

# HEIFER RAISING—BIRTH TO WEANING

## 30) FEEDING HAY, CONCENTRATES AND WATER

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### INTRODUCING SOLID FOOD IN THE DIET

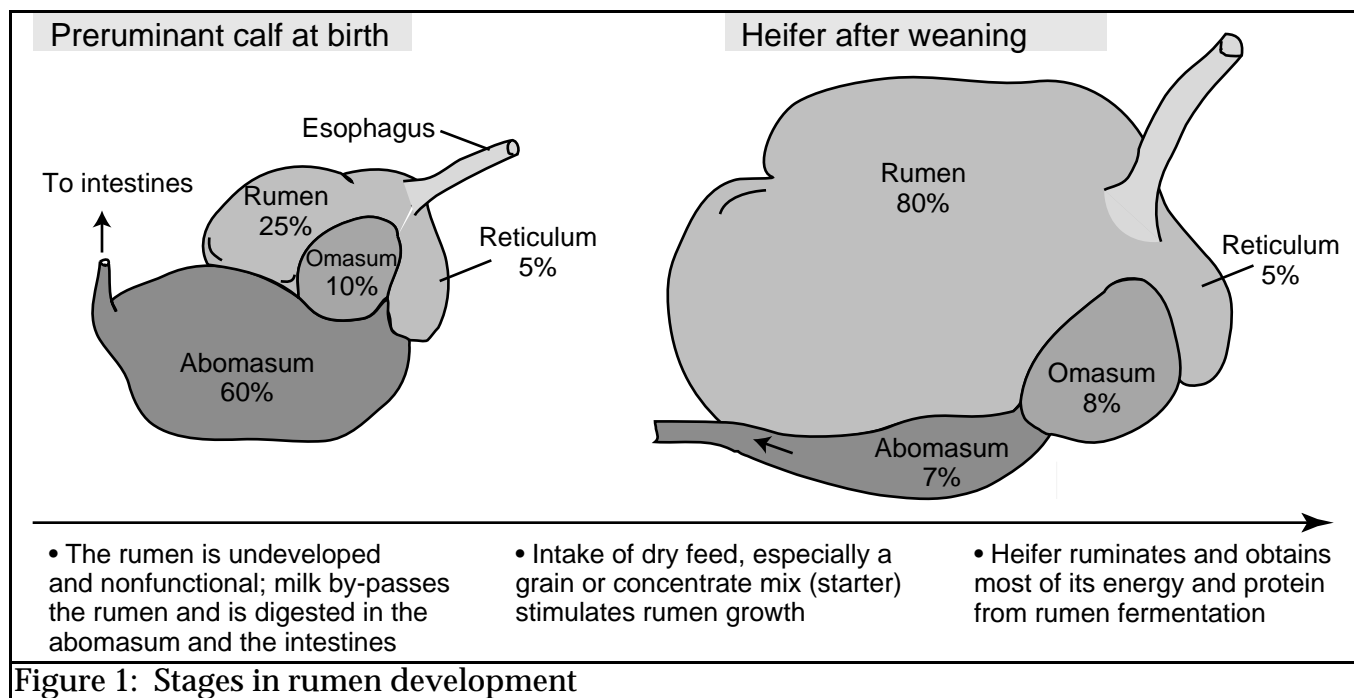
Newborn and young calves fed primarily liquid diets do not function as ruminants because they have only one functional stomach, the abomasum. When a calf is fed milk or milk replacer, the closure of the esophageal groove makes milk bypass the reticulo-rumen and flow directly into the abomasum. However, when solid feeds are ingested, the esophageal groove gradually ceases to function, a population of bacteria is established in the rumen, and rumen wall development begins. Eventually, heifers become capable of utilizing fibrous feed because of the microbes living and growing

in their rumen. One can tell that the rumen has become functional when a young heifer begins to chew her cud at two to four months of age.

Thus the availability and early ingestion of solid food allows rapid rumen development and early weaning (five to eight weeks of age).

### Rumen development

A calf should not be weaned until its rumen is functional and capable of supporting its nutritional needs. End-products (volatile fatty acids) of ruminal fermentation provide the stimulus needed for rumen development. The rumen of



**Figure 1: Stages in rumen development**

calves denied access to dry food will remain undeveloped. This technique is used to produce veal calves. Thus the consumption of dry feed is critical to rumen development. Bacteria, protozoa and fungi that are normal inhabitants of the rumen are established naturally when the calf ingests dry feed. Hundreds of species of microorganisms enter the rumen attached to feed particles. However, the population in the rumen is dominated by only a handful of microbial species. Bacteria that thrive in the rumen are those capable of fermenting carbohydrates in the absence of oxygen (anaerobic bacteria). The end-products of carbohydrate fermentation (acetate and butyrate in particular) are

important promoters of rumen growth and development. Thus rumen growth and development depend more on grain intake than on forage intake. The early consumption of a highly palatable starter (grain mix) is important to ensure rapid rumen development and a smooth transition at weaning time.

**When should a starter be offered?**

A starter should be offered as early as four days after birth and should continue until about four months of age, six to eight weeks past weaning. The calf will eat very small amounts of solid food for the first two weeks after birth. However, they should be encouraged to eat the starter. For example:

Table 1: Example of concentrate mixture and composition for young calves

INGREDIENTS	GRAIN STARTER <sup>1</sup>				COMPLETE STARTER <sup>2</sup>			
	1	2	3	4	1	2	3	4
	AMOUNT (kg as is)							
Alfalfa Pelleted	--	--	--	--	18.9	17.0	18.8	16.0
Corn Grain	35.0	30.0	50.0	50.0	24.0	22.0	--	15.0
Ear Corn (grain + cob)	--	--	--	--	--	22.0	35.0	10.0
Oats	35.0	13.0	--	--	35.0	--	22.0	10.0
Wheat Bran	--	10.0	10.0	--	--	--	--	--
Beet Pulp	--	--	--	--	--	15.0	--	10.0
Gluten Feed	--	--	--	20.0	--	--	--	10.0
Distillers Grains	--	--	10.0	--	--	--	--	10.0
Linseed Meal		10.0	10.0	10.0	--	--	--	--
44% CP Supplement	22.7	10.0	12.8	12.9	15.0	17.0	17.0	12.0
Dried Whey	--	10.0	--	--	--	--	--	--
Molasses	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Mineral, 23% Ca and 18% P	0.6	--	--	--	1.1	1.2	1.2	1.0
Limestone Feed or CaCO <sub>3</sub>	1.4	1.7	1.9	1.8	0.7	0.5	0.7	0.7
Trace Mineral Premix	0.25	0.25	0.25	0.25	0.3	0.3	0.3	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	COMPOSITION (Dry Matter basis)							
Energy								
TDN <sup>3</sup> , %	80.3	79.5	81.8	82.7	75.6	76.1	75.1	77.4
Net Energy-Maint., Mcal/kg	1.96	1.94	2.00	2.02	1.80	1.83	1.80	1.87
Net Energy-Growth, Mcal/kg	1.32	1.30	1.36	1.39	1.19	1.21	1.19	1.23
Crude Protein, %	19.9	19.6	20.2	20.7	18.4	18.5	18.5	19.4
Acid Detergent Fiber, %	8.6	8.3	7.6	6.7	14.2	16.6	15.4	16.1
Neutral Detergent Fiber, %	18.0	20.4	18.6	17.6	24.3	27.6	26.2	30.1
Calcium, %	0.89	0.95	0.94	0.95	0.82	0.84	0.85	0.85
Phosphorus, %	0.51	0.59	0.52	0.51	0.51	0.51	0.52	0.52
Trace Minerals, %	0.28	0.28	0.28	0.28	0.34	0.34	0.34	0.34

<sup>1</sup> Grain starter may be fed with a forage such as a good quality hay.

<sup>2</sup> Complete starter can be fed alone as it already includes high levels of fiber.

<sup>3</sup> TDN = Total Digestible Nutrients = % digestible crude protein + % digestible crude fiber + % digestible nitrogen-free extract + (2.25 x % digestible ether extract).

- Starter should include molasses or other palatable ingredients;
- Starter should be offered frequently, but in small amounts to keep it fresh;
- Milk intake should be limited to a maximum of 10% of body weight at birth per day;
- Clean, fresh water should be available as soon as the grain starter is offered. Consumption of dry feed is enhanced by increased water consumption;
- A handful of starter can be placed on the calf's muzzle or at the bottom of the pail immediately after it has finished drinking milk;
- Starters may also be fed with a nipple bottle to encourage consumption.

**Should hay and concentrates be fed?**

Early research suggested that a mixture of concentrate and good quality hay was needed for normal rumen development. Fibrous or bulky feed was thought to play a role in increasing rumen capacity and maintaining the normal shape of rumen papillae. However, recent research has shown no advantage to feeding hay when the starter is formulated to contain sufficient amounts of fiber. In contrast, carbohydrates in the concentrate are essential because they provide the butyric acid and acetic acid required for the development of the rumen wall. If the starter does not contain at least 25% neutral detergent fiber (NDF), hay may be provided. In addition, starter should contain about 18% crude protein, 75 to 80% total digestible nutrients (TDN), and should be fortified with vitamins A, D, and E.

There are two types of starters: grain starter and complete starter (Table 1). Complete starter contains a higher level of fiber (i.e., less energy) than grain starter, but both can be formulated with ingredients used to feed adult animals (except urea). Complete starter is likely to be slightly less palatable and ingested in lower amounts than grain starter. When

starters are fed, forages are not needed until after the calf is weaned.

Usually the grains in starter are coarsely ground or rolled to obtain a coarse texture. Grinding too fine is not recommended as fine particles do not stimulate rumination. Palatability is often improved by including 5% molasses in a starter. When calves eat more than 1.5 to 2 kg of starter per day (at three months of age), they may be fed a less expensive concentrate mixture. Figure 2 shows the expected consumption of grain starter when forage is fed free-choice starting at two weeks of age.

**WEANING**

Weaning should take place when a calf is growing well and is consuming at least 1% of its body weight as grain starter (500-600g to 700-800g of starter for small and large

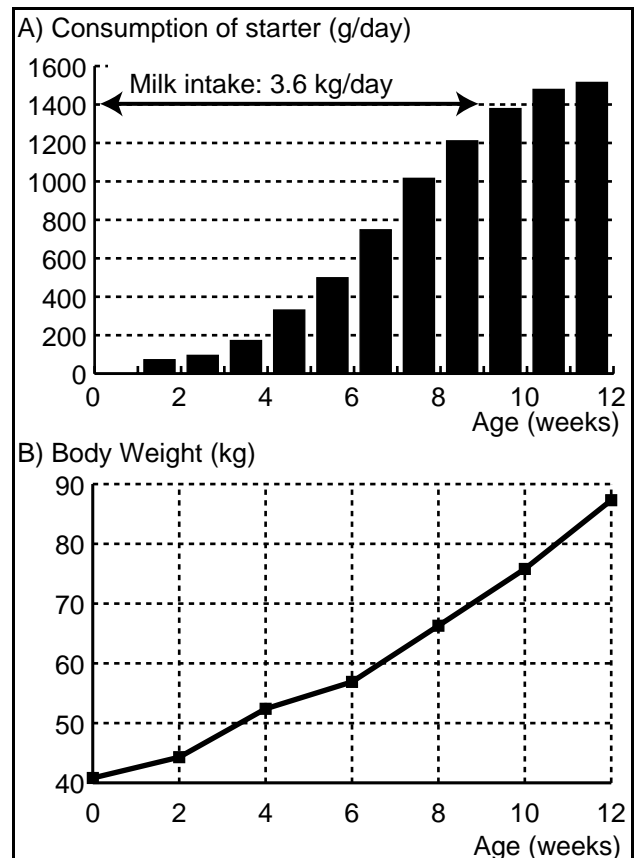


Figure 2: Consumption of a grain starter and body weight gain of young calves fed milk at a constant rate and forage free-choice

breeds respectively). Milk should be continued for small or weak calves. Milk may be offered only once a day the week before complete weaning. Most calves can be weaned between five and eight weeks of age. Calves fed a grain starter may be ready for weaning a few weeks earlier than those fed a complete starter. Weaning before four weeks of age presents more risks and usually leads to a higher mortality rate. In contrast, weaning later than eight weeks of age is costly because:

- The ration of a weaned calf (forage and concentrates) is usually less expensive than milk or milk replacer;
- The growth rate remains limited as long as calves are fed a liquid diet. Weight gain increases considerably after weaning, provided the calf is well adapted to a diet of solid food (starter and forages).

As indicated earlier, the calf's nutritional needs and the development of its rumen will be better served with a starter feed



Figure 3: Feeding of a palatable grain starter and water allows rapid development of the rumen and early weaning.

than with forage, especially before weaning. However, good quality hay or silage should be fed after weaning. Ration composition should be carefully monitored, especially when corn silage is included in the ration. As intake capacity increases after weaning, body weight gain can, and should, be increased to the desired long term level.