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GROWTH PERFORMANCES OF FEMALE AND MALE HOLSTEIN CALVES FED WITH MILK AND MILK REPLACERS

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Abstract

The objective of this study was to compare growth performances of male and female Holstein calves fed milk and milk replacers. A total of 60 Holstein calves were used in the study. Calves were divided into three equal groups. In each group, there were 10 female and 10 male calves. Calves were offered colostrum for 3 days after birth and were weighed at fourth day for the trial. Initial body weights of calves in dietary treatments were statistically similar. The first, second and third groups were fed milk, milk replacer-I (CP 21% and CF 16.5%) and milk replacer-II (CP 24% and CF 18%), respectively. In addition to milk and milk replacers, calves were supplemented with ad libitum concentrate feed and alfalfa. Dietary treatment was significantly effective (P<0.05) on body weight of calves at 60 days of age. In conclusion, growth performances of calves increased with increasing protein content of milk replacer, also growth performances of calves fed milk and milk replacer containing high-protein had better than those of calves fed milk replacer containing low-protein. Therefore, during the suckling period, in feeding of Holstein calves, milk or milk replacer containing high-protein should be preferred primarily.

Key words: *Holstein calf, milk replacer, milk, growth performance.*

INTRODUCTION

Efficient growth of young dairy calves is important for profitability of the dairy enterprise. Before weaning, intake of nutrients from liquid feeds is usually limited to stimulate early dry feed intake, allow development of ruminal function and early weaning (Bush and Nicholson, 1986). Appropriate and ample supply of nutrients for calves through liquid feed (milk or milk replacer) is essential for performance and welfare. Conventionally, dairy calves are separated from dams within few hours of their birth and receive a restricted amount (typically 10% of BW/day) of milk or milk replacer through a nipple or bucket (Lee et al., 2009).

Milk replacers are generally cheaper and offer an alternative to whole milk feeding to weaning. These practices are common in the management of calves from temperate breeds such as Holstein-Friesians in contemporary dairy systems (Bhatti et al., 2012). Modern milk replacers can be classified by protein source, protein/fat levels and inclusion of medication or additives. Protein and fat levels are both important to consider when choosing a milk replacer (BAMN, 2013). Good quality milk replacers are also very good sources of liquid feed for calves (Grobler, 2008). Feeding of calves with milk replacers is limited. Therefore, further researches are needed on this subject in calves.

The objective of this study was to compare growth performances of male and female Holstein calves fed milk and milk replacers.

MATERIALS AND METHODS

The study was conducted on a commercial dairy farm (DIMES, Kazova Vasfi Diren Agriculture Farm) located in Turhal district of Tokat province, Turkey. A total of 60 Holstein calves were used in the study. Calves were divided into 3 groups (n=20, 10 male and 10 female). Two different milk replacers (MR-I and MR-II) and milk were used for calves feeding. The first group was fed MR-I, the second group was fed MR-II, and the third group was fed milk. Calves received milk and

milk replacers during 60 days. Calves were separated from their mothers within 1 h of birth, and were kept in individual hutches (1.2x1.4x1.3 m) bedded with straw. Calves were offered 4 liters of colostrum for 3 days after birth and were weighed at the fourth day. Body weights of calves in dietary treatments were statistically similar. Milk replacers and milk feeding were started at fourth day.

Calves were weighed at intervals of 15 days until 60th day.

Body weights of calves were determined with a scale (TESS, Yildirim Electronic Weighing Systems, Yenibosna, Istanbul) that is fine-tuned to 50 g. Average daily gains were determined from birth to 60th day. To prepare milk replacers, diluted milk replacers were prepared in buckets by mixing 0.125 kg of milk replacer in 1 liter of warm water (50°C). Diluted milk replacers were then cooled to 38-40°C for feding. Prepared milk replacers and milk were poured to the bucket having nipples, and fed to the calves twice in a day. Daily milk replacers and milk offered were divided equally and fed at 08:00 and 16:00 h. In addition to milk and milk replacers, calves were supplemented with ad libitum concentrate feed and alfalfa between 4-60 days of age. Water intake was ad libitum. Chemical compositions of milk replacers are given in Table 1.

Table 1. Chemical compositions of the milk replacers (MR-I and MR-II)

	MR-I	MR-II
Crude protein (CP) %	21	24
Crude fat (CF) %	16.5	18
Crude cellulose (% max.)	0.5	0.1
Crude ash (% max.)	8	6.9
Ash insoluble in HCL (% max.)	1	0.6
Humidity (% max.)	3.5	3.5
NaCl (% max.)	0.6	0.6
Lactose (%)	25	39
Ca (%)	0.9-1.1	0.9-1.5
P (%)	0.85	1
Vitamin A (IU)	40000	40000
Vitamin D3 (IU)	4000	4000
Vitamin E (mg)	100	-

Feeding programs of Holstein calves fed milk and milk replacers are given in Table 2.

Descriptive statistics for studied variables (characteristics) were presented as mean, standard errors. Two-way analysis of variance was performed to compare means of dietary treatment groups and gender for the body weight scores. Following analyses of variance, the independent samples t-test was used to determine whether differences between the genders.

Table 2. Feeding programs of Holstein calves fed with milk (M) and milk replacers

Colostrum (liter)			
Day-week	Morning	Evening	Total
1-3 days	2	2	4
M, MR-I and MR-II (liter)			
4-7 days	2	2	4
2nd -4th week	2.5	2.5	5
5-6th week	3	3	6
7th week	2.5	2.5	5
8th week	2	2	4
57-60 days	1	1	2
	Starter concentrate	Alfalfa	Water
4-60 days	ad libitum	ad libitum	ad libitum

Descriptive statistics for studied variables (characteristics) were presented as mean, standard errors. Two-way analysis of variance was performed to compare means of dietary treatment groups and gender for the body weight scores. Following analyses of variance, the independent samples t-test was used to determine whether differences between the genders.

Differences between three feeding groups were analyzed by using Duncan multiple comparison test in one-way ANOVA method. Statistical significance levels were considered as 5% and SPSS statistical program was used for all statistical computations (SPSS, 2002).

RESULTS AND DISCUSSIONS

Body weights of female and male Holstein calves fed milk and milk replacers are presented in Table 3. When Table 3 is examined, initial weights for male and female calves in three dietary treatment groups were similar. Body weights of female and male calves at 15 days of age were not affected by dietary treatments. Interactions between dietary treatment and gender during all periods of growth were not statistically significant ($P>0.05$). Body weights of both female and male calves at 30, 45 and 60 days of age were

affected (P<0.05) by dietary treatments. Body weights of calves fed milk and milk replacer-II were heavier than those of calves fed milk replacer-I.

Better body weight gain at weaning in calves fed whole milk compared with those fed milk replacer may be attributed to better bioavailability (digestion and utilization) of nutrients (protein and energy). Availability of ideal protein (casein) and energy-yielding constituents (fat and lactose) along with other known (minerals, vitamins, enzymes, and hormones) and unknown growth factors probably resulted in better body weight gain in whole milk-fed calves compared with those fed milk replacer (Lee et al., 2009). Jaster et al. (1990) reported that increasing fat in milk or milk replacer increased body weight gain during the first months of the calves' life. Eivazi et al. (2013) reported that effects of feeding full milk and milk replacer on average daily gain of Holstein calves were significantly different. Results of the current study was in agreement with the findings reported by Eivazi et al. (2013) for Holstein calves. Bhatti et al. (2012) reported that average daily gain of Sahiwal calves offered milk was higher than those offered milk replacer. Lee et al. (2008) has reported no difference in the performance of Holstein calves fed varying levels of protein in energy in the milk replacer-fed Holstein calves. In a study, Lee et al. (2009) have reported that weaning weights for Holstein calves were lower in milk replacer fed calves than whole milk group, despite similar dry matter intake and gross composition of both milk replacer and whole milk. They described that better weaning weights of calves from whole milk group, was probably because of the better bioavailability of nutrients and some unknown growth factors in milk.

Table 3. Body weights (kg) of female and male Holstein calves fed milk and milk replacers.

Days	Dietary Treatments (DT)	Gender (G)				*Significance of G*	DT x G
		Female		Male			
		Mean	SE	Mean	SE		
0 (Initial)	M	40.40	0.72	41.50	0.56	ns	ns
	MR-I	39.70	0.50	41.60	0.58	ns	
	MR-II	40.00	0.67	41.70	0.65	ns	
	Significance of DT	ns		ns			
15	M	43.90	0.98	46.30	0.63	ns	ns
	MR-I	42.90	0.67	44.90	0.46	ns	
	MR-II	43.30	0.67	45.30	1.33	ns	
	Significance of DT	ns		ns			
30	M	49.50^{bA}	1.09	53.60^{aA}	0.93	*	ns
	MR-I	46.70^{B}	0.97	47.80^{B}	0.71	ns	
	MR-II	50.40^{A}	1.08	51.60^{A}	1.45	ns	
	Significance of DT	*		*			
45	M	59.60^{A}	1.45	62.90^{A}	0.66	ns	ns
	MR-I	56.10^{B}	1.38	54.30^{B}	0.78	ns	
	MR-II	58.30^{A}	1.45	59.80^{A}	2.03	ns	
	Significance of DT	*		*			
60	M	72.80^{A}	1.69	75.80^{A}	1.31	ns	ns
	MR-I	65.40^{B}	1.40	63.90^{B}	1.20	ns	
	MR-II	69.00^{A}	1.78	71.70^{A}	2.01	ns	
	Significance of DT	*		*			

$^{a, b}$:The differences between the means of groups with different superscripts (in the same row) are significant (P<0.05).
$^{A, B}$:The differences between the means of groups with different superscripts (in the same columns) are significant (P<0.05).
ns: Non significant

Average daily gains of female and male Holstein calves fed milk and milk replacers are presented in Table 4. When Table 4 is examined, average daily gains of both female and male calves in the interval day 0-15 and 0-30 were not affected by dietary treatments. But, average daily gains of both female and male calves in the intervals day 0-45 and 0-60 were affected (P<0.05) by dietary treatments. Average daily gains of calves fed milk and milk replacer-II were heavier than those of calves fed milk replacer-I.

In the present study, the average daily gain of Holstein calves fed milk and milk replacer containing high-protein were higher than those of calves fed milk replacer containing low-protein. However, El-jack and Ahmed (2012) reported that the pre-weaning weight gain

obtained by calves fed milk replacer were significantly higher than that obtained by calves fed raw milk. This may be attributed to the highly nutritious value of milk replacer compared to the raw milk. On the other hand, growth performances observed for calves reared on milk replacer in this study were lower than that reported by El-jack and Ahmed (2012). The findings of the current study showed that calves fed milk and milk replacer containing high-protein were grew faster than calves fed milk replacer containing low-protein. Hill et al. (2006) conducted an experiment on effect of feeding a control 20% crude protein, 20% fat milk replacer compared to feeding a 28% crude protein, 20% fat milk replacer (0 to 49 days). They reported that average daily gains of calves in each groups were similar (0.53 and 0.54 kg/day, respectively). However, our study has shown that average daily gains of calves fed with different milk replacers did differ. Growth performances of calves fed certain milk replacers may be increased due to supplementing specific amino acids of the milk replacer (Hill et al., 2007; Hill et al., 2008). Khan et al. (2012) reported effect of milk replacer on weaning weight of different bovine breeds was significant. In the present study, growth performances of calves increased with increasing protein content of MR. This finding is compatible with the finding reported by Blome et al. (2003).

Table 4. Average daily gains (g/day) of female and male Holstein calves fed milk and milk replacers

Days	DT	Gender (G)				*Significance of G*	DT x G
		Female		Male			
		Mean	SE	Mean	SE		
0-15	M	233.33	30.23	320.00	34.14	ns	ns
	MR-I	199.97	24.35	220.00	22.33	ns	
	MR-II	220.00	14.23	240.00	56.39	ns	
	Significance of DT	ns		ns			
0-30	M	303.33^{b}	21.34	403.33^{a}	25.56	*	*
	MR-I	233.33	23.31	206.67	17.78	ns	
	MR-II	346.67	27.76	330.00	32.38	ns	
	Significance of DT	ns		ns			
0-45	M	426.67^{A}	22.90	475.56^{A}	21.00	ns	*
	MR-I	364.44^{aB}	23.00	282.22^{bC}	18.16	*	
	MR-II	406.67^{A}	29.45	402.22^{B}	33.37	ns	
	Significance of DT	*		*			
0-60	M	540.00^{A}	21.11	571.67^{A}	28.00	ns	ns
	MR-I	428.33^{B}	19.88	371.67^{B}	23.05	ns	
	MR-II	483.33^{A}	28.54	500.00^{A}	25.58	ns	
	Significance of DT	*		*			

$^{a, b}$:The differences between the means of groups with different superscripts (in the same rows) are significant ($P<0.05$)

$^{A, B, C}$:The differences between the means of groups with different superscripts (in the same columns) are significant ($P<0.05$).

CONCLUSIONS

Growth performances of calves increased with increasing protein content of milk replacer, also growth performances of calves fed milk and milk replacer containing high-protein had better than those of calves fed milk replacer containing low-protein. Therefore, during the suckling period, in feeding of Holstein calves, milk or milk replacer containing high-protein should be preferred primarily.

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