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Effects of pre and post-calving feed supplementation on milk yield, reproductive performance and farm profitability of Ethiopian dairy cows

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Feed is the main cost component of dairy cows accounting to between 50 and 60% of the total cost of production (FAO, IDF and IFCN, 2014). Feed management is very essential as it is related to efficiency, health and overall with farm profitability. Dairy farms with poor feed management might underfeed, overfeed nutrients or poorly balance lactating cows diet, thereby failing to match the nutritional requirements with physiological needs of the cows.

At low dry matter feed intake (DMI), associated with low feed quality, cows will lose weight excessively, produce less milk which is often low in solids, have a poor fertility and are susceptible to metabolic diseases (Kavanagh, 2016). Consequently, profitability of the dairy business is affected. Cow nutrition during the last stages of lactation and the first months after calving are quite determinant of the performance of next lactation and for calf body weight and health (Salehi et al 2016).

Furthermore, a low dietary energy intake reported to cause ketosis, which is most common after calving (Lukuyu et al 2012). On contrast , cows with high dietary energy intake pre-calving become fat at calving and might experience dystocia; they further require lower levels of calcium in the diets during the last days pre-calving to prevent milk fever incidence (Lukuyu et al 2012; Gaafar et al 2011, Lukuyu et al 2007). Ultimately, farmers would incur additional costs which could be avoided when feeding cows a balanced ration.

In Ethiopia, it is common that fresh cows are not managed and fed optimally, thus, they do not reach peak milk production and as a result, cow efficiency is low. Several studies reported that optimum feeding management during pre-calving are essential as they will help to improve producer's profitability.

The objective of this work is to evaluate the effect of pre- and post-calving feed supplementation on milk production, reproductive performance and on farm profitability.

Key messages:

1) Feed supplementation by adding a high quality concentrate to cows' diet was found to increase milk yield and improve reproductive performance of cows while increasing farm profitability.

2) We recommend farmers to include good concentrate feed to dairy diets typically fed. A supplementary feeding pre calving and adjustment of feed quantities were found to be essential to match cow performance during lactation and to increase cows productivity and farm profitability.

Mixing brewer's spent grains with other feeds

1. Setting up the trial

A feeding trial was conducted in Debre Zeit town at Nardelli commercial dairy farm. Twelve pregnant cows were selected and divided into two groups (with six cows per group; a control group and a test group). For each group and due to the limited number of animals, three were heifers expecting their first calves and three were multiparous. In total, three diets were offered. The control group received a standard concentrate ration (see table 1) which was the typical ration on the farm. Meanwhile, cows in the test group were offered two rations, one ration for dry cows, and another improved ration (i.e., with higher dietary concentrate) for lactating cows starting by two weeks before calving and last for 3 months post calving. Compared to the requirements, the control diet was found to be limiting in metabolisible energy (ME) and crude protein (CP). Therefore the major dietary differences were caused by levels of concentrate feeding varying between groups, in addition to balancing diets to match the dietary requirement of the cows. In addition, cows in the test group were fed formulated diets based on based on their milk production level.
The rations for the treated and control groups are shown in Table 1.

Table 1: Nutritional composition of feeds

						Feed percentage in rations		
Feed ingredient	**DM (%)**	**ME (MJ)**	**CP (%)**	**Price per kg (ETB)**		**Control ration**	**Test ration for lactating cows**	**Test ration for dry cows**
Brewer's spent grain	25%	11.0	28.0%	1.30		18.4%	22.3%	10.2%
Grass hay mature	90%	7.6	8.5%	6.00		23.0%	14.9%	31.7%
Lucerne (fresh)	20%	11.0	25.0%	5.00		23.0%	18.6%	36.6%
Wheat straw	90%	6.8	4.0%	4.00		9.2%	3.7%	7.3%
Corn maize	89%	13.9	8.0%	5.00		7.8%	3.3%	4.4%
Nough cake	93%	11.0	30.0%	8.00		9.2%	3.7%	4.9%
Wheat bran	89%	10.2	14.5%	4.50		9.2%	3.7%	4.9%
Concentrate 17% CP	90%	11.7	18.9%	7.00		0.0%	29.7%	0.0%
Cost per kg of composed diet in Ethiopian Birr (ETB)						3.35	4.97	4.99

2. Results

2.1 Milk production

The average milk production from all cows the test and control groups are presented in figure 1.

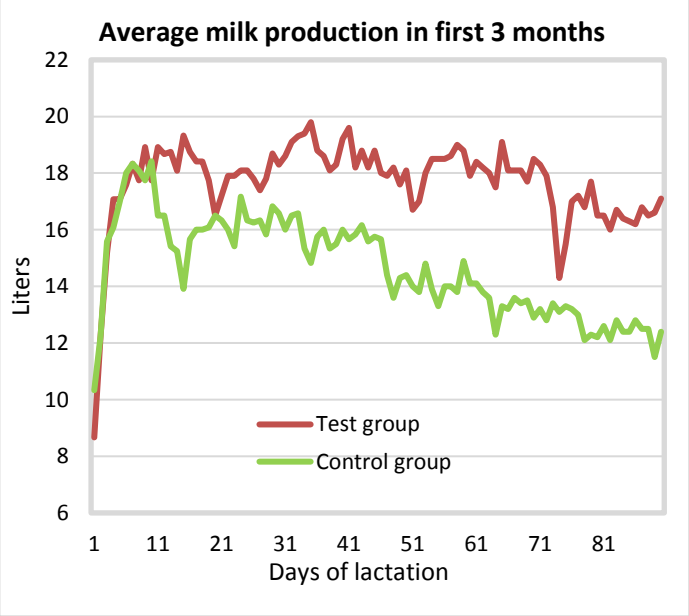

Figure 1: Average milk production of cows during the first 3 months of lactation

The graph further elaborates the variations between the groups. Over the studied period, significant differences ($p>0.01$) were found between milk production in the control and test groups. Average daily milk yield was 22% higher in the test group (i.e., 18 vs 14 kg/cow/day) in the test and control group, respectively). Furthermore, cows in the test group have maintained a longer peak period compared to cows in the control group, which suggest a greater lactation period and average daily milk yield.

2.1 Reproductive performance

Table 2 shows the reproductive performance of cows in the control and test groups. There was only a small difference (of 7 days) in duration until first insemination between the test and the control group. However, the average number of services needed to induce the conception was 2 times for the control group versus 1.3 for the test group. Therefore, insemination cost is reduced in the test group by 35% compared to that in the control group. Furthermore, and under a similar lactation period, we speculate that the inter-calving period will be greater in the control group.

This is reflected in the percentage of cows which were diagnosed pregnant within 100 days after calving.

Table 2: Reproductive performance of cows

	Control group	Test group
Average days until first insemination (second heat after calving)	114	107
Average number of services per conception	2.0	1.3
% of cows pregnant within 100 days after calving	17%	50%

The results further show that cows in the Test group were three times more likely to get pregnant within 100 days compared to cows in the control group. Therefore, in a conclusion, most of the variations in the productive and reproductive performance are driven by balancing the diet and by offering greater amount of concentrate. Furthermore, increasing dietary ME intake has a combined effect on cows by improving their milk production, and improving cows reproductive performance (indicated by the pregnancy rate).

2.3 Farm profitability

The profitability of pre and post-partum supplementary feeding was calculated and illustrated in Table 3.

Table 3: Costs and benefits of feed supplementation during the entire trial period (90 days)

	Test group	**Control group**
Total feed intake over 90 days (kg fresh matter/cow)	1658	1530
Feed price (ETB/kg)	4.97	3.35
Total feed cost over 90 days (ETB/cow)	8241	5126
Total milk production over 90 days (kg)	1,579	1,261
Total milk income (ETB)	22,109	17,647
Difference in feed cost between treated and control group	3,116	
Difference in milk revenue between treated and control group	4,462	
Profit from improved feeding (difference between value of additional milk and cost of supplementary feeding)	1,346	

Based on the economic calculations in Table 3, it was clear that the control ration was cheaper and the cows received less feed compared to the cows of the Test group, leading to a huge difference in feed cost between the two groups. However, there was equally a great difference in the milk yield of the two groups, which when multiplied by the milk price overcompensated the additional feed costs.

Switching from the control diet to the Test diet will lead to a net profit of about 1400 ET per cow over the first 90 days of lactation which is an additional 15 ETB per cow per day. With the current farm gate milk price being 14 – 15 ETB (in February 2018), we conclude that the net profit from feed supplementation is the value of one additional litre of milk per cow per day.

Conclusions & recommendations

Feed supplementation by adding a high energy concentrate to cows' diet was found to be instrumental in increasing milk yield and improving reproductive performance of cows while increasing farm profitability. For economic and nutritional improvements, farmers are recommended to improve dietary energy concentration by including good quality concentrate feed to meet pregnancy and lactation requirements.

However, the magnitude to which farm profitability could be improved is subject to the price and amount of concentrate fed.

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