

Formulation of Balanced Ration of Buffaloes

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Abstract

Research work in animal nutrition has resulted in a better understanding of a balance of nutrients for optimum utilization of feeds in animal production. This knowledge if transferred to farm practice will show positive result in both livestock production and conservation of feed supplies. A balanced ration consists of carbohydrates, proteins, minerals and vitamins. Out of these factors, considering only one or two in feed formulation will alter the health condition of animals regardless of its environmental conditions. Balanced ration has to be different for different stages of an animal as its requirement is various according to the demands of the body. Offering balance ration to the ruminants is a must to increase the production, to prevent from many metabolic diseases as well as to fulfil the demands without affecting the animal health.

Keywords: Nutrition, balance ration, metabolic disease, ruminant

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INTRODUCTION

A balanced ration is the amount of feed which provides the right quantity and proportion of nutrients that are required for proper nourishment of the particular animal for 24 h. The objective in formulating rations is to provide animals with the right quantity of feeds that will fulfil all the nutrient requirements in adequate or greater amounts and do so in a cost-effective way and the components of the feed can be divided into protein, energy (carbohydrates), fat, minerals and water. The feeds ingredients which are selected for preparing a balance ration should be nutritive as per standard, palatable, laxative, economical and locally available.

The recent livestock census of Department of Animal Husbandry, Dairying and Fisheries (DADH), Government of India (2013) indicates a rise in buffalo population (108.7 million) contributing around 21.23% of the total livestock population. Buffalo produce more than 62.12 million tons of milk annually (2011) contributing about 51.2% of the total milk production. This led to the increase in per capita availability of milk from 260 g/d in 2007–2008 to 280 g/d in 2010–2011. Enhancing the productivity of animals is of major concern to India, which can be addressed by developing proper feeding system to provide adequate and balanced nutrients to fulfil the requirements.

There are certain points which should not be avoided while offering a balanced diet.

- It should not be too bulky;
- Individual feeding should be considered;
- Varieties of highly digestible feed ingredients should be used;
- Avoid sudden change in diet;
- Allow much of green fodder;
- Regular feeding.

FEED INGREDIENTS OF BUFFALO FEED

Buffaloes are ruminants and therefore they utilize microorganisms for feed digestion. Ruminants are known for its capability to convert cellulose and other fibrous materials to high quality products such as milk and meat.

Roughage

The main diet for the buffalo is roughages such as grass, legumes and straw. Roughage alone can meet the maintenance requirements; however, concentrates and green fodders are given to meet proper growth, healthy pregnancy and high milk yield. It should be supplied in correct amount as too much nonfibrous feed will alter the rumen environment. In the long run, this could lead to serious problems in feed digestion causing loss of appetite, decrease in weight and a drop in milk yield. This is especially important for animals under stress, such as high growth rate and high milk yield.

Roughages should be of good quality, both nutritional and hygienic quality, this cannot be emphasized enough. Leguminous plants such as lucerne, berseem and clover have an advantage over grass as they contain more protein, calcium, vitamin E and carotene which are of great importance for milk production [1]; moreover, they are well known for nitrogen fixation and therefore less dependent on the nitrogen content of the soil. As far as tree legumes are concerned, a maximum ratio of 50% tree legumes in the total diet can be considered as a safe level. It is because tree legumes such as *Leucaena leucocephala*, *Gliricida* spp., *Sesbania*, contain antinutritional compounds which may depress digestibility as well as decrease feed intake, they should not be fed as the sole source of roughage.

Straw roughages such as rice, barley, wheat, sorghum etc. contain lower energy, zero protein and high silica content in the cell walls which makes it difficult to digest. Chaffing, grinding and pelleting are ways to improve nutritive quality of straws to some extent by making the nutrients available to the rumen microbes [2]. Chemical treatments with alkali or ammonia are effective ways of improving quality. Ammonia treated chaffed straw may even substitute green forage for low milk producing buffaloes to some extent. Ensiling lucerne reduces vitamin E and carotene content [3].

Concentrates

Grains and oilseed cakes are used as energy and protein source, respectively. Other types of feed which can be classified as concentrate are molasses and urea. Urea can be used by the microbes as a source of nitrogen. It also requires an easily fermented energy source for the microorganisms; e.g. molasses to balance

protein and energy content in the rumen. There are a number of readymade concentrates on the market manufactured by various companies. Care should be taken to ensure that the quality of the concentrate is up to standard.

PRACTICAL FEEDING OF NEWBORN CALVES UP TO THREE MONTHS OF AGE

Immediately after the birth of a newborn, the calf should be fed colostrum within 30 min of birth and continued up to four days of age at the rate of 3–4 l per day. Colostrum contains all the nutrients needed such as carbohydrates, protein, fat, vitamin (A, D and E) and minerals (Ca, Mg, Fe and P) along with the vital antibodies. Where the dam's colostrum is not available, mixture of two eggs, 10,000 IU of vitamin A, 80 mg of Aureomycin and 30 ml of castor oil should be fed orally or serum of the dam should be administered intravenously for 2–3 days for increasing immunity of calves. Alternatively, colostrum from other animals can be fed to the newborn calves. It can be preserved in deep freeze for several months for future use. After the colostrum period, whole milk should be provided to the calf @ a level of 1/8th to 1/10th of the calf's body weight. Milk replacer can be fed along with the whole milk provided but it is not advisable to completely substitute whole milk with milk replacer [4]. The milk and/or replacer should be served two occasions per day at body temperature (38–39 °C). At two weeks of age, calf starter and good quality green should be introduced to calf starter for stimulation of rumen to grow and function properly. Nutrient requirements and feeding schedule of buffalo calves up to three months and calf starter mixture are given in Tables 1–3, respectively.

Table 1: Nutrient Requirements of Buffalo Calves Upto Three Months.

Age (days)	Daily gain (kg)	DCP (g)	TDN (g)	ME (M cal)	Ca (g)	P (g)	Vit A (1000 IU)	Vit D (IU)
0–15	0.20	80	400	1.5	2.5	1.5	1.5	200
16–30	0.30	90	500	1.7	3.0	2.0	1.5	250
31–60	0.30	125	800	2.4	3.5	2.5	1.7	250
61–90	0.35	150	1000	3.6	4.0	3.0	2.0	260

Table 2: Feeding Schedules for Calves Upto Three Months.

Age (Days)	Whole milk (kg)	Calf starter (kg)	Green roughages (kg)
1-7	2.50	nil	Nil
8-14	2.50	0.05	0.25
15-21	3.00	0.10	0.35
22-28	3.50	0.20	0.50
29-35	3.50	0.40	0.55
36-42	3.00	0.60	0.60
43-49	3.00	0.70	0.70
50-56	2.00	0.80	0.80
57-63	1.50	1.00	1.00
64-70	1.50	1.20	1.10
71-77	1.00	1.30	1.20
78-84	0.50	1.40	1.40
85-90	Nil	1.70	1.90

Table 3: Calf Starter Mixture.

Feed source	Amount
Crushed barley	50%
Groundnut	30%
Wheat bran	8%
Fish meal/skim meal powder/ meat meal	10%
Mineral mixture	2%
Molasses	5-10 kg
Salt	500 kg

A calf starter should contain 22% CP and 70-75% TDN and it should be prepared from good quality feeds. About 10 g of vitamin supplement (A, B2 and D3) should be added in 1 quintal of the mixture, if green fodders are not fed. Molasses and salt are added to increase the acceptability of the other feed ingredients as urea-molasses salt complex enhances the palatability of the Stover's as well as the digestibility and nutrient value [5].

PRACTICAL FEEDING OF CALVES FROM THREE TO SIX MONTHS OF AGE

After three months of age, rumen developed substantially and microbial digestion in rumen become functional and the calves attain about 60-70 kg body weight under normal feeding condition. Thus a palatable diet containing 13-14% CP and 60-62% TDN may support 500-600 g average daily growth rate. Any of the

following feeding schedules presented in Table 4 can be followed.

Table 4: Feeding Schedule for Calves from Three to Six Months of Age.

Schedule	Concentrate mixture	Green fodder	Straw
1	1.0 kg	10 kg cereal fodder	<i>ad libitum</i>
2	1.0 kg	15 kg leguminous fodder	<i>ad libitum</i>
3	2.0 kg	1-3 kg green fodder	<i>ad libitum</i>
4	1.0 kg	7.5 kg cereal fodder and 2.5 kg leguminous fodder	-

PRACTICAL FEEDING OF BUFFALO CALVES FROM SIX MONTH OF AGE

In this phase, buffaloes should be fed about 4-7 kg DM of feed having 12% CP and 58-60% TDN in ration to have an average daily gain of at least 450-550 g ADG. Generally, a growth rate of 500-600 g/d between 100 and 300 kg body weight is considered optimum growth rate for Indian buffalo heifers. In order to reach the optimum size for calving within reasonable time, a concentrate mixture containing 20% CP and 63% TDN may be fed @ 1.5, 2.0, 2.5 and 3.0 kg per head per day at 100, 150, 200 and 250 kg body weight or above along with 10 kg green fodder and *ad libitum* straw for attaining 500 g ADG. Cultivated green forages (Hybrid napier, Para, Guinea, Maize, etc.) can be given at the rate of 2 kg per day from three months onwards, raising the quantity to 5-10 kg and 20-25 kg at six months and one year of age, respectively. The quantity of concentrate mixture is adjusted depending upon the quality and quantity of the forage offered. When green fodder is not available, additional 1 kg concentrate mixture should be fed as replacement of 10 kg green fodder. For faster growth rate, additional 1 kg concentrate may be fed daily. If the main roughage is straw or stover, 2.5 kg of concentrate mixture given daily to calves of six months to one year of age and 3 kg mixture for older growing stock. Straw fed to growing stock should preferably be ammoniated and could be given along with low quality green feed and concentrate to keep or increase body weight of growing buffaloes. With decrease in availability of green fodder 1

kg concentrate mixture should be additionally fed to replace every 10 kg green fodder.

FEEDING OF PREGNANT BUFFALOES

Buffaloes in early stage of pregnancy can be fed on maintenance or restricted level of feeding. It is because only about one-third of the total products of conceptus are produced during the first six months of gestation period and nutrient requirements for intrauterine growth are very small relative to mother's maintenance. Subsequently, there is substantial extrauterine growth in dam especially during early pregnancy and rapid acceleration in fetal development during the last three months of gestation period. Appropriate intake of nutrients is essential to achieve optimal fetal growth and neonatal survival. In pregnancy of adult buffaloes, CP requirement increases by 3%, 8.4%, 16%, 26%, 43% and 64% of maintenance requirement on 5th, 6th, 7th, 8th, 9th and 10th month of pregnancy, respectively. The corresponding increases in TDN requirements are 4.3%, 7.2%, 18.8%, 22.2%, 39.0% and 67.4% of maintenance requirement, respectively. Extra maintenance allowances for all nutrients except vitamins A and D by 20% during the first pregnancy and 10% during 2nd pregnancy. Calcium requirement can be increased from 25% to 33% if the animal is not in Ca balance. In case of adult buffaloes, maternal growth is considered as nonessential for pregnancy. However, in high yielding buffaloes additional allowance during early pregnancy may be given to facilitate building up of extra body reserve which can be utilized to meet out energy deficiency in early lactation when animals are invariably in negative energy balance due to limited DM intake capacity. Pregnant buffaloes should be dried at least two months before expected date of calving. Challenge feeding of buffaloes with good quality fodder and concentrate mixture during last three weeks of pregnancy helps in priming the rumen for increased concentrate feeding in early lactation and build up body reserve for lactation. In pregnancy, DM intake is low (about 1.7–2% of BW). Pregnant buffaloes (at >5 month of pregnancy) should be fed with 30 kg green fodder and 2 kg concentrate mixture (20% CP & 70% TDN) and *ad libitum* wheat straw to meet protein requirement for entire

pregnancy and energy requirement upto nine month of pregnancy but additional 1–1.5 kg grain should be given to support energy shortage. For pregnant immature buffaloes in first pregnancy, additional 1 kg grain or 5.5 kg cereal fodder or 7.5 kg legume fodder should be fed to support 300–350 g average daily maternal growth. Similarly, buffaloes in their 2nd pregnancy should be fed additional 0.5 kg grain or 2.7 kg cereal fodder or 3.7 kg legume fodder to support 120–200 g average daily maternal growth.

FEEDING OF LACTATING BUFFALOES

Energy requirement of a lactating animal is many times more than its maintenance requirement and the appetite of the animal during the early lactation (up to eight weeks) is reduced by 2–3 kg per day. So all the nutrients requirements of the animals are to be provided within this appetite limit. Dietary energy is the most limiting factor in milk production and therefore high energy diets are to be formulated and challenge feeding has to be adopted. For challenge feeding, concentrate mixture of 500 g per day should be started to give two weeks before the expected date of calving and increase it gradually to a level of 500–1000 g per 100 kg body weight. Also adequate fibre (36% NDF in the total ration) is critical for maintenance of normal milk fat. Milk production increases gradually, reaches peak at 42–56 days after calving, and the peak is maintained for next 70 days. It declines gradually thereafter from 126 to 305 days. The secretion of nutrients into the milk exceeds the rate of uptake of nutrients from the digestive tract. The nutrient deficit is compensated by the diversion of nutrients from the body reserves resulting in weight loss as well as they will not reach their optimum milk production capacity and delay in initiation of postcalving estrus cycle. Thus utmost care should be taken so that they are not underfed during early part of their lactation. The lactating buffaloes in their first and second lactation continue to grow and thus additional 20% and 10% of maintenance requirement should also be provided in first and second lactation, respectively. The lactating buffaloes of 450 kg body weight can be fed following any of the four type of ration presented in Table 5 depending on availability of feed and fodders

and the concentrate should contain 20% CP and 70% TDN.

Table 5: Feeding Schedule of a 450 kg Body Weight Lactating Buffalo.

Milk yield (kg/d; 7% fat)	Conc mixture (kg)	Green fodder (kg)	Straw (kg)
6	2.7	15	8
6	5.5	-	6.4
8	3.7	15	8
8	6.4	-	7.5
10	4.8	20	7
10	7.3	-	7.6
12	5.6	20	8.3
12	8.5	-	8.3
14	6.5	20	7
14	9.8	-	8.2
16	7	20	7
16	10.9	-	9.3

FEEDING OF BREEDING BULLS

Low plane of nutrition delay puberty and the adverse effects of malnutrition are more pronounced if they occur in early life than postweaning. Some of the conditions that can lead to delay puberty, reduce libido and retardation of testicular growth in males are deficiency of vitamins A and Zn, high concentrate diets (80% concentrate in DM) and about 40–60% restriction of energy and protein during growing phase. Therefore, it has been recommended to provide 10% higher CP and 20% higher energy in breeding buffaloes than maintenance requirement for mature female buffaloes. Breeding bulls should be fed with good quality balanced ration. However, care should be taken to avoid overfeeding as fatness lead to reduced libido and reduced reproductive performance. Feeding schedule of breeding bulls is given in Table 6.

Table 6: Feeding Schedule for a 700 kg Buffalo Bull.

Schedule	Conc mixture (kg)	Vegetable oil cake (kg)	Green fodder (kg)	Straw (kg)
1	-	0.8	40	-
2	-	1.2	10	10
3	2.0	1.0	2-3	8.0

FEEDING OF WORKING BUFFALO BULLOCKS

For working animals, nutritional requirements depend on duration of work, speed of work and load carried. Carbohydrates need to be supplied to meet the extra energy required for work because of the increased in muscular activity and higher energy demand in working animal than animal in rest. However, fats also can be utilized as their catabolism can be used by the system to furnish energy through the carbohydrate aerobic oxidation cycle. As long as there is a sufficient supply of carbohydrates in the feed, an ox at work needs no more protein than required for maintenance except probably when the work done is very hard. In formulating a ration for working bullocks, it is nevertheless necessary to give some supplemental proteins for two reasons:

- When the feed intake of the animal is higher than what is required for maintenance, the digestibility of the ration as a whole is diminished.
- For the proper utilization of feed carbohydrates in the rumen, there should be a proper ratio between energy and protein; otherwise the digestibility of crude fibre will be greatly diminished, leading to a shortage in energy supply.

Any of the following feeding schedules presented in Table 7 can be followed for a 550 kg body weight buffalo bullocks.

Table 7: Feeding Schedule for Working Buffalo Bullocks.

Schedule	Conc mixture (kg)	Vegetable oil cake (kg)	Green fodder (kg)	Straw (kg)
For light work (4 h/d)				
1	4.0	-	-	7.0
2	1.5	-	35	-
3	-	0.5	20	8.0
4	2.0	0.4	10	2.0
For heavy work (8 h/d)				
1	5.0	-	-	8.0
2	3.0	-	40	-
3	-	-	40	7.0
4	3.0	-	14	8.0

PRACTICAL FEEDING FOR MAINTENANCE OF NONWORKING BUFFALOES

Dry adult nonpregnant buffaloes or nonworking bullocks can meet their nutrient requirement for maintenance from 6–7 h grazing with *ad libitum* feeding of straw during off grazing hours. For stall-feeding of a 450 kg buffalo, the schedule given in Table 8 can be followed.

Table 8: Schedule for Stall-Feeding of a 450 kg Buffalo.

Schedule	Conc mixture (kg)	Vegetable oil cake (kg)	Green fodder (kg)	Straw (kg)
1	-	9.5	-	9.5
2	-	-	10 (15% DM)	7.0
3	-	-	28 (20% DM)	-
4	-	0.4	10	2.0

For every 50 kg higher body weight than 450 kg, a) 0.7 kg straw+55 g groundnut cake/soyabean cake; or b) 3 kg green berseem; or c) 2.5 kg cereal fodderhas to be added and vice versa.

IMPACT OF FEEDING BALANCED RATION

- Increase in milk production and net daily income.
- Increase in milk production efficiency and quality.
- Improvement in reproduction efficiency of animals.
- Efficient utilisation of locally available feed resources.
- Possible reduction in daily feeding cost.
- Reduction in calving interval, and as a result increase in productive life.
- Improvement in the growth rate of calves, leading to early maturity and earlier calving.
- Increase in rumen microbial protein synthesis.

- Increase in immune status of animals.
- Decrease in parasitic load in animals.
- Decrease in enteric methane emission.
- Increase in efficiency of feed nitrogen use in milk.

CONCLUSION

A ration can only be used most efficiently when it is properly balanced. A well-balanced ration is required for better growth, production and reproduction of an animal without disturbing the health condition of an individual.

REFERENCES

1. Agabriel C, Cornu A, Journal C, *et al.* Tanker milk variability according to farm feeding practices: Vitamins A and E, carotenoids, color, and terpenoids. *Journal of Dairy Science*. 2007; 90: 4774–896p.
2. Greenhalgh JFD, Wainman FW. The nutritive value of processed roughages for fattening cattle and sheep. *Proceedings of the British Society of Animal Science*. 1972; 1: 61–72p.
3. Homb T, Sundstphil F, Arnason J. Chemical treatment of straw at commercial and farm levels. In: *New FeedResources. FAO Animal Production and Health Paper No.4*. Rome: FAO; 1977. 25–38p.
4. Hill TM, Bateman HG, Aldrich JM, *et al.* Effect of consistency of nutrient intake from milk and milk replacer on dairy calf performance. *Prof Anim Sci*. 2008; 24: 85–92p.
5. Hutchison CB, Kotok EI. The san Joaquin experimental range. *Calif Agr Exp Sta Bul*. 1942; 663.

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