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EFFECTS OF TOTAL MIXED RATION (TMR) DIFFER BETWEEN PROGRESSIVE AND LESS PROGRESSIVE DAIRY FARMS

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ABSTRACT: A study was conducted with the objective to determine the effects of Total Mixed Ration (TMR) on milk yield and constituents. Feeding experiment was conducted at a progressive dairy farm in Phuntsholing and two less progressive farms in Sarpang. All cows in individual farms received same amount of TMR in addition to their normal diet. Milk yield was recorded before and after TMR feeding. Milk samples from all experiment animals were collected and analyzed weekly for nutrient composition. Feeding trial lasted for 21 days, including two weeks of adaptation period. There was no significant difference in milk production before and after feeding TMR at progressive dairy farm. However, milk production, fat, SNF and protein contents were significantly higher after TMR feeding at less progressive farms. The study findings suggest TMR as a healthy feeding strategy to improve nutritional status and enhance productivity of dairy cows. Where local feed ingredients are abundant, TMR feeding should be recommended for the dairy farms with poor feeding practices. The study also suggests TMR not to be recommended for commercial dairy farms with improved feeding practices. Formulation of TMR should be carried out under the supervision of trained extension personnel.

Keywords: Dairy; milk; crude protein; Total Digestible Nutrients; Total Mixed Ration.

1. INTRODUCTION

Dairy farming is gaining momentum in Bhutan and the number of dairy farmers' groups and cooperatives has risen in recent years. The Royal Government has made concerted efforts to enhance milk production and various subsidies and market facilities are made available. Although, there are improved cattle breeds, there is still a need to realize the full genetic potential of these breeds. One of the important strategies to achieve this is to improve the quality of feed, especially under farmers' management condition.

Feed constitutes about 70% of the total production cost (Pond and Mishra 1981). The competitive dairy industry is compelling milk producers to improve productive efficiency of dairy cattle without incurring additional expenses. The high energy requirement of high yielding dairy cows has led to an increase in intake of concentrates. However, the ration must possess appropriate quantity and quality of fibre with adequate particle size in order to prevent nutritional and metabolic disorders, like displaced abomasum, laminitis, or rumen acidosis (Zebeli et al. 2010).

Shortage of feed resources in Bhutan usually occurs in winter when green pasture and fodder resources are not available. In some cases, the available feed resources are not fed in right amount, as per requirement of animal. This is one reason that has not allowed dairy farmers to fully realize the

genetic potential of milking cows. Although, the compound cattle feed manufactured by commercial feed mills are available, majority of the backyard dairy farmers at village level cannot afford to feed cattle concentrate to their cows. However, despite feed shortage, milk production and productivity of dairy cows can be improved substantially if the available feed resources are judiciously and proportionately used.

One of the relevant and useful feed formulation and fodder utilization technologies is the Total Mixed Ration (TMR) technology. TMR is a mixture of both roughages and processed ingredients, formulated and mixed to supply animals with required amount of feed and nutrients, in a form that precludes selection (Nissanka et al. 2010). The benefits of TMR include increased milk production, enhanced use of low cost feed ingredients, ability to control forage concentration ratio, lower incidence of metabolic and digestive disorder and reduced labour input for feeding (Chumpawadee and Pimpa 2009). According to Maekawa et al. (2002), feeding forage and concentrates separately results in cows consuming a high proportion of concentrates than intended, increasing the risk of ruminal acidosis. In Bhutan, TMR is less popular and the technology is yet to be adopted by dairy farmers. Bhutan has diverse fodder resources, which provide opportunities to develop TMR technology within the dairy farm. As a step towards developing TMR technology, we conducted a study at dairy farms managed by progressive and less progressive dairy farmers. The objective of the study was to evaluate the effects of feeding TMR on milk yield and composition in dairy cows.

2. MATERIALS AND METHODS

2.1 Study sites and selection of animals

The study was conducted at Pasakha in Phuntsholing and Gawathang in Sarpang where there is potential for dairy farming. In Phuntsholing, we selected a progressive dairy farm, whereas in Sarpang, we selected two less progressive dairy farms. Both study sites experience sub-tropical climatic condition, which is characterized by hot and humid summer with moderately cold and dry winter.

Six Jersey cross cows from progressive dairy farm in Phuntsholing and five from backyard dairy farm in Sarpang were selected for the study. The cows were in early lactation stage. All experimental animals were subjected to only one TMR treatment. The health status of experiment animals was inspected prior to commencement of feeding trial. Body weights were recorded before and after the experiment.

2.2 TMR preparation and application

Feed ingredients and chemical composition of experimental diets for respective farms are presented in Table 1 and 2. The green fodder and roughage were chopped to appropriate size before incorporating them into TMR diets. Based on body weight, 16 kg TMR was fed to each cow at the progressive farm in Phuntsholing and 8 kg TMR to

Table 1: TMR formulation and chemical composition of the ingredients (B.B commercial dairy farm).

Ingredients	Composition (%)	TDN(kg)	DCP(kg)	Ca (gm)	P (gm)
Fig	20	2.44	0.32	0	0
WBG	40	6.44	1.68	120	280
Maize grit	25	17.85	1.42	100	175
Molasses	3	1.2	0	0	0
Mustard oil cake	10	6.09	2.55	50	0
Mineral mixture	1	-	-	-	-
Salt	1	-	-	-	-

Source: Practical Guide for Feeding Dairy Cattle in Bhutan (2008)

Table 2: TMR formulation & chemical composition of the ingredients (Dairy backyard farm)

Ingredients	Composition (%)	TDN(kg)	DCP(kg)	Ca (gm)	P (gm)
Green fodder silage	55	8.58	0.99	55	55
DDG	10	11.29	0.85	15	105
Maize grit	20	10.71	1.42	60	105
Molasses	3	1.2	0	0	0
Mustard oil cake	10	6.09	2.55	40	56
Mineral mixture	1	-	-	-	-
Salt	1	-	-	-	-

Source: Practical Guide for Feeding Dairy Cattle in Bhutan (2008)

each cow at the less progressive farms in Sarpang. TMR was weighed daily and fed at 6.00 and 16 hours for 21 days. There were no refusals of TMR. The roughage to concentrate ratios in TMR were 20:80 and 55:45 for progressive farm in Phuntsholing and less progressive farms in Sarpang, respectively.

2.3 Milk yield measurement

Milk yield was recorded after two weeks of feeding TMR and continued till the 21st day. Milk samples were collected weekly from all experimental animals and analyzed with the Milko-Tester machine for milk protein, fat, SNF and lactose.

2.4 Data analysis

The data obtained from the field was processed in Microsoft Excel and analyzed, using the Statistical Package for Social Science (SPSS) version 23. The paired sample t-tests were conducted to test the statistical differences between before and after TMR feeding in respective farms.

3. Results and Discussion

3.1 Milk yield and composition

In the dairy farm in Phuntsholing, there was no significant difference in milk production before and after feeding TMR (Figure 1). Although statistically non-significant, the SNF, lactose, and salt contents were higher after feeding TMS (Figure 2). However, fat content decreased after feeding TMR. The non-significant difference in milk yield and constituents level is explained by the fact that the progressive farm in Phuntsholing is a well-organized farm with intensive management and improved feeding practices. The farm is adjacent to the Pasakha Beverage factories and has access to Wet Brewery Grains (WBG), sold at cheaper rate. WBG is the major concentrate feeding source for the farm, along with high quality commercial concentrate feed. WBG has low dry matter (20-32%), high protein content, and high content of total digestible nutrients (TDN) as a result of high digestibility of the available fiber (Chanie and Fievez 2017). Therefore, WBG are a good source of protein with a crude protein that range from 25 to 34% (Thomas et al. 2016).

Unlike the progressive farm in Phuntsholing, there were significant differences in both milk yield and constituents at the farms in Sarpang (Table 3). Milk yield, fat and SNF level increased significantly after feeding TMR. Similar result was reported by Wachirapakorn et al. (1997) who observed increase in milk yield after TMR feeding.The farms in Sarpang had been following different and poor feeding system prior to TMR feeding. The normal animal diet of dairy farm of Mr. Pema Chojay is mainly roughage, supplemented with concentrate

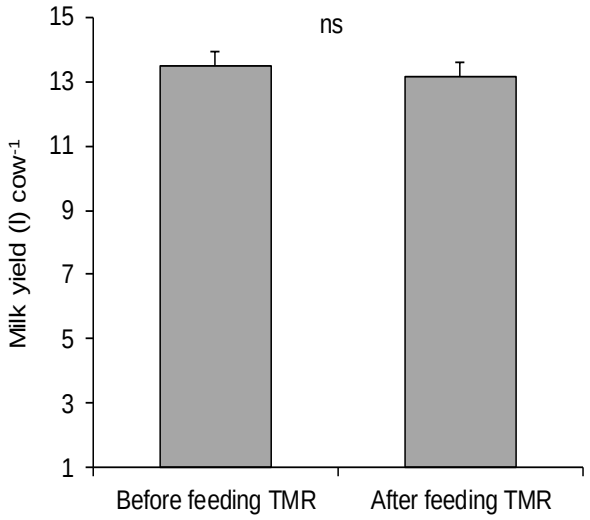

Figure 1: Milk production before and after feeding TMR in progressive dairy farm in Phuntsholing.

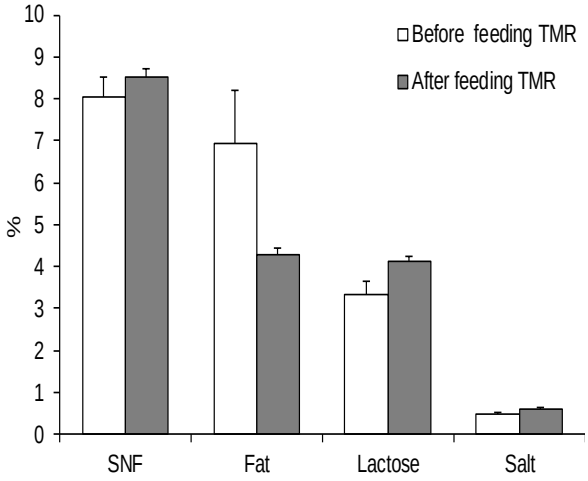

Figure 2: Milk constituents before and after feeding TMR in progressive dairy farm in Phuntsholing.

feed that is fed separately. Whereas, the dairy farm of Mr. Kinchab Loday is restricted to grazing and feeding waste slurry obtained from distillery. These separate feeding and poor quality of diet have led to low nutrient intake and thus, explains the consequent low milk production of dairy farms in Sarpang. Moujahed et.al (2009) reported that the separate feeding of basal diet and concentrate results in concentrate wasting and frequent metabolic disorders such as acidosis, as a result of consuming high amount of starchy concentrate.

4. Conclusion

Where local feed ingredients are abundant, TMR feeding should be recommended for the dairy farms with poor feeding practices. TMR is not recommended for commercial dairy farms with improved feeding practices. Formulation of TMR should be carried out under the supervision of trained extension personnel.

Table 3: Milk production and constituents before and after feeding TMR at less progressive farms in Sarpang.

Farmer's name	Parameters	Before feeding TMR	14 days after feeding TMR	21 days after feeding TMR	Significance
Pem Chojay	Milk (l)	4.61±0.21 b	6.70±1.18 a	6.83±1.11 a	***
	Fat (%)	3.77±0.09 b	4.90±0.31 a	5.37±0.41 a	*
	SNF (%)	6.20±0.06 b	9.50±0.00 a	9.27±0.13 a	**
	Protein (%)	2.10±0.06 b	3.40±0.00 a	3.37±0.03 a	**
	Lactose (%)	3.37±0.08 b	5.07±0.09 a	5.07±0.08 a	**
	Salt (%)	0.50±0.00 a	0.70±0.00 a	0.70±0.00 a	ns
Kinchab Loday	Milk (l)	2.48±0.06 b	4.82±0.17 a	5.05±0.23 a	***
	Fat (%)	3.90±0.10 b	5.20±0.20 a	6.65±0.95 a	**
	SNF (%)	7.70±0.10 b	9.20±0.00 a	9.30±0.30 a	**
	Protein (%)	2.90±.10 b	3.30±0.00 a	3.30±0.00 a	*
	Lactose (%)	4.50±0.10 a	5.00±0.00 a	4.90±0.00 a	ns
	Salt (%)	0.60±0.00 a	0.70±0.00 a	0.70±0.00 a	ns

*p≤0.05 **p≤0.01 ***p≤0.001 ns: nonsignificant

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