



EUROPEAN UNION
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Development FUND



**Zemnieku
Saeima**

FEEDING AND CARE OF NEWBORN CALVES

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Our target

- Get as many viable calves as possible
- Save all born calves
- Achieve excellent weight gain
- Breed good breeding heifers:
- First calving at 22.5 - 23.5 month = optimal milk yield!
- ~ 570 kg weight and ease calving
- Resistance to infections
- Quickly fits into the herd
- Productive and healthy

THE GROWTH OF THE NEXT COW

BEGINS

IN THE COLOSTRUM PERIOD

IN THE COLOSTRUM PERIOD

Colostrum

- First milk that cow produces
- It is richer than normal milk in many aspects
 - most important: immunoglobulins (antibodies)
 - antibodies are proteins produced by immune system in response to different infections
- The quality of colostrum is defined by concentration of antibodies
- It can vary between cows

Colostrum

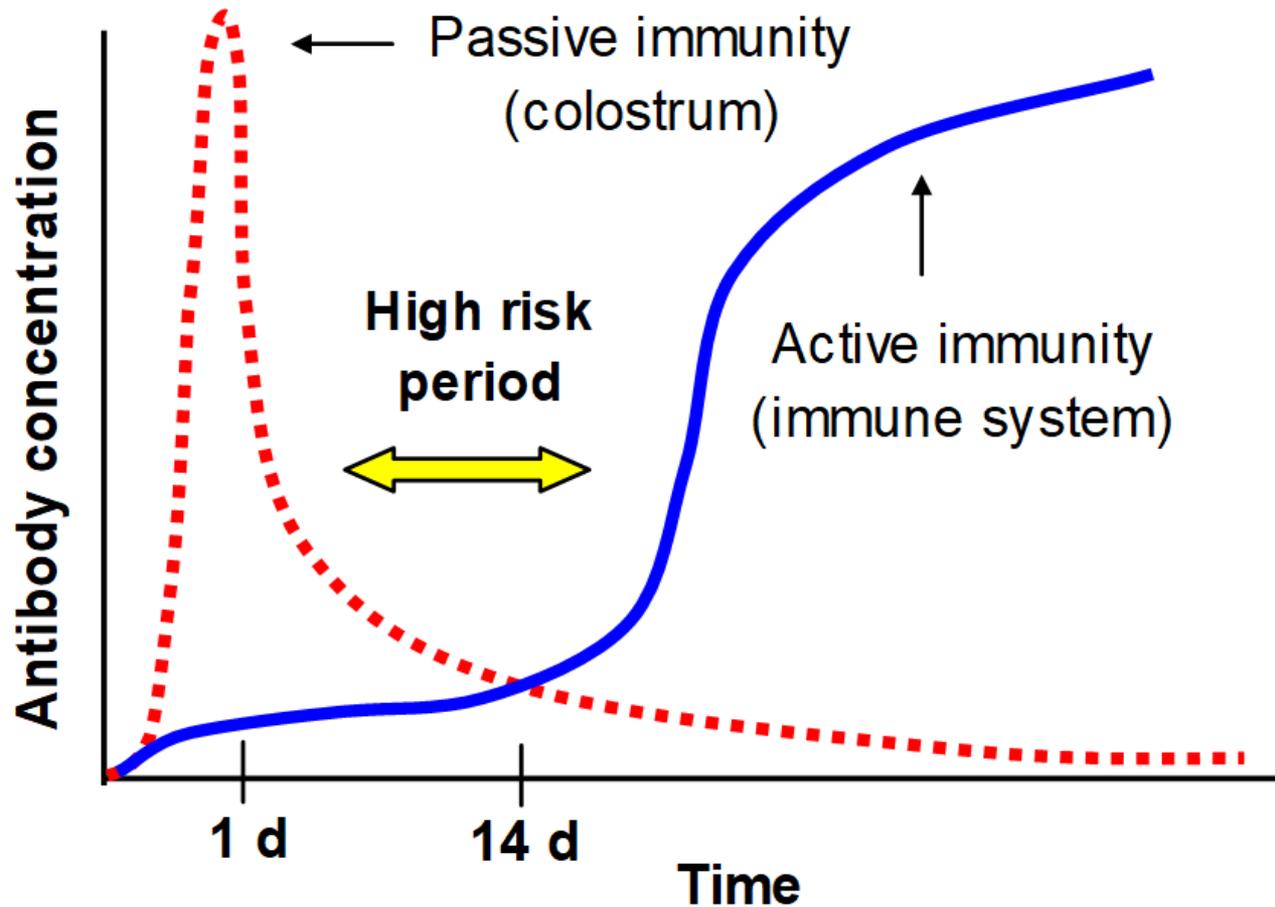
- The second and subsequent milkings contain less antibodies and are considered as transition milk rather than colostrum
- Colostrum should never been mixed with transition milk for feeding newborn calves!

WHY IS IT SO IMPORTANT TO KNOW EVERYTHING ABOUT COLOSTRUM?

Calves are born “sterile”

- Calves have no antibodies in their blood at birth and their own immune cells do not begin to produce antibodies until approximately 4 weeks of age.

In the first minutes contact with microbes



Some facts

- As the volume of colostrum increases, the quality of the colostrum decreases;
- This is partly due to the dilution effect.
- An experiment undertaken at *Teagasc's research, advisory and education Center (Ireland)* - confirmed the fact: concentration of antibodies halves between first and second milking.

Important to know

- Colostrum quality is lower in higher yielding cows!
- Holstein cows have poorest quality colostrum within the dairy breeds...
- After calving, dairy cows produce large amounts of milk, which means that the milk is “weaker” and is poorer in IgG concentration with every hour that passes between calving and first milking.

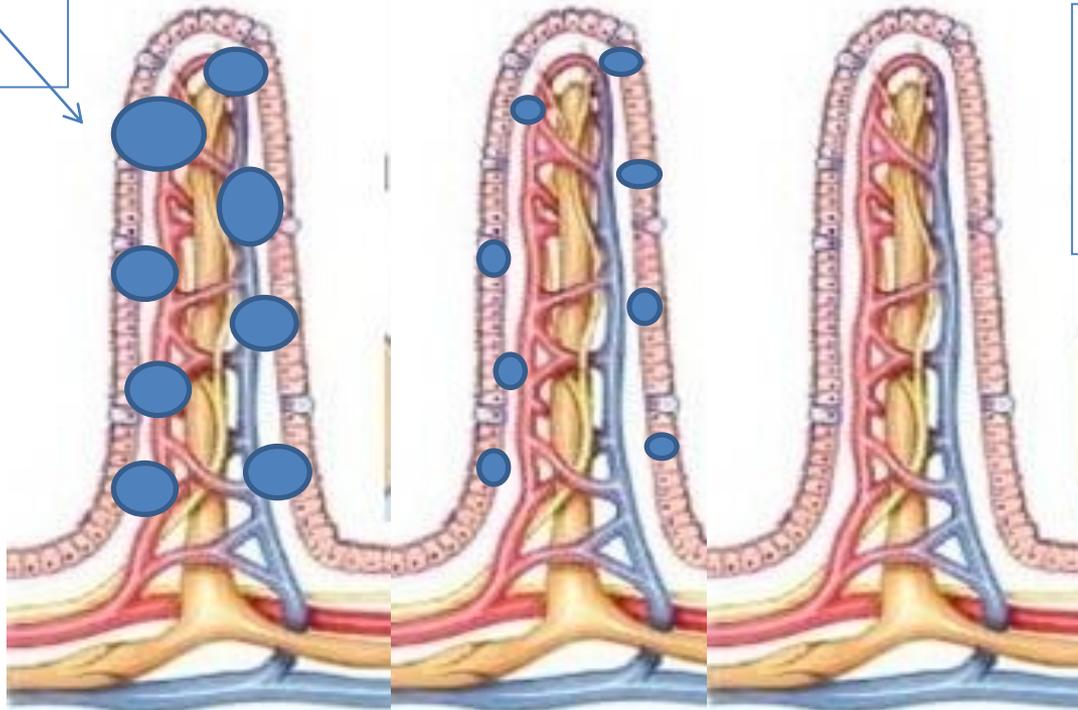
Important to know

- Antibodies are large proteins that can enter the blood from intestines of calf in the first hours.
- Ability to absorb these large proteins decreases a few hours after birth and has gone by 24 hours.
- The calf is at risk of infections when it enters the birth canal – at the moment of calving.

The ability of the gut to absorb immunoglobulins

Openings in wall

Intestinal mucosa villi



0-2 hours

2-8 hours

8< hours

Interesting facts

- The sooner the calf receives colostrum, the faster the openings in the intestinal wall close.
- Delayed ingestion of colostrum delays closure (risk of infection!)
- Higher amounts of colostrum are used worse.
- There is a 3-hour "distance" between the rumen and the real stomach (abomasum): **the milk that enters the rumen will only reach the abdomen after 3 hours.**
- 100-200 g IgG mass contained in 2.5 - 3 liters of colostrum is OK (50g/liter).

Colostrum and calves must be clean!

- If bacteria enter the bloodstream before antibodies are present, the calf has an extremely high risk of death.
- Bacterias in colostrum can also interfere with the absorption of IgG.



- Quality (concentration of IgG)
- Quantity (volume)
- Speed (milk and drink)
- Hygiene

COLOSTRAL MANAGEMENT GOALS

Colostrum rules



- Immediately!
- From the first milking!
- Clean!

During the first hour (~ 3 liters) HF breed,
(for very small calves 2-2,5 liter is OK).

≥ 10% of body weight during the first 12 hours.

Important to remember

- Antibodies cannot cross over from the cow to the calf during pregnancy!
- **Calf is born without any immunity!**
- If calves do not get enough antibodies through colostrum soon after birth, they will have failure of passive transfer of antibodies.
- Calves that do not receive enough antibodies in first hour, will become ill and/or die soon.
- Calves that survive have poorer grow.
- Colostrum is a **source of energy and protection.**
 - Calves desperately need this energy immediately after birth (do not have fat reserves)



- By ensuring that your calves receives plenty of colostrum soon after birth you will help lower the infectious pressure across whole herd and newborn calves will perform better!

Quality

- IG concentration - 50 g / liter = good
(*refractometer or colostrometer*)
- Free of blood, dirt, clots (mastitis)
- From a healthy cow

Facts

- Large fluctuations from cow to cow and farm to farm!
- Average IG concentration = 40.0 g / liter
- Concentration range = 14.5-94.8 g / liter

¹ Kehoe et al. A survey of Bovine Colostrum Composition and Colostrum Management Practices on Pennsylvania Dairy Farms, JDS 2007;90:4108

² Godden et al., Improving passive transfer of immunoglobulins in calves. II: Interaction between feeding method and volume of colostrum fed,,JDS 2009;92:1750.

Colostrometers

Colostrum that tests:

"green" contains > 50 mg/L

"yellow" contains 20 - 50 mg/mL,

"red" contains < 20 mg/mL Ig.

T⁰ is important!

Figure 1

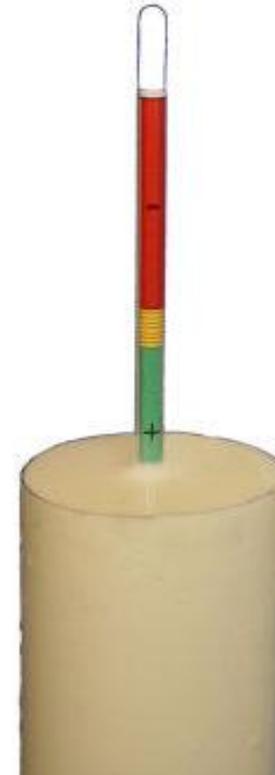


Figure 2



Refractometers

- Digital and optical Brix refractometers have provided similar results.
- Research suggests the Brix refractometer provides an accurate method of estimating IgG in colostrum with the benefit of an instrument that is much less fragile than the colostrometer

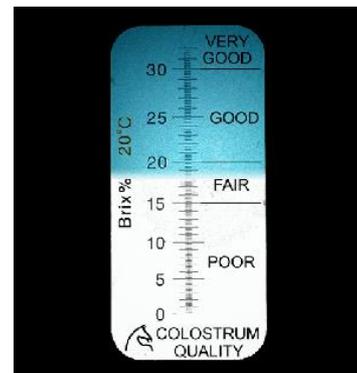
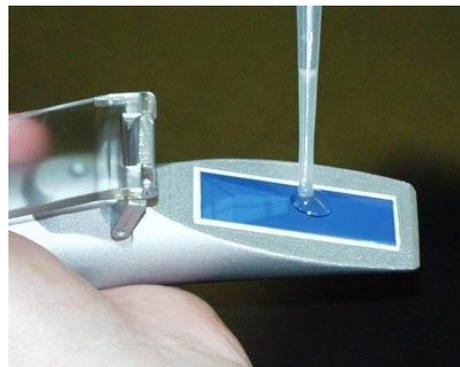


Refractometer reading not related to milk T°!



What is quality?

- **Colostrum** with a **Brix value** $\geq 22\%$ should be used.
- **Colostrum** with a **Brix value of** $< 18\%$ should be discarded.
- If **colostrum** has a **Brix value of** $\geq 18\%$ but $< 22\%$, supplementation should be considered.



Important

- If not good: think of stress, feeding, housing, vaccination issues...



Factors that may affect colostrum quality

- Lactation number - the quality of colostrum increases with the number of lactations = **SMART MILK.**
- However, heifers can produce high quality colostrum and should not be neglected.
- Antibodies help the calf "remember" previous diseases and limit any subsequent infections with the same pathogen.



Important to know

- It takes at least 5 weeks for a cow to produce a good colostrum.
- The quality will be poor:
 - if dry period is less than 5 weeks
 - if the colostrum looks watery, or cow leaked milk before calving
 - if the cow has mastitis
 - if the cow was ill during the dry period (e.g. winter diarrhea)
- Bacterial contamination reduces availability of the antibodies!

Reticular Groove

- Transport milk directly from the esophagus to the abomasum
- Reticular groove is composed of two lips of tissue that run from the cardiac sphincter to the reticulo-omasal orifice
- Closure is stimulated by:
 - Suckling
 - Consumption of milk proteins
 - Consumption of glucose solutions
 - Consumption of sodium salts



Some important notes

- Smaller stomachs require frequent feedings to allow a calf MAXIMIZE nutrient uptake
- If too many nutrients at once
 - milk can travel back to the rumen and cause bloating
 - it will pass right through the calf and cause nutritional scours
- Feeding schedules should consider what a calf can physically digest in one meal.

Basics

How it happens in nature?

- Calves need about 6 kg / milk / day in the first week and 12 kg / day in the 9th week.
- Calves want to eat an average of 8-12 x per day in the first week, ~ 10 minutes per each meal.
- Calves fed by the mother cow begin to graze and chew cud from about 3rd week and regularly graze with adult animals from 4-6 months.
- The weaning phase starts around the 10th month and goes away gradually.
- This reduces the frequency and production of milk.

Colostrum rules 1-2-3

1. The **FIRST milk**, and only the FIRST milk produced by the cow, should be used to feed the newborn calf at the first feeding.
2. Feed calves within **2-3 HOURS** of birth as antibody absorption is highest at this time.
3. Give the calf **3 LITERS** to get enough antibodies for the calf.

What happens if the calf receives colostrum later?

Local protection

- Unabsorbed antibodies line the intestinal tract of the calf, providing a protective coating that prevents microorganisms from adhering to the wall.
- This defense mechanism is suppressed if bacteria, such as *E. coli*, enter the digestive tract first.



Feeding time is critical for two reasons

- The short-term ability to absorb large molecules and the potential for pathogenic bacterial colonization of the intestine.
- For a limited time after birth, the secretion of digestive enzymes remains low, allowing antibodies not to be digested and to ensure maximum absorption.
- About 12 hours after birth, the secretion of enzymes increases, thereby reducing the ability of antibodies to reach the blood.
- It has also been found that calves born from mothers who experienced heat stress before calving, take up less IgG.

Colostrum Management Assessment



- Success in providing adequate immune defenses in calves can be monitored in calves between 24 and 48 hours of age.
- Blood samples. Measurement of total protein in serum with a refractometer using a total protein or Brix scale.
- **Serum total protein correlates strongly with IgG levels.**
- If the calves have received sufficient high quality colostrum, the total protein in serum will be **5.5 g / dl or more.**
- When total protein falls between 5.0 and 5.5 g / dL, there is a marginal risk of mortality and morbidity.

Goal

- The goal in feeding colostrum is to achieve a **serum IgG** concentration > 10 mg/mL.
- Calves that do not reach 10 mg/mL experience failure of passive transfer of immunity and are at greater risk of disease and death (Godden, 2008).

Important

- Blood samples should be collected when the calf is between 2 and 7 days old to provide the most accurate indication of passive transfer (Elizondo-Salazar and Heinrichs, 2009).
- Pasteurizing colostrum changes the relationship between serum total protein and IgG concentrations.
- Calves that receive pasteurized colostrum will have higher IgG concentration in their blood despite lower serum total protein.

Facts (USA and UK, study period 20 years, 6566 herds)

- 2x more frequent morbidity and 4x higher mortality were observed in groups of animals with serum IgG levels below 10 mg / ml.
- **Conclusion:** one of the most important indicators of herd health is the level of IgG in the blood serum of calves at 1-2 week of age.

Important

- Generally, higher total protein and %Brix values indicate higher concentration of IgG; however, very high values can indicate that a calf is dehydrated.

Causes of calf mortality

Abortion	14,6%	76,5 %
Complicated labor	24,9 %	
Twins	15,4 %	
Hypotrophy, lethargy	17,3 %	
Developmental defects	4,3 %	
Umbilical cord infection	1,5 %	3,1 %
Joint damage	1,6 %	
Diarrhea in the 1st week	7,7 %	15,7 %
Diarrhea in the 2nd week	5,8 %	
Diarrhea in the 3rd week	2,2 %	
Pneumonia	4,7 %	

The pathogens that cause diarrhea are on every farm!

1. *E. Coli* 4%
2. *Rotaviruses* 20%
3. *Coronaviruses* 8%
4. *Cryptosporidia* 31%
5. *Coccidia and mix* 31%
6. *Salmonella (bring in)* 6%

Whether the pathogens will cause diarrhea is up to you!

During diseases, the growth of the calf stops

Why?



Goals when treating scours

- Maintain caloric intake
- Restore hydration status and electrolytes
- Stabilize the intestinal tract

Pathogens

- Adult animals are a source of infection in newborn calves.
- The calf is immune to rotavirus infection for the first THREE days due high enough intestinal Ig levels (lactogenic immunity).
- Outbreak begins at 5-7 days of age (watery diarrhea)
- In large herds, 50-60% of cows may be carriers of rotavirus (less in the summer months).

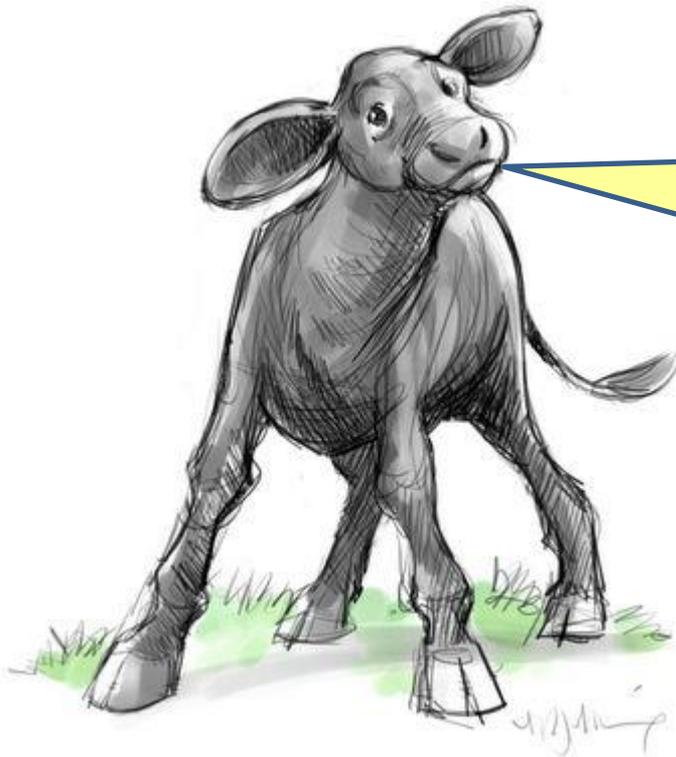
Proven facts

(Ontario, 34 herds, Holstein calves)

- Heifers suffering from pneumonia between 1 and 3 months of age were:
 - later inseminated
 - they were more often eliminated
 - they had lower milk yields
- Heifers that had a umbilical cord infection had much worse health and survival than calves that had other diseases.

Some truths:

- Calves born from the first-calvers are more likely to suffer from respiratory diseases.
- Calves that develop diarrhea in the first 3 months are more likely to develop respiratory diseases later.



Heifers to be
used for
reproduction
**DO NOT GET
SICKNESS AT
ALL!**

Development of the digestive system

- When calves are born, their initial digestive processes are similar to those of monogastric animals such as pigs.
- The reason: to maximize the digestion of milk proteins, fats and simple sugars.
- Rumen development begins in the first days and continues for several weeks.
- This is due to the intake of bacteria from the diet (from the environment) and the intake of roughage.

When we talk about
successful calf rearing, we
think about promoting rumen
development!

Anatomy of the rumen

The rumen has two layers:

1. a layer of **muscle** that helps to contract and mix feed, an epithelial layer that absorbs nutrients.
2. **epithelium** that forms fringes called *papillae*, which increase the absorption capacity through increasing the surface area.

Hay and grains are important for **fatty acid production** and rumen development.

- Fermentation of starch into grains produces large amounts of butyrate, which plays a crucial role in the formation of new papillae
- Intake of roughage promotes the development of rumen muscles and stimulates digestion and saliva formation.

- A healthy rumen is dark in color due to large blood vessels and dense tissue mass.
- There must be many papillae, they must be seen without a microscope.
- For calves receiving a more varied diet, it is easy to see the difference in length, number and color of papillae.



It is important to note that the intake of fodder ensures the normal development of papillae; however, concentrates (muesli, starter) stimulate *papilla* growth to a greater extent than roughage alone.

The production of fatty acids from solid feed stimulates the development of rumen epithelium i.e. increases the surface area.

That is interesting

- To visualize the magnitude of this change, stack 8-10 twenty liter bottles in a pile and create a "rumen" volume model, than place a 3 liter jar as a "calf's stomach" next to the stack!





Rumen development conditions

- A calf rumen that is denied access to a variety of feeds will remain undeveloped!
- Consumption of rough and granular feed is critical for rumen development.
- Bacteria, protozoa and fungi, which are natural inhabitants of the rumen, occupy the rumen when the calf receives roughage.
- Hundreds of species of microorganisms, along with good quality hay, enter the rumen.

Important

- As the intake of dry food increases, rumen contractions begin.
- When calves are fed milk, hay and concentrate soon after birth, normal rumen contractions can be seen as early as 3 weeks of age.
- Saliva provides urea and minerals such as sodium bicarbonate, which help maintain the normal growth and development of the rumen microflora.

Big rumen = high-yielding cow!

- Rumen development is promoted by volatile fatty acids, mainly butyrate and propionate, produced by the rumen microbiota.
- Butyric acid is not absorbed through the rumen wall, but is converted into an energy source that the rumen wall cells use for efficient rumen development (increases the area of the rumen wall, forming new fringes and promotes capillary development)
- Butyric acid (butyrate) provides energy for rumen development.
- Acetic acid (acetate) and propionic acid (propionate) are well absorbed by the rumen wall and provide energy for calves to grow (used as energy sources).

Do not do without microflora!

- The rumen is sterile after birth - NO bacteria
- By the age of 24 hours, there are already a large number of bacteria - mainly aerobic bacteria
- With the intake of starter food, typical rumen bacteria begin to colonize
- At 5 -13 weeks there is already a complete microflora population.

Do not do without microflora!

- The required microflora is formed in contact with other animals and the environment.
- Bacteria enter the digestive tract even if the calves are kept separate from adult cows (protozoa is different!).
- Favorable environment for microflora colonization:
 - Presence of substrates
 - Optimal pH in the rumen
 - Water - for forming the liquid part
 - Optimal T° in the rumen

Consumption of roughage is a ruminant instinct that manifests itself very early!



A calf's milk feeding period is a golden opportunity to maximise growth

- Feed efficiency is the animal's relative ability to turn feed nutrients into growth. It peaks around this period, at around 50%.
- i.e. 100 g of feed = 50 g of growth
- An animal's ability to use feed efficiently declines with age.
- Prior to puberty, heifer growth focuses mainly on bone and muscle growth, whereas in later life heifers gain more fat, demonstrating poor growth efficiency.

Good nutrition is not enough!

- Housing and care are just as important as the quality of the feed!
- Check regularly:
 - air quality
 - water quality
 - lighting
 - environmental T°
 - group density
 - cleanliness / health
- The best calf breeders always evaluate the overall situation and so "open up" the growth and development potential of the calves.



Shouldn't we make mistakes
at all?

**You can, but you will
have to pay for it!**

















The most important stages



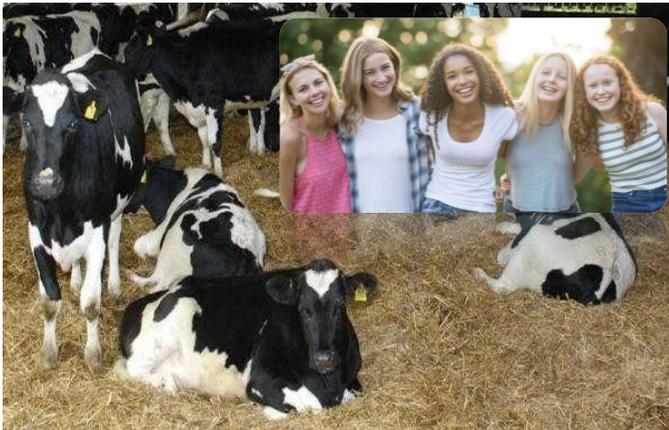
Newborn



Baby / milk period



Pupil, child



A teenager



Ready for reproduction



Pregnant

Light: better growth, health and more accurate work





Body condition

How to understand if we are doing everything right?

Measure or weigh!



During the measurement, the calf rests on all four legs

Weaning

- Method 1:
by chest size (92 cm <) =?
- Method 2:
at a certain age (8-10 weeks) =?
- Method 3:
starter feed capacity.
At least 1.5 -2.0 kg per day (3 days in a row)
= the safest method!
Calves ruminate at rest!

Important notes

- Encourage early intake of high quality starter food from a few days of age - provide small amounts and keep it fresh.
- Good quality straw and clean, fresh water must always be available.
- Make sure that the calf eats at least 2 kg of starter food for 3 consecutive days before weaning.
- Calves must reach twice their birth weight by weaning.
- Calves must be healthy.

Recommendation

- Colostrum 3 days min.
- Whole milk or milk replacer up to 1.5-2 months of age.
- From day 3 good quality hay and prestarter feed – provide small amounts and keep it fresh.
- At the time of weaning, eat 1.5-2 kg of prestarter feed for 3 consecutive days, able to eat hay.
- Earlier weaning (3 - 4 weeks) leads to a prolonged period of wasting and / or chronic diarrhea.
- **The sooner you want to wean a calf, the earlier it must be taught to eat dry food!**

THINK RUMEN!!!!





- It's important never to change a diet at once, and change should be gradual to avoid nutritional scours.
- Protein and fat levels must be correctly balanced.
- If you grow a calf too fast you can end up with fat animals!
- Less stress!
- Calves should have doubled their birth weight by weaning (use a weigh band).
- Calves to be weaned should be healthy and free of diseases.

For reflections

- The sooner the calf begins to eat rough / solid food, the sooner the rumen begins to develop ... and drinking water improves dry matter intake
- Think about yourself: how easy is it to eat dry breakfast cereals?
- Provide calves ad lib with clean, fresh water from birth.



Water

- **Rumen bacteria** must live in an aquatic environment. Without enough water, bacteria cannot grow and the development of ruminants is slowed down.
- For the fermentation to take place the bacteria need water.
- The water that is in the milk does not contribute, because the milk bypasses the rumen and goes directly into the abomasum.
- Calves that have free access to water eat more starter concentrates and have enhanced ruminal development.
- **Thus, it is recommended that clean water is provided at all times.**

Proven facts

- The older the heifer at the first calving, the shorter the productive life.
- Younger first-calver has a lower milk yield, but with a marked tendency to increase (if adequate nutrition).
- Calving at 22-26 months increased lifetime yield and increased profitability.
- Sustainability is also improved as a lower age at first calving results in cows lasting longer in the herd, therefore reducing the replacement rate.

Umbilical cord



- Should dry out in 1 week
- Anatomically, the umbilical cord remains in close contact with the structures of the abdominal cavity.
- It is a direct link to the outside world.
- This is exactly what the infection is waiting for!
- The infection can manifest in any of the surrounding structures.
- The clinical findings in **navel ill** are usually the enlargement of the umbilicus with purulent material, chronic toxæmia, and unthriftiness (Radostits et al., 2007), or septicaemia.
- It usually occurs as a mixed bacterial infection usually with possible localization **in the joints** (joint ill), bones, meninges, eyes, endocardium and end arteries of the feet, ears and tail (Naik et al., 2011).

- Calves that have not reached sufficiently high serum IgG levels are at higher risk to **septicaemia** (Naik et al., 2011).





Thank you!

