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Review Article

A Review of Critical Management of Bovines during Gestation, Peri-Parturient and Lactation Period

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A B S T R A C T

India has around 300million bovines, 65.07million sheep, 135.2 million goats and about 10.3 million pigs, residing in India is basis of livelihood of poor and marginal farmers (DAHDF, 2016). Such a huge livestock population is sustaining our milk production (155.5 million ton in 2016) and milk by-products far ahead from any other nation of the world. Among such livestock commodity, buffalo contributes the major part of total milk production of our nation (around 49%). Livestock rearing gives direct income to sustain their daily life. To get sustainable production through livestock rearing, farmers should carefully manage the production life. To get maximum profitability and sustainable production through livestock rearing farmers should monitor some important manage mental considerations during various production phages such as, animal's dry matter intake, rumen papillae development, minerals balance and immune status.

Introduction

India is considered as one of the most livestock populated nation. Among this huge population, buffalo's constitutes around 108million and imparts around 49% of total milk production of the nation. This tremendous population is managed by our marginally educated and poor farmers, those having lower assets and lesser skills of animals rearing. During entire course of animal's rearing, production phages may consider as one of the most devastating life span which ultimately reflects the gross output potential through livestock. Thus, cross over such a devastating period is deciding factor of future benefits through livestock rearing. The transition period in buffaloes lies within last three weeks before parturition to three weeks after parturition (Grummer, 1995). However, its gestation length is 310±5 days and lactation length is also around 305 days. Such phages are characterized by tremendous metabolic and endocrine adjustments that the buffaloes experiences from late gestation to early or far lactation Drackley et al (2001). One of the most important physiological changes occurring during this period is the decrease in dry matter intake around parturition and the sudden enhancement in nutrients requirement for milk production (Drackley, 1999; Ingvartsen and Andersen 2000).

As a result of these critical changes, most of the infectious diseases and metabolic disorders occur during this period (Goff and Horst, 1997; Drackley, 1999). Milk fever, ketosis, retained fetal membranes (ROP), metritis and displacement of the abomasum primarily affect buffaloes within the first few weeks of lactation (Drackley, 1999). Physical and metabolic stressers of pregnancy, calving and lactation contribute to the decline in host resistance during the peri-parturient period Mallard et al (1998). During peri-parturient period the T-cells populations exhibit a significant decline, which contribute to the immune-suppression in dairy cows at calving Kimura et al (1999). This immune-suppression during the peri-parturient period leads to enhanced susceptibility to mastitis and other infectious diseases Mallard et al (1998). Other diseases those are not clinically apparent during the first two weeks of lactation such as laminitis, ovarian cysts, endometritis etc. can be traced back very soon that occurred during early lactation (Goff and Horst, 1997). Thus, the present paper compiled various nutritional or other manage mental aspects during gestation, peri-parturient and lactation stages to harvest more and more profit through buffalo rearing

Metabolic disorders generally associated with peri-parturient period

Some metabolic disorders are critically linked before parturition and soon after parturition. Thus, this entire duration of approx. 40-45 days should be carefully monitored. Some important metabolic disorders are mentioned below:

(A) Metabolic diseases typical to first 2 week of lactation such as Milk fever, ketosis, retention of placenta, abomasal displacement etc.

(B) Metabolic diseases occurring beyond this period such as Laminitis etc.

(C) Infectious diseases occurring during the first 2wk of lactation such as Mastitis, John's disease, salmonellosis etc.

It is required to develop species specific equations for energy requirements in various species. Equation cited by (GFE, 2003) may be used for any ruminants for energy requirements have given below;

ME= 0.0312 (MJ/g) × DEE (g) + 0.0136 (MJ/g) × DCF (g) + 0.0147 (MJ/g) × (DOM-DEE-DCF) (g) + 0.00234 (MJ/g) × CP (g)

Where,
DEE= Digestible
EE= Ether Extract
DCF= Digestible crude Fibre
DOM= Digestible Organic Matter

1 kg of TDN= 15.129 MJ ME (NRC, 2001)

Generally the existing feeding standards recommend additional requirements of 20 and 10% of maintenance requirements, respectively for immature buffaloes during 1^{st} and 2^{nd} lactation.

The protein requirements presented in the feeding standards suggested by Mondal et al (2003) is based on the factorial calculations from the slaughter data in the cattle are recommended by (AFRC, 1991). No information is available on protein requirement for mammary development during pregnancy and maternal growth. However, most of the feeding standards have recommended that for immature buffaloes in the first and second lactation 2% and 10%, respectively additional DCP should be given to meet out the growth requirements over and above maintenance requirement.

Critical considerations for management of gestation period

Gestation period is most demanding stage of buffalo's life. As during this stage requirements influenced and buffalo is unable to consume sufficient DM. During gestation period buffalo should carefully monitored and should segregate from entire herd. As the pregnancy advances, there should be individual feeding of buffalo. Laxative diet should be incorporate. As buffalo may be off feed or not able to consume enough DM during this stage so by-pass fat or protein supplementation of nutrients should be provided. Clean water should be available at all the time. Mineral imbalances are mostly seen during this stage. Thus, mineral requirements should be carefully monitored. Ca and P should be critically managed and gradual addition of such should be considered, as the pregnancy advances.

A concentrate mixture of 20% CP and 68-72% of TDN should be formulated and 2kg for maintenance along with 1.75kg additional concentrate for pregnancy is required. Apart from concentrate mixture, 4-6kg straw and 20kg green should be provided.

Critical considerations for management of lactation period

Lactation demands should be critically managed and ration should formulate on the basis of its milk production and more importantly on the basis of fat %age of milk. A concentrate mixture of 20% CP and 68-72% of TDN should be formulated and 2kg for maintenance along with 1kg additional concentrate for each 2.0kg milk production in buffaloes is offered. Apart from concentrate mixture, 4-6kg straw and 20kg green should be provided.

Critical considerations for management of peri-parturient period

Successfully prevention of peri-parturient diseases and increased potential for successful reproduction revolves around five critical control points:

- Maximizing dry matter intake
- Enhancement of rumen papillae growth
- Suppressing negative energy and protein balance
- Maintaining minerals balance
- Boosting of immune status

a) Maximizing dry matter intake

As the animals reaches towards advanced pregnancy i.e. peri-parturient period (PPP), suffers from lower DMI due to various physiological and metabolic changes. During advanced pregnancy, larger size of developing fetus creates a constant pressure on rumen and rumen size gets shorten and ultimately results very drastic reduction in DMI (may reaches upto 1.5% of 100kg body weight) and body condition score (BCS).

Thus, preventive strategies should be followed to enhance DMI such as, palatable diet with proportionate ratio of roughage and concentrate (roughage: concentrate:: 60:40) along with condensed source of energy should be provided to full fill energy requirement of animal, even though lesser feed intake.

b) Enhancement of rumen papillae growth

Rumen papillae play a very important role in absorption of nutrients and ultimately meet the requirement of animals. Intake of food is not useful until or unless it is ready of absorption and meet the requirements at tissue level i.e. ready to use a tissue level.

Thus, papillae developments should be achieved by incorporation of palatable roughage in ration of animals.

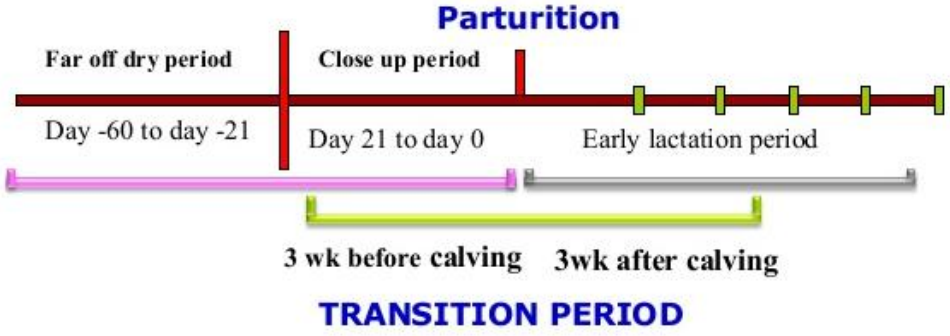
c) Minimizing negative energy and protein balance

Due to reduced dietary intake during advanced pregnancy, animal generally suffers from low DMI because of depressed physiological status of animals. Lesser DMI results declined BCS and lesser availability of metabolically active micro and macronutrients. Thus, strategies such as condensed source and by-pass nutrient such as by-pass fat and proteins should be provided to sustain BCS of animal and maintain its energy and protein balance.

d) Maintaining minerals balance

During onset of lactation of any species, there is drastic loss of minerals especially calcium, phosphorus and other metabolically active micro-minerals from body reserve through colostrum and milk which ultimately creates a significant deficit of minerals in body reserve pool. It may create milk fever and other metabolic disorders, resulted loss of future productivity.

Table.1 Radial growth of *Alternaria alternata* on PDA medium amended with five fungicides at three concentrations



Source- Adapted by Pragya Bhadauria, 2016

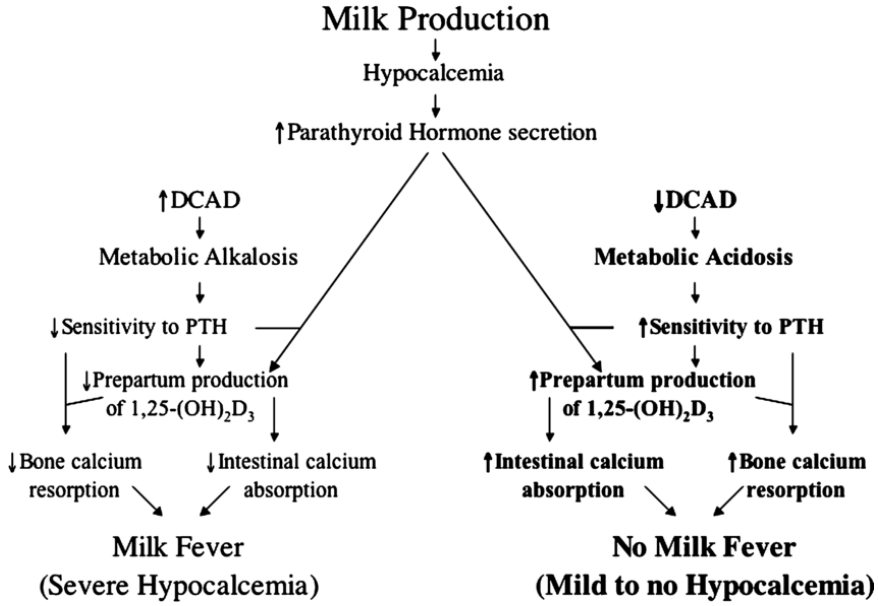


Table.1 Comparative dry matter intake of growing cattle and buffaloes

Body weight (kg)	DMI (% of B. Wt.)		DMI (g/$W^{0.75}$kg)	
	Cattle	Buffalo	Cattle	Buffalo
90	2.79±±0.08 (n=28)	2.98±±0.1 (n=22)	86.1±±2.8	92.4±±4.1
115	2.96±±0.09 (n=28)	2.78±±0.06 (n=28)	97.1±±2.9	89.0±±1.8
140	2.85±±0.06 (n=53)	2.82±±0.07 (n=33)	93.6±±3.0	94.3±±2.3
165	2.65±±0.07 (n=46)	2.52±±0.05 (n=55)	96.0±±2.6	89.9±±1.8
190	2.41±±0.05 (n=36)	2.35±±0.08 (n=25)	90.4±±1.8	87.6±±3.0
210	2.30±±0.06 (n=15)	2.34±±0.03 (n=29)	88.8±±2.6	88.9±±1.3
230	2.44±±0.09 (n=26)	2.40±±0.07 (n=10)	97.4±±2.79	93.8±±2.7
260	2.23±±0.09 (n=29)	2.26±±0.08 (n=33)	86.9±±4.7	92.5±±3.1
320	2.08±±0.09 (n=11)	2.10±±0.07 (n=21)	94.1±±3.3	88.0±±2.3

*P< 0.05 for all comparisons Source- Nutrient requirements of buffaloes by Dr. S.S. Paul

Table.2 Summary of energy (TDN) requirements of buffaloes

Stage of life cycle	Maintenance (g/$W^{0.75}$kg)	Growth (g/g gain)	Lactation (g/Kg6% FCM)	Reference
Growing female	27.51	-	-	Bakshi et al (1984)
Growing female	52	0.37-0.64	-	(Siviah and Mudgal, 1978)
Early lactation	44.53	-	585	(Mudgal and kurar, 1978)
Mid lactation	33.59	0.38	360	(Siviah and Mudgal, 1978)
Late lactation	49.20	1.90	557	(Tiwari and Patle, 1983)
Lactation	-	-	376(344-400)	(Gupta, 1973)
Lactation	-	-	430(320-511)	Shukla et al (1972)
Lactation	-	-	502	Singh et al (1972)
Lactation	35.34	1.97	406.32	Paul et al (2002)

Table.3 Summary of protein (DCP) requirements of buffaloes

Stage of life cycle	Maintenance (g/$W^{0.75}$kg)	Growth (g/g gain)	Lactation (g/Kg 6% FCM)	Reference
Dry non-pregnant	2.49-2.35	-	-	(Kurar and Mudgal, 1981)
Growing female	1.11 (3.40) ˜	0.45	-	Singh et al (1994)
Early lactation	3.20	-	53	(Kurar and Mudgal, 1980)
Mid lactation	3.65	-	68.6	(Siviah and Mudgal, 1978)
Lactation	3.005 (5.83)	0.20 (0.39)	102.2	(Tiwari and Patle, 1997)
Lactation	3.14 (5.43)	0.23 (0.33)	55.24 (90.3)	Paul et al (2002)

~Values in parenthesis are CP requirements

Table.4 Daily nutrient requirements of lactating buffaloes

Maintenance of lactating buffaloes								
					CP			
					Digestibility (%) of dietary proteins			
B.Wt. (kg)	DM (kg)	TDN (kg)	ME (Mcal)	DCP (g)	55	60	65	70
350	4.86	2.84	10.22	255	463	425	392	364
400	5.40	3.16	11.37	280	509	466	431	400
450	5.86	3.45	12.42	307	558	511	472	438
500	6.34	3.74	13.46	332	604	553	510	474
550	6.81	4.01	14.44	357	649	595	549	510
600	7.27	4.28	15.40	380	691	633	584	542
650	7.72	4.55	16.38	404	734	673	621	572
700	8.17	4.81	29.41	427	776	712	657	610

Source- Nutrient requirements of buffaloes by Dr. S.S. Paul

Milk production (Nutrient requirement per kg of milk of different fat %)								
5	0.602	0.359	1.29	49.00	89	82	75	70
5.5	0.642	0.383	1.37	52.00	94	87	80	74
6	0.681	0.406	1.46	55.24	100	92	85	79
6.5	0.720	0.429	1.54	58.45	106	97	90	84
7	0.760	0.453	1.63	61.63	112	103	95	88
7.5	0.800	0.476	1.71	64.82	118	108	106	93
8	0.838	0.499	1.79	68.01	124	113	105	97

Source- Nutrient requirements of buffaloes by Dr. S.S. Paul

Table.5 Additional requirement of energy (TDN, kg/day) for pregnancy in mature buffaloes

Expected calf birth weight (kg)	Week before Parturition										
	20	18	16	14	12	10	8	6	4	2	Zero
35	0.16	0.21	0.27	0.36	0.48	0.63	0.83	1.01	1.46	1.79	2.52
30	0.14	0.18	0.23	0.31	0.41	0.54	0.71	0.87	1.25	1.54	2.16
25	0.12	0.5	0.19	0.26	0.34	0.45	0.59	0.73	1.04	1.28	1.80
20	0.09	0.12	0.15	0.21	0.27	0.36	0.47	0.58	0.83	1.03	1.44

Source- Nutrient requirements of buffaloes by Dr. S.S. Paul

Table.6 Additional requirement of protein (DCP, g/day) for pregnancy in mature buffaloes

Expected calf birth weight (kg)	Weak before Parturition										
	20	18	16	14	12	10	8	6	4	2	Zero
35	25	34	43	56	82	106	132	174	219	260	328
30	21	29	37	48	70	91	113	149	188	223	281
25	17	24	31	40	58	76	94	124	157	186	234
20	14	19	25	32	47	61	75	99	125	149	187

Source- Nutrient requirements of buffaloes by Dr. S.S. Paul

The peri-parturient periods of buffalo is most critical stage because of during this period lactogenesis takes place which leads to hypocalcaemia condition due to mobilization of calcium for milk synthesis. Thus the level of plasma parathyroid hormone (PTH) increased due to low level of calcium. There are one condition arise i.e. mild acidosis, may be due to low level of dietary cation anion difference (DCAD). At this stage PTH stimulate the production of 1,25(OH) 2 D 3, to increase calcium absorption from intestine and reabsorption from bone and no or mild hypocalcemia. If add high dietary DCAD may create a mild metabolic alkalosis condition, at which the tissues are less sensitive to the PTH signal, leads to low production of 1,25(OH) 2 D 3 ,thus decreased calcium absorption from intestine, and also decreased calcium resorption from bone.

Therefore this imbalance in both PTH and Calcium during periparturient period leads to a common condition "Milk Fever" (fig no. 1) Thus, strategies should be applied for to maintain minerals reserve pull in optimum concentration during lactation phage, especially during early lactation such as (+)ve DCAD and low concentration of Calcium during entire pregnancy period. Source- (Horst *et al.*, 2005).

e) Boosting of immune status-

Peri-parturient period is most critical phage of once life time. It is a phage of life which creates a heavy demand on animal and explores animal prone to various metabolic and physiological status of animals. It also creates a very sensible effect on animal's immune status.

Thus, dietary innervations such as immune-modulators such as Mn, Zn, Cu etc. micro nutrients having antioxidant enrollments, should available in routine ration to enhance immune status of animal and to resist animals from invading microbial load.

Importance of peri-parturient management

Livestock rearing by farmers are generally for milk and meet purpose or in nut shell to maximize profit through their progeny development. Profitability of livestock rearing is solely depending upon efficient rearing. For successful animal's farming, peri-parturient period occupies a head on space and decides net profitability through high input of costly assets.

Thus, to facilitate smooth peri-parturient period (PPP), farmers should critically manage their livestock otherwise income

would affected directly through lose of production in form of milk production or vitality of both mother and neonates.

In conclusions, Livestock, a major asset of livelihood for poor and marginal farmers should manage very carefully, especially during its production life, those are considered as one of the most critical and life threatening phage of animal's whole life span. Careful managemental and feeding considerations such as palatable diet with minimal affecting rumen environment, minimal stressors, optimal minerals, antioxidants etc. should be considered to get sustainable production through livestock and simultaneously enhancement of life span.

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