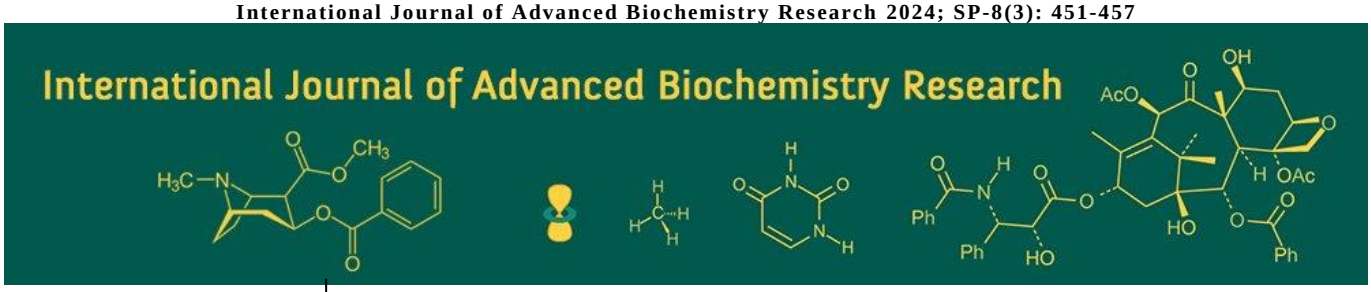

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Harmony in harvest: Unraveling the impact of varied green fodder and concentrate mixtures on holistic milking dynamics in murrah buffaloes

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Abstract
The study investigated the impact of varied green fodder and concentrate mixtures on milking dynamics in Murrah buffaloes, crucial for milk, meat, and other productions in many developing countries. Buffaloes, especially the Murrah breed, contribute significantly to the dairy industry in Asia. Despite their importance, challenges such as low milk yield and poor reproductive performance persist due to irregular access to quality feedstuffs. Feeding constitutes a substantial portion of milk production costs and influences animal productivity and health. The research aimed to enhance milk yield, reproductive performance, and overall herd health by examining different feed compositions' effects on milking parameters. Conducted at the Buffalo farm of the Department of Livestock Production Management, the study involved 18 lactating Murrah buffaloes allocated to three dietary treatment groups (T_1, T_2, and T_3) using a Factorial Completely Randomized Design. Buffaloes were individually fed according to dietary requirements, and treatments were iso-nitrogenous and iso-caloric. Results indicated that increasing the proportion of concentrate mixture in the diet positively impacted milk yield, body weight gain, and reproductive parameters. Buffaloes fed with higher concentrate mixtures exhibited increased milk yield and shorter postpartum estrous periods. While milk fat content remained consistent across treatments, solid not fat content and total solids content increased with higher concentrate mixture supplementation. The study underscores the importance of optimizing feed formulations to enhance milk yield and quality in dairy animals, particularly Murrah buffaloes. By providing valuable insights into dietary management, the research contributes to the sustainability and profitability of dairy farming practices, crucial for agricultural economies like India.

Keywords: Harmony in harvest, varied green fodder, concentrate mixtures, holistic milking dynamics, murrah buffaloes

Introduction
The global buffalo population stands at approximately 177.24 million, distributed across 42 countries, with 97% of them concentrated in Asia, according to FAO (2008) [8]. Over the past decade, the world buffalo population has increased by about 18 million, reflecting an annual growth rate of approximately 1.13%, primarily driven by rising numbers in Asian countries. In India, which occupies 2.4% of the world's geographical area, agriculture plays a pivotal role, with nearly 69% of its land falling within arid, semi-arid, and dry sub-humid regions (Bhandari *et al.*, 2007) [4].

India's livestock sector is a cornerstone of its economy, contributing nearly 25.6% of the value of output in the agriculture, fishing, and forestry sector, amounting to 4.11% of the total GDP during 2012-13. With a total livestock population of 512.05 million in 2012, buffaloes constitute a significant portion, accounting for 56.7% of the world's buffalo population (19th Livestock census, 2012) [1].

Buffaloes, particularly the Murrah breed, are vital for milk, meat, power, fuel, and leather production in many developing countries. In Asia, they contribute approximately 96.8% of the total milk to the dairy industry and about 12.8% of the world's total milk production despite constituting only 11.6% of the global cattle population (FAOSTAT, 2007) [9].

Despite their economic importance, buffaloes face challenges such as low milk yield, poor reproductive performance, and slow growth rates.

These issues are often attributed to irregular and inadequate access to quality feedstuffs. Malnutrition adversely affects reproduction, causing delayed puberty, anestrus, and prolonged calving intervals (Sahoo *et al.*, 2004; Wathes *et al.*, 2007) [31, 41].

Feeding constitutes a substantial portion of the total cost of milk production and significantly influences animal productivity, health, welfare, and environmental sustainability. Thus, optimizing feed and ration formulations is crucial for enhancing milk yield and composition in dairy animals.

The study aims to unravel the impact of varied green fodder and concentrate mixtures on holistic milking dynamics in Murrah buffaloes. By examining how different feed compositions affect milking parameters, the research seeks to provide insights into improving milk yield, reproductive performance, and overall herd health in Murrah buffaloes, contributing to the sustainability and profitability of dairy farming practices.

Methodology

The study was conducted at the Buffalo farm of the Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, situated in a semi-arid, sub-tropical region with geographical coordinates of 29°10' N latitude, 75°40' E longitude, and 215.2 meters altitude. Ethical approval was obtained from the Institutional Animal Ethics Committee of LUVAS in its 11th meeting on February 6th, 2018. Eighteen lactating Murrah buffaloes in their 1st to 2nd lactation stage were chosen under a loose housing system, and they were allocated to three dietary treatment groups (T_1, T_2, and T_3) using a Factorial Completely Randomized Design (FCRD).

Table 1: Details of feeding plan of buffaloes under different dietary treatments

Treatment	Feeding strategy
T_1 (Control)	Lactating buffaloes were fed with 30: 35: 35 ratios of wheat straw, green fodder and concentrate mixture (on DM basis) to meet out the nutrients requirements as per ICAR (2013) standards.
T_2	30% Crude Protein & Total Digestible Nutrient of green fodder of T_1 were replaced with concentrate mixture for feeding of lactating buffaloes.
T_3	40% Crude Protein & Total Digestible Nutrient of green fodder of T_1 were replaced with concentrate mixture for feeding of lactating buffaloes.

Buffaloes were individually fed according to their dietary requirements, and the three dietary treatments were iso-nitrogenous and iso-caloric. Standard management practices and biosecurity measures were followed, including deworming, ectoparasite disinfection, and immunization against diseases, with a 10-day adjustment period preceding the experiment for acclimatization. The study spanned from 10 days postpartum to 6 months of lactation. Various parameters were observed, including chemical analysis of feed ingredients, Daily milk yield (kg), Milk fat (%), 6% Fat Corrected Milk (kg), Solid not fat (%), Total Solids (%), Milk Protein (%), Peak milk yield, Days taken to attain peak milk yield and Persistency period of peak milk yield. Data were analyzed using the General Linear Models procedure of SPSS-23 software, with ANOVA conducted, and Duncan's multiple range tests employed for mean separation at a significance level of $p<0.05$.

Results and Discussion

The results of the study revealed significant insights into the impact of dietary management on milk related parameters in lactating Murrah buffaloes. Analysis of various parameters provided valuable information regarding the effectiveness of different feeding strategies.

Chemical analysis of feed ingredients

Chemical composition (%DM basis) and cost of different feed ingredients fed to the experimental buffaloes are presented in Table 2.

Table 2: Chemical composition (%DM basis) and cost of different feed ingredients fed to the experimental buffaloes

Ingredients	DM	CP	CF	EE	Ash	OM	NFE	*Rs./kg
Fodder								
Wheat straw	94.43	2.45	36.79	2.87	9.27	90.73	48.62	1.98
Green Berseem	23.52	7.76	27.54	3.12	8.94	91.06	52.64	1.50
Green Maize	25.02	10.45	26.40	4.31	10.37	89.63	48.47	1.50
Concentrate								
Groundnut cake	95.57	45.72	8.67	6.30	5.01	94.99	34.30	26.37
Soybean meal	89.48	46.07	4.67	2.98	7.34	92.66	38.94	27.99
Maize	89.01	9.16	2.32	3.68	1.03	98.97	83.81	19.98
Barley	93.56	9.79	7.96	1.82	4.66	95.35	75.77	15.50
Wheat bran	90.75	13.54	11.08	4.24	5.74	94.26	65.40	17.91
Mineral mixture	96.30	-	-	-	-	-	-	68.00
Common salt	98.50	-	-	-	-	-	-	4.40

The ingredient composition (%) and the cost of concentrate mixture fed to the experimental buffaloes are presented in Table 3.

Table 3: Ingredient composition (%) and the cost of concentrate mixture fed to the experimental buffaloes

Ingredient	Parts/100kg
Groundnut cake	20
Soybean meal	8
Maize	25
Barley	15
Wheat bran	29
Mineral Mixture	2
Common Salt	1
Total	100
Cost (Rs./kg)	21.43

Chemical composition (%DM basis) of concentrate mixture fed to the experimental buffaloes is presented in Table 4.

Table 4: Chemical composition (%DM basis) of concentrate mixture fed to the experimental buffaloes

Attributes	Chemical composition (% DM basis)
Dry matter (DM)	92.02
Crude Protein (CP)	21.20
Crude Fibre (CF)	10.03
Ether Extract (EE)	3.40
NFE	54.75
Total Ash	10.62
Organic matter (OM)	89.38

The mean dry matter content of wheat straw, berseem green fodder, maize green fodder and concentrate mixture were 94.43, 23.52, 25.02 and 92.02 per cent, respectively. The average crude protein content of wheat straw, berseem green fodder, maize green fodder and concentrate mixture were 2.45, 7.76, 10.45 and 21.20 per cent, respectively. The cost (Rs./kg) of the wheat straw, green fodder and concentrate mixture was Rs. 1.98, 1.50 and 21.43 per kg, respectively.

Daily milk yield (kg)

Milk yields of experimental buffaloes were in increasing order up to the peak yield of different treatments and thereafter it started declining up to the end of the experiment. The overall mean values of daily milk yield pooled over periods were 9.68, 12.21 and 12.69 kg in treatment groups T_1, T_2 and T_3, respectively. The results of the study revealed that the milk yield was more in T_2 and T_3 treatment groups as compared to T_1 (control) and statistical analysis of data revealed that significantly ($p<0.05$) higher milk yield was reported in treatment groups fed ration with replacement of 30 or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

Present results are in accordance with the findings of Macleod *et al.* (1983) [22]; Tessmann *et al.* (1991) [38]; Gaynor *et al.* (1995) [12]; Voelker *et al.* (2002) [40]; Broderick (2003) [5]; Argov-Argaman *et al.* (2014) [2] and Machado *et al.* (2014) [21] where they observed that daily milk yield was significantly ($p<0.05$) increased in lactating Holstein cows when proportion of concentrate was increased in diet. The finding of the study is also in agreement with Yadav (1993) [42] and Gaafar *et al.* (2009) [11] that daily milk yield was significantly ($p<0.05$) increased in the treatment group of lactating buffaloes fed high proportion of concentrate in the diet.

Similarly, Ferris *et al.* (2003) [10]; Moorby *et al.* (2006) [26]; Degirmencioglu (2013) [6] and Schobitza *et al.* (2013) [33] revealed that increased concentrate ratio in the diet of Holstein-Friesian dairy cows significantly ($p<0.05$) increased daily milk yield. Rinne *et al.* (1999) [30]; Shingfield *et al.* (2002) [34] and Kuoppala *et al.* (2004) [19] reported that daily milk yield in Ayrshire dairy cows significantly ($p<0.05$) increased on high concentrate diet as compared with low concentrate diets.

Meeske *et al.* (2006) [25] also revealed that increased concentrate ratio in the diet of Jersey cows significantly ($p<0.05$) increased daily milk yield. Sporndly (1986) [35]; Okine *et al.* (1997) [28]; Sanh *et al.* (2002) [32]; Sterk *et al.* (2011) [37]; Beyero *et al.* (2015) [3]; Ghosh *et al.* (2018) [13] and Utama *et al.* (2018) [39] also confirmed that daily milk yield was increased with higher levels of concentrate feeding to dairy cows.

Contrarily to present finding, Neeradi (1998) [27]; Keady *et al.* (2001) [17] and Loor *et al.* (2005) [20] found that daily average milk yield was not affected significantly with varying levels of concentrate and forages in the ration of dairy cows. The different results observed by these researchers might be due to feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. Increase in daily milk yield, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes might be due to comparatively more daily dry matter intake in these treatment groups. DMI has a positive correlation with milk yield.

Milk fat (%)

The overall mean values of milk fat pooled over periods were 7.53, 7.49 and 7.47 per cent in treatment groups T_1, T_2 and T_3, respectively. From the results of the investigation, it was found that milk fat % was almost equal in all the treatment groups with non-statistical variations at each progressive week of sampling, also statistical analysis of data revealed that the overall mean value of milk fat % in different dietary treatments were nonsignificant.

These results are corroborated with findings of Tessmann *et al.* (1991) [38] and Voelker *et al.* (2002) [40] as they found no effect on milk fat content in lactating Holstein cows when the proportion of concentrate was increased in the diet. Hossain *et al.* (2017) [14] also witnessed similar results in lactating buffaloes. Similarly, Degirmencioglu (2013) [6]; Rinne *et al.* (1999) [30] and Ghosh *et al.* (2018) [13] revealed that increased concentrate ratio in the diet of dairy cows did not alter milk fat concentration.

In contrary to the results of current study, Macleod *et al.* (1983); Sanh *et al.* (2002) [32]; Moorby *et al.* (2006) [26]; Sterk *et al.* (2011) [37]; Machado *et al.* (2014) [21]; Argov-Argaman *et al.* (2014) [2] and Beyero *et al.* (2015) [3] found decreased milk fat content, while Okine *et al.* (1997) [28]; Neeradi (1998) [27]; Keady *et al.* (2001) [17]; Shingfield *et al.* (2002) [34]; Kuoppala *et al.* (2004) [19] and Schobitza *et al.* (2013) [33] found increased milk fat content with higher levels of concentrate feeding to dairy cows. The different results observed by these researchers might be due to

feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. Milk fat % was not affected by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes which might be because forage diets high in cellulose give rise to acetic acid, while concentrate diets give rise to propionic acid (McDonald *et al.*, 1995) [24]. High levels of concentrate are conducive to production of propionic acid in the rumen, which in turn promotes partition of energy towards synthesis of body fat instead of milk fat synthesis (Randby, 1996) [29].

6% Fat Corrected Milk (kg)

The overall mean values of 6% FCM pooled over periods were 11.30, 14.19 and 14.79 kg in treatment groups T_1, T_2 and T_3, respectively. The data indicated that the 6% FCM was more in T_2 and T_3 as compared to T_1 (control) and statistical analysis of data revealed that significantly ($p<0.05$) higher 6% FCM was reported in treatment groups fed ration with replacement of 30% or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

Analogous to the findings of the present study, Yadav (1993) [42] and Gaafar *et al.* (2009) [11] observed that FCM yield was significantly ($p<0.05$) increased in lactating buffaloes with increasing level of concentrate and decreasing level of roughages in the diet. Similarly, Sporndly (1986) [35]; Okine *et al.* (1997) [28]; Shingfield *et al.* (2002) [34]; Ferris *et al.* (2003) [10]; Kuoppala *et al.* (2004) [19] and Meeske *et al.* (2006) [25] witnessed that increased concentrate ratio in the diet of dairy cows significantly ($p<0.05$) increased fat corrected milk yield.

Contrarily to present finding, Macleod *et al.* (1983) [22]; Voelker *et al.* (2002) [40]; Machado *et al.* (2014) [21]; Neeradi (1998) [27]; Beyero *et al.* (2015) [3] and Ghosh *et al.* (2018) [13] observed that FCM yield was not affected significantly with varying levels of concentrate and forages in ration of dairy cows. Hossain *et al.* (2017) [14] also reported similar results in lactating buffaloes. The different results observed by these researchers might be due to feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. Increased in 6% FCM yield, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes was due to increase in daily milk yield.

Solid not fat (%)

The mean values of solid not fat content pooled over periods were 8.78, 8.96 and 9.01 per cent in treatment groups T_1, T_2 and T_3, respectively. These data indicate that the SNF was more in T_2 and T_3 as compared to T_1 treatment and statistical analysis of data revealed that significantly ($p<0.05$) higher SNF was reported in treatment groups fed ration with replacement of 30% or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

Present results are in accordance with the findings of Gaafar *et al.* (2009) [11] who reported that SNF was significantly ($p<0.05$) increased in the treatment group of lactating buffaloes fed high proportion of concentrate in the diet. In contrary to the results of the present study, Neeradi (1998) [27]; Degirmencioglu (2013) [6]; Beyero *et al.* (2015) [3] and Ghosh *et al.* (2018) [13] observed that SNF in milk was not affected significantly with varying levels of concentrate and forages in the ration of dairy cows. The different results observed by these researchers might be due to feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. Increase in SNF % in milk, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes might be due to comparatively more daily dry matter intake in these treatment groups.

Total Solids (%)

The mean values of total solids pooled over periods were 16.31, 16.45 and 16.49 per cent in treatment groups T_1, T_2 and T_3, respectively. The statistical analysis of data revealed that significantly ($p<0.05$) higher total solid contents in milk was reported in treatment groups fed ration with the replacement of 30% or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

These results are corroborated with findings of Gaynor *et al.* (1995) [12] who found that total solids content in milk was significantly ($p<0.05$) improved in lactating Holstein cows when the proportion of concentrate was increased in the diet. Gaafar *et al.* (2009) [11] also reported similar results in lactating buffaloes.

Contrarily to present finding, Keady *et al.* (2001) [17]; Beyero *et al.* (2015) [3] and Ghosh *et al.* (2018) [13] observed that total solids content in milk was not affected significantly with varying levels of concentrate and forages in the ration of dairy cows. The different results observed by these researchers might be due to feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. Increase in total solid contents in milk, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes was due to increase in SNF % in milk.

Milk Protein (%)

The overall mean values of milk protein pooled over periods were 3.11, 3.17 and 3.19 per cent in treatment groups T_1, T_2 and T_3, respectively. From the results of present investigation, it was found that milk protein % was almost equal in all the treatment groups with non-statistical variations at each progressive weeks of sampling. Statistical analysis of data revealed that the overall mean value of milk protein % in different dietary treatments were nonsignificant.

Analogous to the findings of the present study, Neeradi (1998) [27]; Keady *et al.* (2001) [17]; Loor *et al.* (2005) [20]; Meeske *et al.* (2006) [25]; Machado *et al.* (2014) [21]; Beyero *et al.* (2015) [3] and Ghosh *et al.* (2018) [13] observed no effect on milk protein content in dairy cows when proportion of concentrate was increased in diet. Hossain *et*

al. (2017) [14] also witnessed similar results in lactating buffaloes.

In contrary to the results of current study, Macleod *et al.* (1983) [22]; Sanh *et al.* (2002) [32]; Moorby *et al.* (2006) [26]; Gaynor *et al.* (1995) [12]; Rinne *et al.* (1999) [30]; Okine *et al.* (1997) [28]; Shingfield *et al.* (2002) [34]; Ferris *et al.* (2003) [10]; Kuoppala *et al.* (2004) [19]; Degirmencioglu (2013) [6]; Schobitza *et al.* (2013) [33] and Argov-Argaman *et al.* (2014) [2] found increased milk protein content with higher levels of concentrate feeding to dairy cows. Similarly, Gaafar *et al.* (2009) [11] reported that milk protein content was significantly ($p<0.05$) increased in the treatment group of lactating buffaloes fed high proportion of concentrate in the diet. The different results observed by these researchers might be due to feeding of different levels of roughages and concentrates in diets and addition of different composition in different ratio or due to combination with other nutrients etc.

The present results are in agreement with most of the findings of earlier researchers. On the basis of present findings, it was reported that milk protein % was not affected by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes.

Peak milk yield

The mean values of peak milk yield of experimental buffaloes were 12.40, 15.17 and 15.35 kg in treatment groups T_1, T_2 and T_3, respectively. The statistical analysis of data revealed that the peak milk yield was higher in T_2 and T_3 treatment groups as compared to T_1 (control) but the difference was nonsignificant among different dietary treatments.

The finding of the present study is in agreement with Tessmann *et al.* (1991) [38] that peak milk yield was increased in lactating Holstein cows when the proportion of concentrate was increased in the diet. The present results are in agreement with the findings of earlier researchers. Increase in peak milk yield, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes was due to increase in daily milk yield.

Days taken to attain peak milk yield

The mean values of days taken to attain peak milk yield of experimental buffaloes were 46.67, 56.67 and 62.33 days postpartum in treatment groups T_1, T_2 and T_3, respectively. Statistical analysis of data revealed that days taken to attain peak milk yield were significantly ($p<0.05$) greater in treatment groups fed ration with the replacement of 30% or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

These results are corroborated with findings of Tessmann *et al.* (1991) [38] who found that days taken to attain peak milk yield was greater in lactating Holstein cows when the proportion of concentrate was increased in the diet. More days have taken to attain peak milk yield, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes was due to increase in daily milk yield.

Persistency period of peak milk yield

The mean values of persistency period of peak milk yield of experimental buffaloes were 56.00, 67.67 and 68.83 days postpartum in treatment groups T_1, T_2 and T_3, respectively. Statistical analysis of data revealed that persistency period of peak milk yield was significantly ($p<0.05$) greater in treatment groups fed ration with the replacement of 30% or 40% CP and TDN of green fodder with concentrate mixture than the control treatment group, which among themselves did not differ significantly.

The finding of the present study is in agreement with Tessmann *et al.* (1991) [38] that persistency period of peak milk yield was greater in lactating Holstein cows when the proportion of concentrate was increased in the diet. Greater persistency period of peak milk yield, by increasing concentrate mixture in place of green fodder in the ration of lactating Murrah buffaloes was due to increase in daily milk yield.

Conclusion

In conclusion, the study emphasizes the critical role of dietary management in optimizing milk yield, reproductive performance, and overall herd health in Murrah buffaloes, which are integral to the dairy industry in many developing countries, particularly in Asia. The findings shed light on the significant impact of varied green fodder and concentrate mixtures on milking dynamics, providing valuable insights for dairy farming practices. Through a comprehensive examination of different dietary treatments, the research revealed that increasing the proportion of concentrate mixture in the diet positively influenced milk yield and reproductive parameters. Buffaloes fed with higher concentrate mixtures exhibited higher milk yield, shorter postpartum estrous periods, and improved persistency of peak milk yield. These outcomes highlight the importance of optimizing feed formulations to enhance milk production and quality in dairy animals.

While milk fat content remained consistent across treatments, solid-not-fat (SNF) content and total solids content increased with higher concentrate mixture supplementation. This suggests that concentrate supplementation contributes to improved milk composition, enhancing its nutritional value. The study's findings align with previous research indicating that dietary adjustments, particularly increasing concentrate ratios, positively impact milk production parameters in dairy animals. The observed increase in milk yield and quality attributes with higher concentrate supplementation underscores the importance of providing balanced diets to lactating buffaloes. Moreover, the study underscores the need for sustainable feed management practices to address challenges such as low milk yield and poor reproductive performance in buffaloes. By optimizing feed formulations and dietary strategies, farmers can enhance milk production efficiency and profitability, contributing to the sustainability of dairy farming operations.

Overall, the research contributes valuable insights into the complex relationship between diet and milk production dynamics in Murrah buffaloes. By understanding and implementing optimal feeding practices, farmers can improve the economic viability and sustainability of dairy farming, ultimately benefiting agricultural economies reliant on buffalo milk production. Further research and extension efforts are warranted to disseminate these findings and facilitate their adoption among dairy farmers, ensuring the continued growth and development of the dairy industry.

References

1. 19th Livestock Census. Department of Animal Husbandry and Dairying. Ministry of Agriculture, Government of India; c2012 [Online]. Available: www.dahd.nic.in/dahd/statistics/livestockcensus. Accessed.
2. Argov-Argaman N, Mesilati-Stahy R, Magen Y, Moallem U. Elevated concentrate-to-forage ratio in dairy cow rations is associated with a shift in the diameter of milk fat globules and remodeling of their membranes. J Dairy Sci. 2014;97:6286-6295.
3. Beyero N, Kapoor V, Tewatia BS. Effect of different Roughage: Concentrate Ratio on Milk Yield and Its Fatty Acid Profile in Dairy Cows. J Biol Agric Healthcare. 2015;5(13):176-185.
4. Bhandari PM, Bhadwal S, Kelkar U. Examining adaptation and mitigation opportunities in the context of the integrated watershed management programme of the Government of India. Mitig Adapt Strat Glob Change. 2007;12:919-933.
5. Broderick GA. Effect of varying dietary protein and energy levels on production of lactating dairy cows. J Dairy Sci. 2003;86:1370-1381.
6. Degirmencioglu T. The effects of concentrated feed level on the milk production and composition. Int J Agric Innov Res. 2013;2(1):91-93.
7. Duncan DB. Multiple range and multiple F tests. Biometrics. 1955;11(1):1-42.
8. Food and Agriculture Organisation of the United Nations (FAO). The State of Food and Agriculture. Rome: Food and Agriculture Organisation; c2008.
9. Food and Agriculture Organization of the United Nations (FAOSTAT). [Online]. Available: http://www.faostat.fao.org. Accessed: 2007.
10. Ferris CP, Patterson DC, Gordon FJ, Kilpatrick DJ. The effect of concentrate feed level on the response of lactating dairy cows to a constant proportion of fodder beet inclusion in a grass silage-based diet. Grass Forage Sci. 2003;58:17-27.
11. Gaafar HMA, Mohi El-Din AMA, Basiuoni MI, El-Riedy KFA. Effect of concentrate to roughage ratio and baker's yeast supplementation during hot season on performance of lactating buffaloes. Slovak J Anim Sci. 2009;42(4):188-195.
12. Gaynor PJ, Waldo DR, Capuco AV, Erdman RA, Douglass LW, Teters BB. Milk Fat Depression, the Glucogenic Theory, and Trans-C18:1 Fatty Acids. J Dairy Sci. 1995;78:2008-2015.
13. Ghosh C, Prasad S, Datta S, Roy DC, Roy A, Kesh SS, Tudu NK. Effect of Cooling and Concentrate Feeding on Performances of Karan Fries Cattle under Loose Housing System. Int J Curr Microbiol App Sci. 2018;7(12):2657-2670.
14. Hossain SA, Sherasia PL, Phondba BT, Pathan FK, Garg MR. Effect of feeding green fodder based diet in lactating buffaloes: Milk production, economics and methane emission. Indian J Dairy Sci. 2017;70(6):767-773.
15. Indian Council of Agricultural Research (ICAR). Nutrient requirements of cattle and buffalo. Nutrient requirements of animals. New Delhi: Indian Council of Agricultural Research; c2013.
16. Josi S, Vadodaria VP, Shah RR, Tajna KR. Packed cell volume and haemoglobin values in relation to age, season and genetic groups and their correlation with wool trait in various grades of Patanawadi sheep. Indian J Anim Sci. 1991;61(7):728-734.
17. Keady TWJ, Mayne CS, Fitzpatrick DA, McCoy MA. Effect of concentrate feed level in late gestation on subsequent milk yield, milk composition and fertility of dairy cows. J Dairy Sci. 2001;84:1468-1479.
18. Khan MA, Sarwar M, Nisa M, Iqbal Z, Khan MS, Lee WS, Lee HJ, Kim HS. Chemical composition, in situ digestion kinetics and feeding value of grass (Avena sativa) ensiled with molasses for Nili Ravi buffaloes. Asian-Aust J Anim Sci. 2006;19:1127-1136.
19. Kuoppala K, Yrjanen S, Jaakkola S, Kangasniemi R, Sariola J, Khalili H. Effects of increasing concentrate energy supply on the performance of loose-housed dairy cows fed grass silage-based diets. Livest Prod Sci. 2004;85:15-26.
20. Loor JJ, Ferlay A, Ollier A, Doreau M, Chilliard Y. Relationship among trans and conjugated fatty acids and bovine milk fat yield due to dietary concentrate and linseed oil. J Dairy Sci. 2005;88:726-740.
21. Machado SC, McManus CM, Stumpf MT, Fischer V. Concentrate: forage ratio in the diet of dairy cows does not alter milk physical attributes. Trop Anim Health Prod. 2014;46(5):855-859.
22. Macleod GK, Grieve DG, McMillan I. Performance of first lactation dairy cows fed complete rations of several ratios of forage to concentrate. J Dairy Sci. 1983;66:1668-1674.
23. Makkar HPS. Animal nutrition in a 360-degree view and a framework for future R&D work: towards sustainable livestock production. Anim Prod Sci. 2016;56(10):1561-1568.
24. McDonald P, Edwards RA, Greenhalgh JFD, Morgan CA. Animal Nutrition. Fifth edition. Longman Scientific and Technical. Produced by Longman Singapore Publishers (Pte) Ltd. Printed in Singapore; 1995.
25. Meeske R, Rothauge A, Merwe GDV, Greyling JF. The effect of concentrate supplementation on the productivity of grazing Jersey cows on a pasture-based system. S Afr J Anim Sci. 2006;36(2):105-110.
26. Moorby JM, Dewhurst RJ, Evans RT, Danelon JL. Effects of dairy cow diet forage proportion on duodenal nutrient supply and urinary purine derivative excretion. J Dairy Sci. 2006;89(9):3552-3562.
27. Neeradi R. Effect of feeding rations containing different forage to concentrate ratios on the performance of lactating crossbred cows. M.V.Sc. Thesis. Livestock Production Management Department of Dairy Science. Acharya N.G. Ranga Agricultural University, Hyderabad, India; c1998.
28. Okine EK, Khorasani GR, Kennelly JJ. Effects of source of forage and level of concentrate on chewing activity and milk production response in late lactation cows. Can J Anim Sci. 1997;77:253-258.
29. Randby AT. Nutritional effects of increased use of concentrate in dairy cows. Norsk Landbruksforsking 1996;10:59-74.
30. Rinne M, Jaakkola S, Kaustell K, Heikkila T, Huhtanen P. Silages harvested at different stages of grass growth v. concentrate foods as energy and protein sources in milk production. Anim Sci. 1999;69:251-263.

31. Sahoo A, Elangovan AV, Mehra UR, Singh UB. Catalytic supplementation of urea-molasses on the nutritional performance of male buffalo (Bubalus bubalis) calves. Asian-Aust J Anim Sci. 2004;17:621-628.
32. Sanh MV, Wiktorsson H, Ly LV. Effects of natural grass forage to concentrate ratios and feeding principles on milk production and performance of crossbred lactating cows. Asian-Aust J Anim Sci. 2002;15(5):650-657.
33. Schobitza J, Ruiz-Albarránb M, Balocchia OA, Wittwerc F, Noroc M, Pulidod RG. Effect of increasing pasture allowance and concentrate supplementation on animal performance and microbial protein synthesis in dairy cows. Arch Med Vet. 2013;45:247-258.
34. Shingfield KJ, Jaakkola S, Huhtanen P. Effect of forage conservation method, concentrate level and propylene glycol on intake, feeding behaviour and milk production of dairy cows. Anim Sci. 2002;74:383-397.
35. Sporndly R. Intake and production response of dairy cows to a fixed ratio of silage to cereals, fed as separate feeds, blended or ensiled together. In: Ensiling of blended grass and grain and its utilization by dairy cows. Report 155. Dept. of Animal Nutrition and Management, Swedish University of Agricultural Sciences, Uppsala, Sweden; 1986.
36. SPSS-23. Statistical Program for Social Sciences. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp; 2019.
37. Sterk A, Johansson BEO, Tawell HZH, Murphy M, Van Vuuren AM, Hendriks NH, Dijkstra J. Effects of forage type, forage to concentrate ratio and crushed linseed supplementation on milk fatty acid profile in lactating dairy cows. J Dairy Sci. 2011;94:6078-6091.
38. Tessmann NJ, Radloff HD, Kleinmans J, Dhiman TR, Satter LD. Milk production response to dietary forage:grain ratio. J Dairy Sci. 1991;74(8):2696-2707.
39. Utama S, Mulyati S, Wurlina W, Mustofa I. Effect of concentrate to forage ratio on milk urea nitrogen, milk production and reproductive performance of dairy cows. Philipp J Vet Med. 2018;55(SI):25-34.
40. Voelker JA, Burato GM, Allen MS. Effects of pretrial milk yield on responses of feed intake, digestion, and production to dietary forage concentration. J Dairy Sci. 2002;85:2650-2661.
41. Wathes DC, Fenwick M, Cheng Z, Bourne N, Llewellyn S, Morris DG. Influence of negative energy balance on cyclicity and fertility in the high producing dairy cow. Theriogenology. 2007;68S:S232-S241.
42. Yadav BL. Effect of housing and feeding system on milk yield, milk composition and physiological reactions of Murrah buffaloes during the rainy season. M.V.Sc. Thesis. Livestock Production Management department. CCSHAU, Hisar, India; c1993.