/L	840	3
IL-1ra, ug/L	**5.2**	**27**
IL-6, ug/L	77	0.15
TNF-α, ug/L	**926**	**3.3**
ITF-γ, ug/L	260	0.21
Insulina, mg/L	**4.2-34.4**	**0.042-0.34**
IGF-1, ug/L	100-2000	<25
IGF-2, ug/L	**200-600**	**<10**
GH, ug/L	<1	<0.03
EGF, mg/L	**4-8**	**2**
TGF-β2, ug/L	100-300	1-2

Boudry et al., 2008
Georgiev, 2008

TRANSITION MILK

Still a high quality feed

Composition of colostrum, transition milk and whole milk of Holstein cows

	Colostrum	Transition milk (milking postpartum)		Milk
Parameter	1	2	3	6
Specific gravity	1.056	1.040	1.035	1.032
Total solids (%)	23.9	17.9	14.1	12.9
Fat (%)	6.7	5.4	3.9	4.0
Total protein (%)	14.0	8.4	5.1	3.1
Casein (%)	4.8	4.3	3.8	2.5
Albumin (%)	6.0	4.2	2.4	0.5
Immunoglobulins (%)	6.0	4.2	2.4	0.09
IgG (g/100 mL)	3.2	2.5	1.5	0.06
Lactose (%)	2.7	3.9	4.4	5.0
IGF-I (μg/L)	341	242	144	15
Insulin (μg/L)	65.9	34.8	15.8	1.1
Ash (%)	1.11	0.95	0.87	0.74
Calcium (%)	0.26	0.15	0.15	0.13
Magnesium (%)	0.04	0.01	0.01	0.01
Zinc (mg/100 mL)	1.22	—	0.62	0.3
Manganese (mg/100 mL)	0.02	—	0.01	0.004
Iron (mg/100 g)	0.20	—	—	0.05
Cobalt (μg/100 g)	0.5	—	—	0.10
Vitamin A (μg/100 mL)	295	190	113	34
Vitamin E (μg/g fat)	84	76	56	15
Riboflavin (μg/mL)	4.83	2.71	1.85	1.47
Vitamin B_{12} (μg/100 mL)	4.9	—	2.5	0.6
Folic acid (μg/100 mL)	0.8	—	0.2	0.2
Choline (mg/mL)	0.7	0.34	0.23	0.13

COLOSTRUM MANAGEMENT

Colostrum collection

INFECTIOUS AGENTS

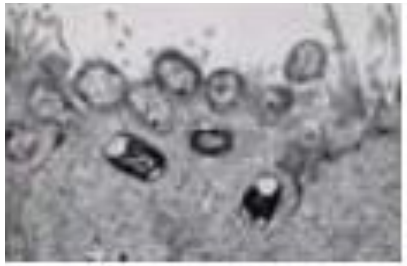
Mycoplasma ssp Mycobacterium Avium Paratuberculosis E. Coli Salmonella spp

Bacteria count < 100.000 cfu/mL

Coliform <10.000 cfu/mL

Keep the bacterial contamination low

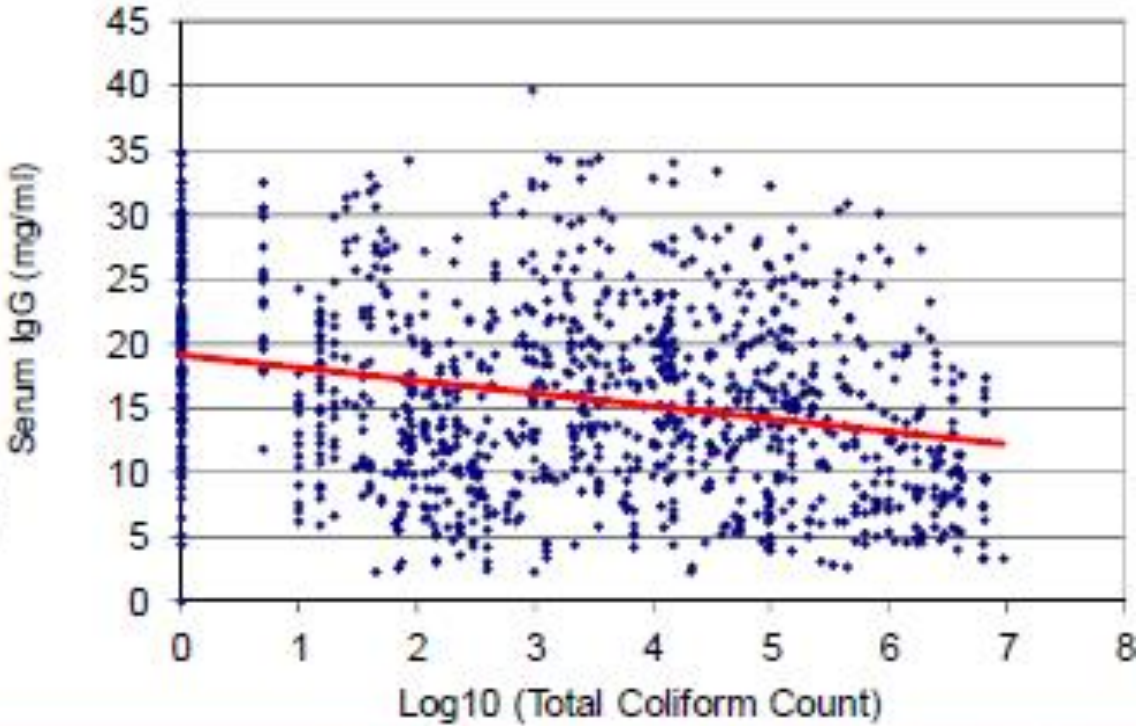
Avoid external contamination



Consequences of microbial contamination of colostrum?

- Pathogens may cause disease
  (e.g. *E. coli*, *Salmonella* spp., *Mycoplasma* spp., *M. avium* subsp. *paratuberculosis*)

- Bacteria counts are associated with ↓ serum IgG levels
  James et al., JDSci 1981;
  Poulson et al., ACVIM 2002;
  Godden et al., JDSci 2012



COLOSTRUM MANAGEMENT

BE CLEAN

& KEEP IT CLEAN

Chlorine dioxide

breaks down the biofilm

kills Crypto

COLOSTRUM MANAGEMENT

Colostrum Administration

WHEN…?

Whitin the 1-2h after birth (max 6h)

Feeding colostrum after the gut has closed still offers the benefit of local immunity in the gut lumen

HOW…?

With a nipple bottle or esophageal feeder
Body temperature (38-39ºC)

Pastourization:
60ºC for 60 minutes

Godden, 2008

COLOSTRUM MANAGEMENT

Colostrum Administration

HOW MUCH…?

1. **100 g IgG** in the first colostrum feeding;

Brix, %	IgG Conc. (g/L)	Colostrum Quality
< 15	0 – 28	Poor
15 – 20	28 – 50	Fair
20 – 30	50 – 80	Good
> 30	> 80	Very Good

4 L

2 L

<36% of the colostrum were good enough to provide 100 g IgG with 2L

>85% of the colostrum were good enough to provide 100 g IgG with 4L

Besser et al., 1991

2. **10 - 12% of calf BW**

COLOSTRUM MANAGEMENT

- If the cow doesn’t produce enough colostrum…?
  - BANK OF COLOSTRUM
    - Refrigerate within 1h after harvesting
    - It will last 1 year
  - COLOSTRUM REPLACER

COLOSTRUM MANAGEMENT

- VERIFY PASSAGE OF PASSIVE IMMUNITY TO CALF

REFRACTOMETER

Measure 24 and 48h after colostrum feeding

Estimates IgG content in the blood

Value on sierum/plasma **>5.4 g/dL**

GOAL: 80% of the calves with successful transfer of passive immunity.

COLOSTRUM
Quantity is important

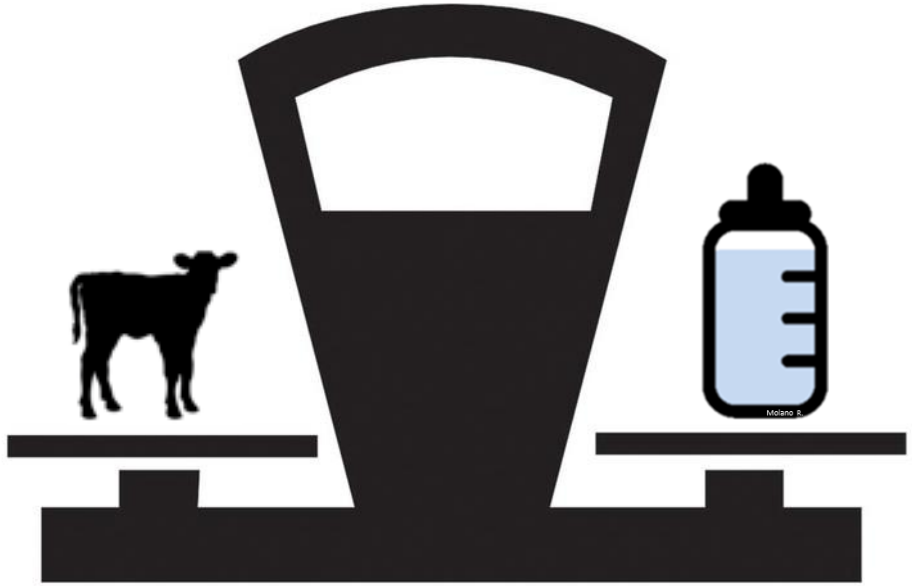
	ADG	Survival at 2nd lactation	Milk production at 2nd lactation
2L	0.78 kg/d	75.3 %	11030 kg
4L	0.90 kg/d	87.1 %	17072 kg

Faber et al., 2005

NUTRITION

CALF NUTRITION

GOAL: MEET THE CALF NEEDS



CALF REQUIREMENTS

- Maintenance;
- Growth;
- Maintain a functional Immune System;

CALF NUTRITION

LIQUID FEED

Whole Milk

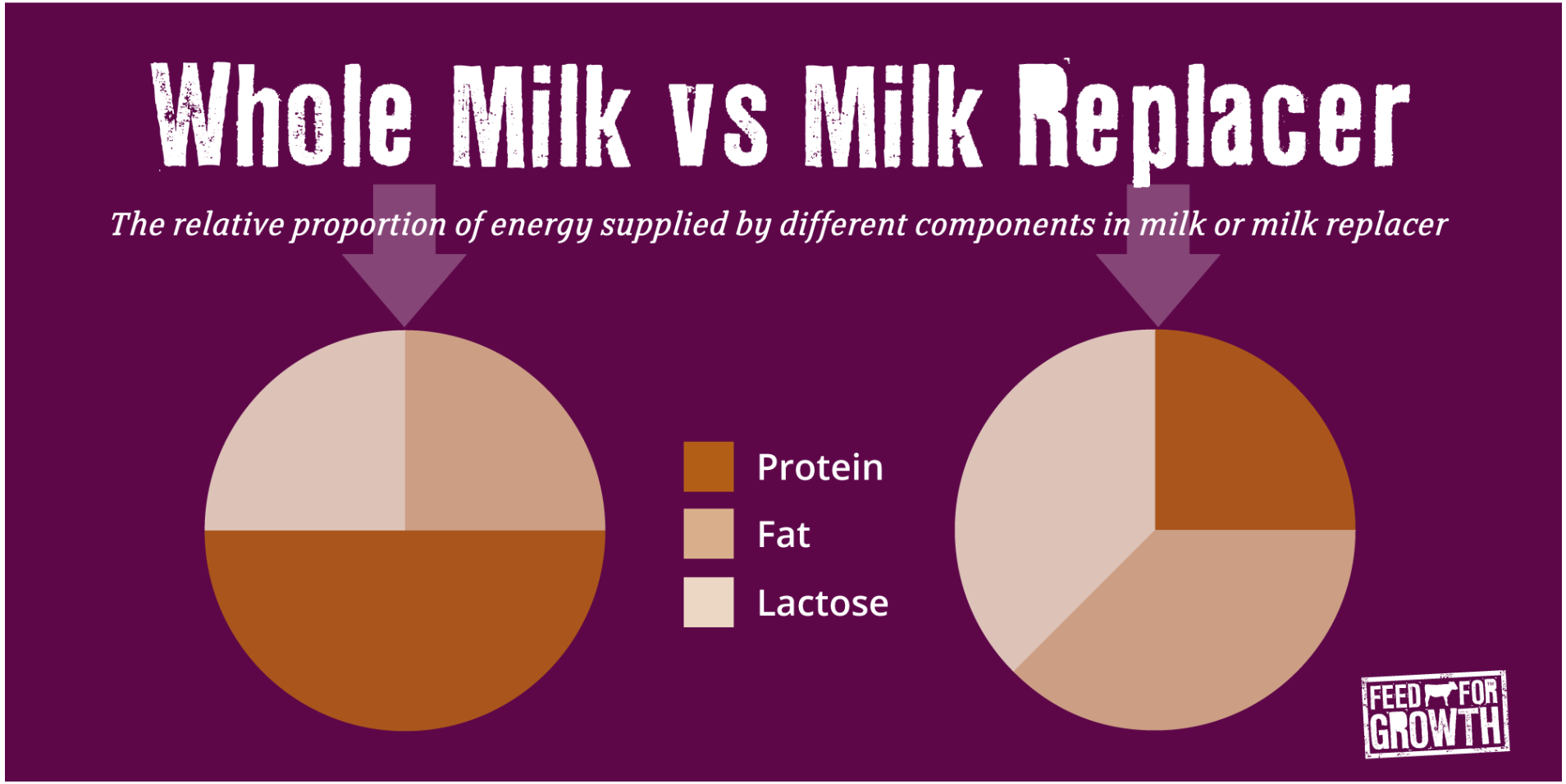
Milk Replacement

Solids

Water

Protein
Fat
Carbohydrate
Sugar
Minerals
Vitamins

CALF NUTRITION



CALF NUTRITION, on farm

QUESTIONS TO MAKE:

1. What kind of milk???

	+	−
• Whole milk	Naturally cover the calf need	Less milk to sell
• Waste milk	Save money	Low quality Antimicrobial content Low consistency
• Milk replacer	Flexibility Safe	Cost Not cattle fat (EU)

CALF NUTRITION

QUESTIONS TO MAKE:

2. How much milk are you feeding???

3. How many times a day??? 2X or 3X

4. How much solids are you feeding???

Milk concentration = **12 – 15%**

Concentration too high = “cause of scour”

CALF NUTRITION, on farm

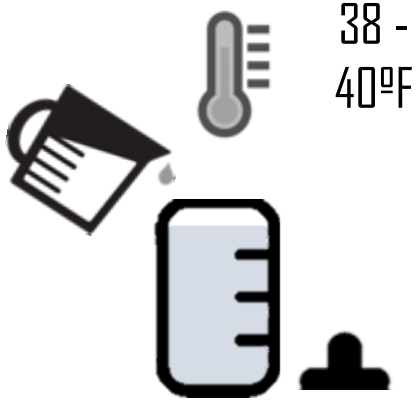
An example

4 L (kg) of milk at 15% = 600 g in 3.4 L of water

0.60 kg of solids for a 40 kg calf
Feeding rate = 1.5% of BW

2 L

600 g

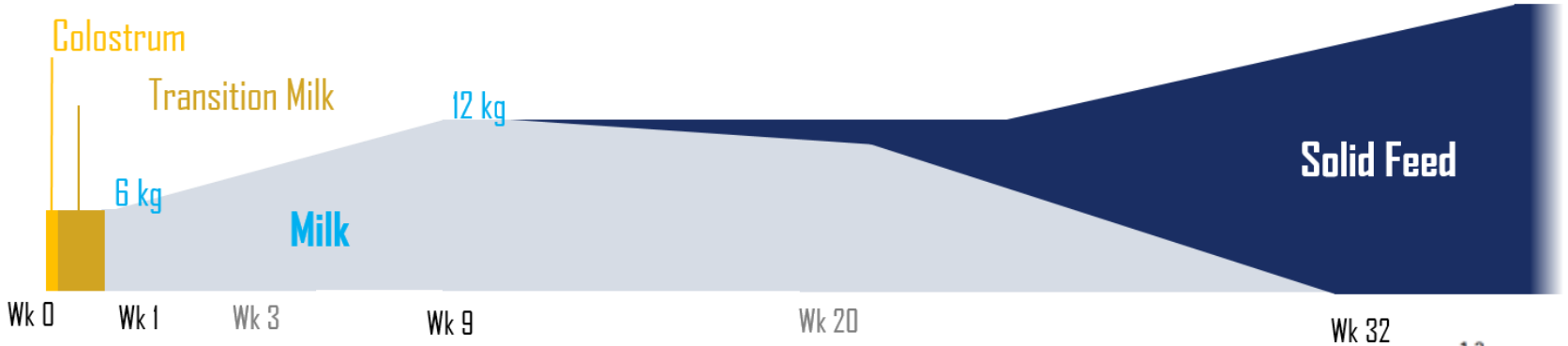


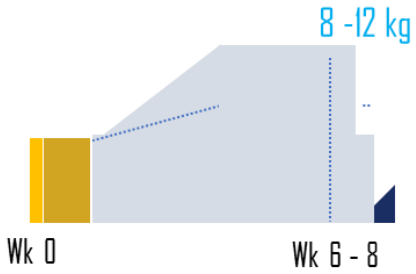
4 L

ANY DOUBTS…???

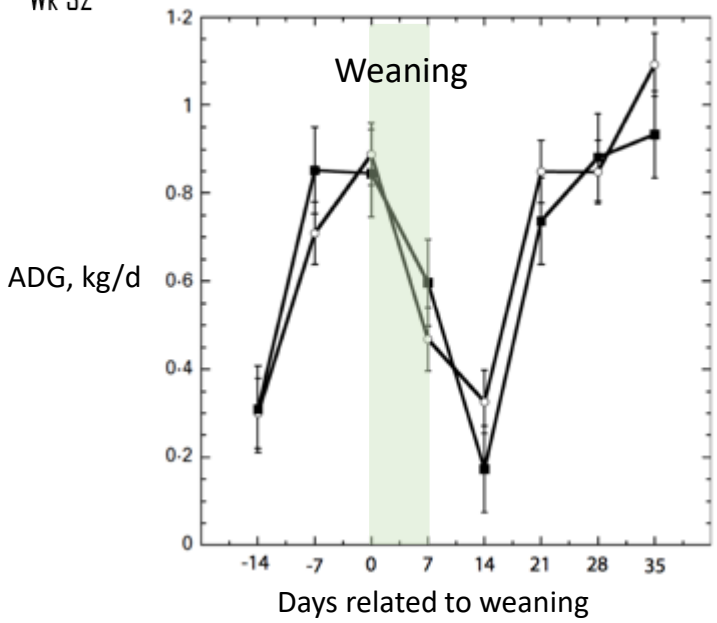
FACTORS AFFECTING CALF NEEDS

1. AGE: DEFINE AN OPTIMAL FEEDING PROTOCOL





FEED A GOOD STARTER
High energy
High palatability



FACTORS AFFECTING CALF NEEDS

2. TEMPERATURE

Solids quantity (kg/d) needed to cover maintenance requirement only

	Temperature, ℃				
BW, kg	18	10	0	-9	-15
27	0.27	0.36	0.41	0.45	0.50
36	0.36	0.41	0.50	0.59	0.64
45	0.45	0.50	0.59	0.73	0.77
55	0.50	0.59	0.68	0.77	0.86

FACTORS AFFECTING CALF NEEDS

3. HEALTH STATUS

Moderate infections increase the energetic needs by 150 – 200%

DON’T RESTRIC FEED IN CASE OF SCOUR!!!

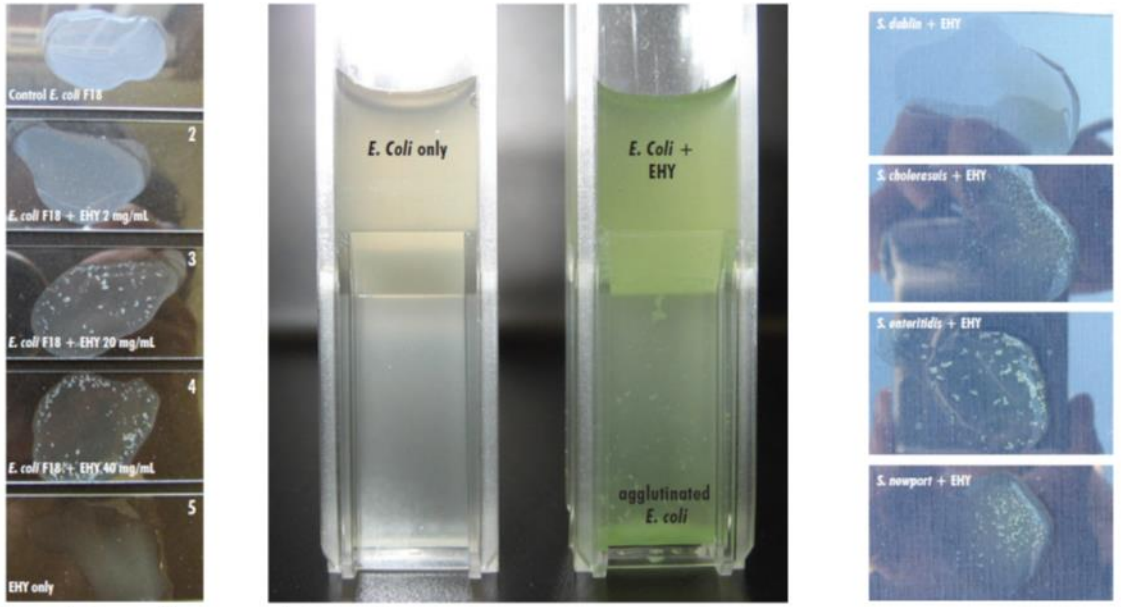
Lochmiller, R. L. and Deerenberg, C. 2000. Trade-offs in evolutionary immunology: just what is the cost of immunity? – Oikos 88: 87–98.

CALF NUTRITION

WATER!!!

TECHNOLOGIC FEEDS

- Acidify Milk
- Antimicrobial
- Yeast/prebiotics/beta-glucans



S. Jalukar, Ph.D. *et. al.* (2009) ADSA

CELMANAX®: yeast & yeast wall components

D-Mannos prebiotics, agglutinate bacteria (E.Coli Salmonella)

MOS prebiotics, agglutinate bacteria (E.Coli Salmonella)

Beta-Glucans bind mycotoxins, stimulate immune functions

RFC + Amines interferes with parasitic infection (Crypto)

RFC: Refined Functional Charbohydrates

Celmanax® Liquid in dairy calf milk replacers

Materials and Methods: 30 newborn Holstein calves were used for this trial. Testing period started in November of 2007 and lasted for 60 days. There were two treatments in this experiment:

- Control diet: Milk replacer supplemented with a leading brand of live yeast and yeast cell wall (MOS)
- Test diet: Milk replacer supplemented with Celmanax Liquid at 5 ml/calf/day

Parameter	Control	Celmanax
Beginning Weight, (Kg)	36.40	35.40
Ending Weight, (Kg)	51.30	58.80
Weight Gain, (Kg)	14.90	23.40
Mortality, (%)	0.00	0.00
Milk Replacer Consumed (Kg/calf)	21.80	19.60
Dry Feed Consumed (Kg/calf)	33.50	39.90
Feed/Gain	2.25	1.71
Medical Cost, ($/calf)	6.33	3.54

Baines, Danica, Mark Sumarah, Gretchen Kuldau, et al.
2013 Aflatoxin, Fumonisin and Shiga Toxin-Producing Escherichia Coli Infections in Calves and the Effectiveness of Celmanax®/Dairyman's Choice™ Applications to Eliminate Morbidity and Mortality Losses. Toxins 5(10): 1872–1895.

Salinas-Chavira, J., M. F. Montano, N. Torrentera, and R. A. Zinn
2018 Influence of Feeding Enzymatically Hydrolysed Yeast Cell Wall + Yeast Culture on Growth Performance of Calf-Fed Holstein Steers. Journal of Applied Animal Research 46(1): 327–330.

. R. J. Dennis1 and S. Jalukar*2,
Effect of Celmanax SCP on calf performance when fed in the milk replacer and grower phase.

SUMMARY

Colostrum

Milk

Solid Feed

Management

Environment

Less heath problem

Better growth performance

ADG= 1.0kg/d

Less time to start the production

Better performance in lactation

+ 1000 kg MILK

Higher costs

Less cost for replacement

Higher return from milk selling

KEEP IN MIND

The genetics of the heifer determine what her potential is. How she is raised, fed and managed determine what she will actually do.

Quality isn't expensive...

...It's priceless!!!

W. Edward Deming

Thank you