50 Years of transforming lives through dairying

NATIONAL DAIRY PLAN MISSION MILK THE NEXT REVOLUTION

NATIONAL DAIRY DEVELOPMENT BOARD

NATIONAL
DAIRY
DEVELOPMENT
BOARD
ANAND
GUJARAT

ANIMAL HEALTH UPDATES

Animal Health Group

VOLUME IV ISSUE IV | Quarterly Newsletter | Jan– Mar'16

IN THIS ISSUE:

Concepts on neonatal calf care and management

Introduction

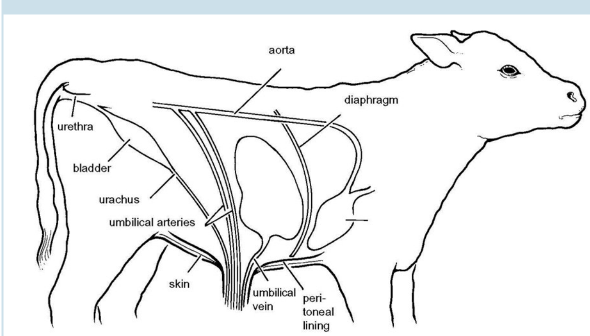
The life of a calf is said to be divided into two; the first 24 hours and the rest. The management of the calf during its first 24 hours of life has a large bearing on its ability to ward off infections. Management practices followed will also have an overarching effect on its productivity later in life.

The basic tenets of calf management during its early days revolves around five elements, namely, (A) navel disinfection (B) colostrum feeding , (C) management of feeding, (D) health management. and (D) management of diarrhoea.

It is necessary for veterinarians to understand the underlying principles of these tenets so that they are able to disseminate knowledge with sound conviction.

A. Navel disinfection

The severed umbilical cord is the gateway to infection if poorly maintained, the reason being that the umbilical arteries directly communicate with the aorta, taking pathogens straight into circulation (see fig below). Bacteriaemia or septicaemia may set in



when pathogens like *E.coli, Listeria, Pasteurella, Streptococcus, Salmonella* etc, gain entry through this route. They may also localize in various joints causing **joint ill**. Animals with joint ill remain unthrifty and usually succumb to septicaemia when the bacteria localized in the joints gain entry into circulation. Such calves have a poor recovery rate even after aggressive antibiotic therapy.

Calf with joint ill

Pus accumulation due to joint ill

The surest and easiest way to prevent this from happening is to carry out **navel dipping** with a strong Tr.Iodine solution (not less than 3.5%, stronger solutions preferred) **before tying off** the cut end of the umbilical cord. Navel dipping **ensures** that Tr.iodine reaches areas in the umbilical region where ordinary smearing or spraying **would not** be able to, thereby reducing the probability of infection. The navel dipping procedure should be **repeated** after **12 hours.**

Performing navel dipping with Tr.iodine

B. Colostrum feeding

True colostrum is obtained only from the first milking. After the first milking and for the next two and a half days, the cow's milk is called transition milk. Colostrum is the primary source of nutrients for the calf.

(i) Composition of colostrum vs whole milk

True colostrum contains **twice** as much dry matter and total solids, **two to three times** as much **minerals,** and **five times** as much **protein** as whole milk. Colostrum also contains various hormones and growth factors that are necessary for growth and development of the digestive tract. Colostrum is lower in lactose, thus decreasing the incidence of diarrhoea. Colostrum contains IgG [IgG_1(mostly) & IgG_2]-70-80%; IgM – 10-15% and IgA – 10-15%.

IgM is the first line of defense and IgA protects mucosal surfaces like intestine. Feeding colostrum for 3 days after birth thus provides protection to intestine against infections.

(ii) Colostrum – immunoglobulin relationships

- There is a **negative** correlation between volume of colostrum and amount of immunoglobulins (Ig).
- There is a **positive** correlation between parity and quality of colostrum w.r.t Ig content.

Some of the reasons for **low Ig** in colostrum are:

•Pre-milked cows (udder oedema or **leaky teats**)

•Breed - **Holsteins** have lower Ig content in colostrum

•**Heat stress** in latter part of pregnancy may reduce Ig content in colostrum.

(iii) Formula for assessing IgG levels in colostrum

It is possible to make a rough estimate of the IgG levels of colostrum in field using a hygrometer to measure the specific gravity of colostrum and employing the following formula:

<u>At 20°C:</u>

IgG in colostrum (mg/ml) = 958 x Sp.gravity-969

<u>At variable temperatures:</u>

IgG in colostrum = [853 x (specific gravity) +
(mg/ml) 0.4 x temperature (° C) - 866]

It is reported that around 75% of the variation in specific gravity of colostrum may be attributed to Ig levels.

Good colostrum would have **>50g of IgG/Litre (L)**

(iv) Colostrum requirement

As a rule of the thumb, the amount of colostrum to be fed to a neonate has been calculated as 1/10th of its body weight to be given soon after birth and again within 12 hours of birth. However for a veterinarian, the calculation should be based on sound scientific knowledge and principles. The same is illustrated by an example to determine the colostrum required for a calf weighing **30 Kg** with the dam's colostral IgG estimated at **~35g/L** (from the above formula)

Weight of the calf = 30 Kg

Plasma Volume (PV) (~9% of body weight) = 2.7 L

Minimum Plasma Concentration (MPC) of IgG required = 10g/L

Apparent Efficiency of Absorption (AEA)= 30% (This may vary from as high as 65% to as low as 25%, most estimates however fall under 30-40%)

Required IgG intake = PV x (MPC/AEA) = 2.7 x 10/0.3 = **90 gms**

Colostrum IgG concentration = 35 g/L

Required colostrum to be fed = 90/35 = **2.6 L**

(v) Failure of Passive Transfer (FPT)

A calf with serum IgG_1 levels **above 10mg/ml** at 48 hours of age is said to have an effective transfer of passive immunity from its dam. This correlates approximately to the **Total Serum Protein** (TSP) of **5.5 to 5.8 g/dL.** A TSP assessment of calves below 5 days of age would throw light on the colostrum feeding practices. The common reasons for FPT are:

- Low volumes of colostrum ingested– Poor nursing, poor udder/teat conformation, weak calf due to peri-natal asphyxia/acidosis commonly seen in delayed calving.
- Low concentration of Ig in colostrum
- Low efficiency of absorption :Within 6 hours of birth, the ability of the gut to absorb antibodies decreases by one-third. By 24 hours, the gut can absorb only 11% of what it originally could have absorbed at birth. Also, at 24 hours of age, digestive enzymes break down and digest all of the antibodies.

FPT occurs in calves more commonly than thought, even in well managed farms. FPT calves are immunologically weak and acquire infections easily. Feeding colostrum by hand or through stomach tube is becoming more common in organized dairy herds since this ensures adequate colostrum intake and thereby high serum levels of IgG in the calf.

Colostrum feeding by hand (left) and gastric tube (right)

(vi) Ensuring oesophageal groove closure

While hand feeding, improper closure of oesophageal groove may occur due to rough handling, feeding milk that is too hot/too cold , force feeding or overfeeding etc, which will lead to bloating, diarrhoea etc due to milk being fermented in the rumen. Due care therefore need to be taken while hand feeding. A raised and wagging tail, head butting and good saliva formation while suckling indicates proper oesophageal groove closure.

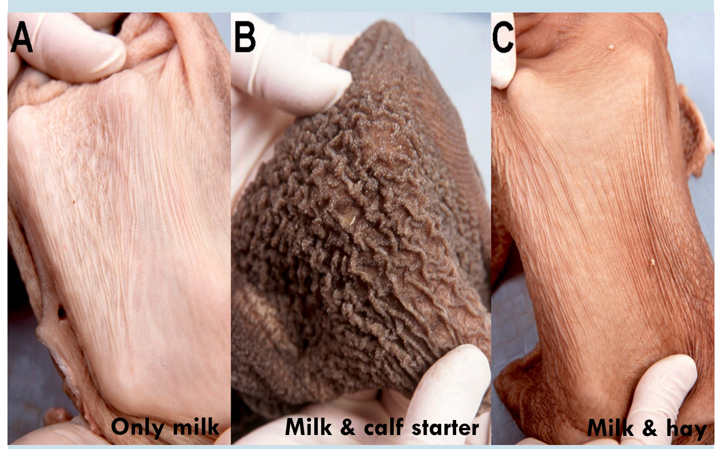
C. Feeding management

Rumen development is usually completed by 3 months of age. Providing an appropriate environment during the early stages of its development has a significant impact on the production potential of the animal. The performance of the calf later in life has a direct correlation with the rumen development and its efficiency in assimilating feed. Feeding management of calves is directed towards achieving this objective.

Proportion of various compartments of the stomach from birth to maturity

	Birth	3-6 m	Maturity
Rumen	25%	65%	80%
Reticulum	5%	5%	5%
Omasum	10%	10%	7-8%
Abomasum	60%	20%	7-8%

Primary factor determining rumen development is the **dry feed intake**. Carbohydrates in the grains are fermented to **propionate and butyrate** which **stimulates** rumen development. However carbohydrates in forages are largely fermented to **acetate**, which is **less stimulatory** to rumen development. The rumen epithelium of 6 week old calves fed different rations are shown in the figure. Rumen epithelium of calves fed milk and calf starter (B in figure) shows marked development compared to A-where the calf was fed only milk and C-where the calf was fed milk and hay. Early intake of calf starter from the 1st week will therefore provide proper stimulation for rumen development.



Palatability is the most important factor in choosing a calf starter for which molasses (4-5%) may be added.

It should contain at least 18% CP and 80% TDN. Calf starter may be provided from 1st week up to around 8th week. Start with small quantities and increase it gradually to about 750-900 g per day at its peak. **Water** is very essential as a rumen substrate for fermentation to take place and must be made available to the calf. It is best to start forages **after 8 weeks.**

D. Health management

Prophylactic measures below would prevent the calf from various infections and infestations that will help in harnessing its maximum potential.

- Deworming at 7-10 days of age and repeated at **monthly** intervals up to 6 months.
- Administration of all vaccines as per schedule.
- De-ticking on a regular basis.

E. Management of diarrhoea

Water constitutes about 60% of the body weight in adults, with higher percentages for calves. A detailed look at distribution of total body water and the ionic pool it supports (see table below) would give a better clarity on the importance of the gastro-intestinal tract in water and ion homeostasis.

Fluid compartment	Proportion of body mass	Major cations	Major anions
Total water	60%	-	-
I. Intracellular water	35%	K^+, Mg^{++}	HPO_4^{--}, Protein
II. Extracellular water			
(i) Interstitial water	3%	Na^+	Cl^-, HCO_3^-
(ii) Intravascular water	5%	Na^+, Ca^{++}	Cl^-, HCO_3^-, protein
(iii) Transcellular water			
(a) Contents of g.i tract	**15%**	**Na^+, K^+**	**HCO_3-**
(b) Other cavities (synovial fluid, cerebrospinal fluid, lung fluid, body cavity fluids etc)	1-2%	-	-

Though the causes of diarrhoea in a calf may be myriad (bacterial, viral, protozoan, parasitic, indigestion etc) , death usually occurs due to **dehydration, acidosis** and **hypoglycaemia**. Correction of these factors are paramount to survival of the calf alongside providing appropriate treatment.

(i) Assessing dehydration

It is important to assess the dehydration levels to provide effective treatment to the calf. The pinch test is an effective method of doing so.

The ideal site to carry out the 'pinch test'

(ii) Deciding the type of intervention

- Calves showing symptoms of **above 8%** dehydration require immediate **intravenous fluid therapy**.
- Calves that are **recumbent** and have **poor suckling** response also require **intravenous fluid therapy**.
- Calves with **good suckling** response and which are **ambulatory** can be provided **oral rehydration.**

Dehydration level (%)	Symptoms
Up to 5%	No symptoms, animal is normal.
5 – 6%	Diarrhoea, no clinical signs , strong suckling reflex.
6 - 8%	Mild depression, skin tenting 2-6 seconds, still suckling, sunken eyes, weak.
8-10%	Depressed, laying down, eyes very sunken, dry gums, skin tenting more than 6 seconds.
10-14%	Cannot stand, cool extremities, skin remains tented, comatose.
Over 14%	Leads to death

(iii) Principles of fluid therapy

Fluid therapy should be aimed at correcting the **dehydration, acidosis** and **hypoglycaemia.** Fluid therapy can be divided into two regimens:

1. Hydration therapy: Intravenous infusion to be carried out in the first 4-6 hours @ ~100ml per kg body weight (BW). **Strong Ionic Difference (SID) solutions (>50 mEq/L)** are preferred along with isotonic dextrose solution (5%). The ionic difference in the intravenous solution is calculated by the formula:

[Na + K]-[Cl]

2. Maintenance therapy : ~50 ml per kg BW intravenously in the next 20-24 hours. The 24 hour requirement may be divided into doses every 2-4 hours. Though the ionic difference of Ringer's Lactate is low at around **25 mEq/L,** it may suffice for **maintenance** therapy along with 5% dextrose solution. Oral route is usually preferred for maintenance therapy. Home remedies for electrolyte loss [Glucose –5 teaspoons (tsp); sodium bi carbonate- 1tsp; table salt- 1tsp in 1 litre warm water] may also be given. Table sugar may be **avoided** since it may worsen the diarrhoea.

(iv) Correcting dehydration, ion deficit & hypoglycaemia

The level of dehydration is a direct reflection of the fluid loss and thereby of the amounts required for rehydration. Eg. A 40 kg calf with diarrhoea having 10% dehydration would require ~ 4 litres of fluid for rehydration **in addition** to its normal liquid intake.

SID solutions like isotonic sodium bicarbonate (1.3%) or higher concentrations along with isotonic dextrose solution (5%) would address the **dehydration , acidosis** & **hypoglycaemia.**

Metabolic acidosis in diarrhoeic calves has been attributed to losses of **HCO_3^- (base deficit), Na^+ (hyponatremia)** , increased formation of **D-lactate** in the gut and, an increase in **total serum protein** concentration due to dehydration. The base deficit for various levels of dehydration is estimated as under:

Dehydration %	Status of calf	Est. base deficit
12-15%	Recumbent	15-20 mEq/L
8-12%	Weak	10-15 mEq/L
5-8%	Ambulatory	5-10 mEq/L

(v) Elucidation through an example : The practical application of the principles of fluid therapy can be explained by extending the above example of a calf weighing **40 Kg** with **10% dehydration** as estimated by the pinch test.

Extracellular fluid (ECF) in the 40 Kg calf = ~20 litres (ECF would be higher in calves ~50%)

Base deficit at 10% dehydration= ~12mEq/L (from above table) x 20 (ECF)= **240 mEq**

The quantity of $NaHCO_3$ required to correct the base deficit/hyponatremia would be:

i. $NaHCO_3$ = **20 g** (1g=12 mEq) or;

ii. Isotonic solution 1.3% (150 mEq/L)= **1.6 L** or;

iii. Hypertonic solution 5% (600 mEq/L) = **0.4 L** or;

iv. Hypertonic solution 8.4% (1000mEq/L) =**0.24 L**

1. Hydration therapy for the calf: The required quantity of $NaHCO_3$, isotonic or SID solution as calculated above can be mixed with isotonic dextrose solution (5%) to about ~4 litres.

It may be worth noting here that normal saline solutions (containing 154 mEq/L each of Na^+& Cl^-) usually used for correcting dehydration along with dextrose 5% has an effective ion difference of **0 mEq/L** and therefore does not have **any impact** in correcting the ion deficit and, thereby acidosis. On the contrary, it has a net **acidifying effect.**

2. Maintenance therapy for the calf: A litre each of Ringer's lactate and dextrose 5% solution (~2 litres) intravenously or oral rehydration with an electrolyte solution.

Significant animal diseases reported to OIE (Jan–Mar'16)

No	Disease Outbreak	Countries reporting
1	Dourine	Botswana
2	Bluetongue	Brazil, Ecuador,
3	Brucellosis (Brucella suis)	Finland
4	Peste des petits ruminants	Georgia
5	Equine infectious anaemia	Greece
6	Foot and mouth disease	Iran [A (new Strain)]
7	African swine fever	Mali
8	MERS-CoV	Saudi Arabia
9	African swine fever	Ukraine
10	BSE	France