CHAPTER-6

Feed formulation -

nutrients requirement for different category of dairy animals, balanced/complete ration, methods of feed formulation

Objectives

1. To study the nutrient requirements of different categories of dairy animals
2. To prepare balanced rations for different categories of dairy animals
3. To acquaint with important points to be kept in mind for feeding dairy animals

Introduction

There are different categories of animals in a dairy herd including growing calves, heifers, breeding bulls, pregnant and lactating animals. Each category has its own nutrient requirements which are by providing them balanced ration. Ration is defined as the amount of feed offered/given during a period of 24 hours while the balanced ration is one which provides nutrients in such amounts and proportions which meets the nutrient needs of animals for various physiological functions viz. maintenance, growth, production, reproduction etc. The term requirement signifies the amount of a specific nutrient needed by the animal for normal functions like maintenance, growth or production.

Nutrient requirement of different categories of dairy animals

Table 6.1: Nutrient requirements pre-ruminant cattle and buffalo calves (ICAR, 1998)

Age (day)	Body wt	Daily gain	DCP (g)	TDN (g)	ME (Mcal)	Ca (g)	P (g)
Birth to 15	25	200	80	0.40	1.5	2.5	1.5
16 to 30	30	300	90	0.50	1.7	3.0	2.0
31 to 60	40	300	125	0.80	2.4	3.5	2.5
61 to 90	50	350	150	1.00	3.6	4.0	3.8

Table 6.2: Nutrient requirements of lactating cattle and buffaloes (ICAR, 1918)

Body weight (Kg)	Dry feed (kg)	DCP (g)	TDN (kg)	Ca (g)	P (g)
Maintenance of mature cows/buffaloes					
200	3.5	150	1.7	8	7
250	4.0	170	2.0	10	9
300	4.5	200	2.4	12	10
350	5.0	230	2.7	14	11
400	5.5	250	3.0	17	13
450	6.0	280	3.4	18	14
500	6.5	300	3.7	20	15
550	7.0	330	4.0	21	16
600	7.5	350	4.2	22	17
650	8.0	370	4.5	23	18
700	8.5	390	4.8	25	19
750	9.0	410	5.0	26	20
800	9.5	430	5.3	27	21
Percent milk production (nutrient required/ kg of milk fat)					
3	-	40	0.270	0.97	1.8
4	-	45	0.315	1.13	2
5	-	51	0.370	1.28	2.2
6	-	57	0.410	1.36	2.4
7	-	63	0.460	1.54	2.6
8	-	69	0.510	1.80	2.8
9	-	75	0.500	2.06	3
10	-	81	0.600	2.16	3.2
11		85	0.700	2.34	3.4

Table 6.3: Water requirements for growth and milk production.

Atmospheric Temperature(^{0}C) (Litre)	Water Intake/ kg Dry Matter Intake(Litre)	Water Intake/ 100 kg Liveweight
Cattle (400 kg)		
10	3.0	5.5
27	3.5	6.0
35	4.5	8.0
Buffaloes (500 kg)		
10	5.0	6.5
27	5.5	7.0
35	6.5	10.0

During the first and second lactations to allow the growth of the lactating cows/ buffaloes, add about 20 and 10% of maintenance allowance

Feeding/ feed formulation for dairy animals:

Dry matter intake

The first thing that comes to our mind regarding the feeding of animals is how much dry matter they consume per day. Dry matter intake of animals is very much related to the body weight of the animals. Adult animal can consume 2.5 to 3.0 Kg dry matter per 100 Kg body weight. This should come partly from green plus dry roughages (2/3) and partly from concentrate (1/3 parts).

Feeding of young calves : Calf is the future dairy animal. Utmost care is required to be taken to raise a calf and keep it healthy and free from infections. New born calf is prone to all types of infections since the immune system is not well developed at birth. However, nature has provided a mechanism to give protection to new calf against infections in the form of colostrums, the first secretion from udder immediately after parturition.

Colostrum should be fed to calf within one hour to get maximum antibodies especially in buffalo calves, for developing immunity against diseases. The calf is capable of absorbing antibodies (immunoglobins) only for a short period of time. Maximum absorption occurs immediately after birth, which decrease with time. Colostrum also creates acidic medium in the intestinal tract which prevent diarrhea, white scour and other intestinal disorders.

After feeding colostrums for 5 days, calf is then put on whole milk feeding for 2 weeks to be gradually replaced by skim milk up to the age of 100 days.

Table 6.4: Milk feeding schedule for calves.

Body Wt. (Kg)	Calf Age (days)	Colostrum (Litres)	Whole milk (Litres)	Skim milk (Litres)
Upto 25	Upto 5	1/10th of body wt	-	-
20-30	6-20	-	1/10th of body wt	-
25-50	21-30	-	1/15th of body wt	1/20th of body wt
30-60	31-60	-	1/20th of body wt	1/25th of body wt
40-75	61-100	-	1/25th of body wt	1/25th of body wt

Green and leafy legume hay can be offered to young calves after two weeks of age, which helps in rumen development. After 3 month of age the concentrate can be offered @ 1.0 to 1.5 kg as per the body wt. changes.

Feeding of dairy heifers/ pregnant animals

Heifers are still in the growing stage. Growing animals need sufficient protein in the diet than energy. The concentrate fed to growing heifers should have 20% CP and 65-70% TDN. Better nutrition of heifers helps in attaining early maturity of the animals which may reduce the age at first calving.

Table 6.5. Feeding schedule for Heifers

Age (months)	Body wt. (Kg)	Roughages Green (kg)	Dry (kg)	Concentrates (kg)
6-9	70- 100	5-8	-	1.25-1.5
9-15	100-150	8-15	-	1.5-2.0
15-20	150-200	15-20	-	2.0-2.25
Above 20	200-300	20-25	2	2.25-2.5

Cows and buffaloes in late pregnancy (during pre partum period) need to be given nutritious feeds, about 2 kgs of good concentrate and a good quality green fodder. This is just to improve the body condition score. This helps in building the reserves, which can then be used during early part of pregnancy of lactation as mobilized nutrients.

Vitamin-E supplementation, 1000 IU may be given 60 days pre partum and 30 days post partum. This is a good preventive measure against sub clinical mastitis, as it provides immunity to the animal against infections, especially udder infections.

Feeding of bulls: Breeding bulls should be fed optimally, consisting of good quality concentrate mixture and green fodder, along with some dry fodder. Concentrate mixture of 14-15% CP should be fed @ 2-3 Kg per animals.

Feeding of concentrates mixture containing bypass protein is all the more beneficial in improving the semen quality, seminal attributes, sexual behavior and libido score bulls.

Feeding of lactating animals : Dairy animals with a potential for milk production need to be fed judiciously a balanced ration consisting of dry roughages, green fodder and concentrate. The concentrate mixture should be of good quality with a CP content 20% and TDN 70 %.

Dairy animals have to be fed nutrient to meet the requirement for maintenance (normal physiological processes) and for production. Additional concentrate has to be fed as per the quality of milk produced, providing allowance for the higher fat content in buffalo milk.

Accordingly, for cows for every 2.5 kg of milk produced 1.0 kg of concentrate has to be fed. For buffaloes, because of higher fat content in milk, for every 2.0 kg of milk produced, 1.0 Kg of concentrate has to fed.

If a sufficient amount of good leguminous fodder is fed, then upto 5 kg of milk, just kg of milk concentrate is enough and when a sufficient quantity of non-leguminous fodder is fed, then upto 5 Kg of milk, just 1.5 kg of concentrate is enough and when a sufficient quantity of non-leguminous fodder is fed 2.0 kg of concentrate may be given.

Table 6.6. Concentrate feeding of lactating animals:

Milk Production (Kg)	Cows (Kg)	Buffaloes (Kg)
5	2	2.5
10	4	5
15	6	7.5
20	8	10

Table 6.7: Composition of a concentrate mixture

Ingredients	Parts
Maize	16 %
Barley/ Wheat/ Oats	15 %
GNC (0iled)	18 %
Mustard cake Cotton Seed Cake	8 %
Cotton Seed Cake	7 %
Wheat Bran	15 %
Deoiled Rice Bran	8 %
Mineral Mixture	2 %
Common Salt	1 %

The above concentrate shall have 20 % CP and 70 % TDN.

Table 6.8: BIS Specification for Type-I & Type-II concentrate mixtures

Parameters	Limit	Type-I Feed %	Type- II Feeds %
Moisture	Max	11	11
Crude Protein	Min	22	20
Crude Fat	Min	3	2.5
Crude Fibre	Max	7	12
Silica	Max	7	4
Urea	Max	1	1
Calcium	Min	0.5	0.5
Phosphorous	Min	0.5	0.5
Salt	Max	2	2
Vitamin A(IU)/ Kg	Min	5000	5000

Table 6.9: Component of mineral mixture.

Ingredients	Percent
Di-calcium phosphate	55.0
Sodium chloride	30.0
Chalk	11.0
Magnesium carbonate	3.0
Ferrous sulphate	3.0
Copper sulphate	0.5
Manganese di-oxide	0.08
Cobalt chloride	0.06
Potassium iodide	0.01
Zinc sulphate	0.26
Total percent	100

Some examples of feeding balanced ration to dairy cow

A Cow weighing 400 kg and yielding 10 kg milk / Day (4% fat)

Sr. No	Feed Stuff	Quantity
Ration 1	Green maize (25% DM) Wheat Bhusa Concentrate mixture or (CP, 20% TDN, 70, %)	10 Kg 4 Kg 5 Kg
Ration 2	Green berseem (12% DM) Wheat Bhusa Concentrate mixture (Same as above)	12 Kg 5 Kg 5 Kg

A Cow weighing 450 kg and yielding 20 kg milk / Day (4% fat)

Ration 1	Quantity (Kg)	DM through feed (Kg)	Total TDN (Kg)	Total CP (Kg)
Maize/Jowar fodder	40.0	8.0	-	-
Concentrate	8.0	7.20	-	-
Total		15.20	10.48	2.16

Ration 2	Quantity (Kg)	DM through feed (Kg)	Total TDN (Kg)	Total CP (Kg)
Berseem fodder	80.0	9.60	-	-
Concentrate	6.5	5.85	-	-
Total		15.45	10.24	2.16

Ration 3	Quantity (Kg)	DM through feed (Kg)	Total TDN (Kg)	Total CP (Kg)
Berseem fodder	55.0	6.6	-	-
Oats fodder	25.00	25.00		
Concentrate	4.30	4.30	-	-
Total		15.47	10.13	2.10

A cow weighing 450 Kg and yielding 38 litres milk /day (4% fat), (Nutritional Requirements: DM 22.75, TDN 15.65 Kg and CP 3.76 Kg)

Ration 1. 40 Kg maize fodder and 17 Kg concentrate.

Ration 2. 80 Kg berseem fodder and 15 Kg concentrate.

Ration 3. 55 Kg berseem fodder, 25 kg oat fodder and 3.3 kg of concentrate .

The requirements of the buffaloes differ from that of cattle, as they are heavier in body weight, need additional 0.5 Kg feed for maintenance and additional concentrate as allowance for higher fat % in milk, as mentioned earlier.

Buffaloes have the ability to utilize more crop residues (straws) then cattle and that is also helpful in maintaining high fat content in buffalo milk.

Important tips in the feeding of dairy Animals

- Dairy animals should be fed balanced rations to meet all their nutrient requirements for the maintenance and production.
- Over feeding is not only uneconomical but it can also cause digestive disturbances.
- Ration should be fed at regular intervals, at least 3 times a day for better fermentation in rumen.
- Feeding of concentrate at each milking time helps in the let down of milk.
- Inclusion of at least 5 Kg of green fodder in the ration, Provides necessary vitamins and minerals to the animal.
- Compound feed must contain 2% mineral mixture. If farmers prepares his own concentrate from cakes, bran and grains, then the mineral mixture should be fed separately. Mineral supplementation improves both productive and reproductive efficiency of the animals.
- Leguminous fodders if given in larger quantities, should be accompanied with some chopped straw to avoid the digestive disturbances like bloat.
- The existing practice of "Sani" as followed by the farmers of the northern India, which is actually the modern concept of "Total Mixed Ration", should be extended to the other regions of the country. This results in less wastage of feed and its better utilization by the animal.

Review Questions

1. What is balanced ration?
2. What are the nutrient requirements of growing calves?
3. Give the feeding schedule of calves up to one month.
4. Compare Type1 and type-2 feeds of BIS.
5. Important points to be considered for feeding dairy animals.