

# Effects of Propolis Administration on Growth Performance and Neonatal Diarrhea of Calves

Banu Yucel<sup>1\*</sup>, Alper Onenc<sup>2</sup>, Attila Kaya<sup>1</sup>, and Ozge Altan<sup>1</sup>

<sup>1</sup>Department of Animal Science, Faculty of Agriculture, University of Ege, 35100, Bornova-Izmir, Turkey

<sup>2</sup>Department of Animal Science, Faculty of Agriculture, University of Namik Kemal, Tekirdağ, Turkey

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\*Corresponding author: Banu Yucel, Department of Animal Science, Faculty of Agriculture, University of Ege, 35100, Bornova-Izmir, Turkey, Tel: +90 -232-3112711, Fax: +90 -232-3881867, E-mail: banu.yucel@ege.edu.tr

## Abstract

The purpose of this study was to determine the effects of propolis on growth performance and neonatal diarrhea of calves. Five females and five male calves from both control and propolis treatment groups, 20 Holstein calves, had been used, totally. Calves in both control and treatment groups were fed with same amount of milk once in a day. Propolis tincture were given to calves 2cc in a day after milk feeding. The research was prosecutioned for 35 days. Daily weight gain of females in control and propolis treatment groups was found 312.8 g/day and 392.83 g/day. Daily weight gain of males in both groups was found 458.31 g/day and 470.50 g/day. Daily weight gain was found significant ( $P < 0.05$ ) in females. Significant differences had been obtained in both body and shoulder length parameters between control and treatment groups of females ( $P < 0.05$ ). The only statistically important difference had been appeared between two groups of males for withers height. Neonatal diarrhea did not observe in propolis administration group. The results of the research showed that the effect of propolis administration was important on growth of calves and is very expectant for preventing neonatal diarrhea that cause a serious economic loss.

**Keywords:** Propolis; Neonatal calf; Growth; Body measurement; Diarrhea

## Introduction

The reproductive efficiency of herd depends on livability of new born calves. The better growth performance of calves made it possible to utilize them as a brood-stock in early ages. Utilizing the young calves as brood-stock would shorten the unproductive period and increase the income of farm gradually [1-3]. Various methods can be utilized in order to reach the target weight gain and growth. Thus, farmers are using various energy-protein rates, feed additives and hormones for feeding calves in order to succeed this aim [3]. Today, such methods are not accepted by consumer because of their inversely effect on human health. The farmers are seeking for natural methods in growth of promotion. Propolis is a bee product that has antibacterial, antibiotic, antioxidant, antimicrobial, antiparasitic and antiseptic properties in its structure [4]. The positive effects and preventive properties of propolis on dangerous pathogenic bacteria's and viral infections have been reported by several researchers [4-

10]. It has not known adverse effects of propolis on human and animal health, except possible rarely seldom allergies. Our study was based on the study of Gubicza and Molnar and Kwon et al. [11,12]. These researchers examined the preventative and treated effect of propolis usage on neonatal calf diarrhea. The aim of our study was to examine the effect of propolis on growth rate of calves.

## Methods

Twenty Holstein calves that were born in winter period in Menemen Agricultural Research Institute, Izmir were utilized as research material. Five female and male calves had been used in both control and propolis group. Calves were randomly assigned to the groups (Table 1).

Calves were allocated with their mothers and fed colostrums for the first three days after the birth [13]. After they housed in portable individual calf pen, and milk was given to calves one in a day from bucket with a nipple at 8.30-10.00 am. Calves were reared with limited milk for 5 weeks. Milk were increased until 3<sup>rd</sup> week then decreased from 3<sup>rd</sup> week to the final of the 5<sup>th</sup> week [14,15]. All calves were weaned at the end of the 5<sup>th</sup> week. Each calf had drunk 154 kg milk in five weeks. Besides, clover hay were given *ad libitum* to calves after the second weeks, water was given from the first week. Clover hay consumption was not recorded.

The raw propolis was *Pinus spp.* origin and supported from the beekeepers Izmir and nearby, stored at -18°C in deepfreeze until using. Raw propolis was grinded in mini coffee machine and made as granule form. After grinding, 500 g propolis was weighted and dissolved in 1lt of ethyl alcohol (70%) in dark and tightly closed bottle. The bottle was shaken 4 times in a day regularly as manual and left in dark place at room temperature

**Table 1:** Experimental design.

Gender	Groups		
	Control	Propolis	Total
Female calves	5	5	10
Male calves	5	5	10
Total	10	10	20

for 15 days. Then, the propolis solution was filtered and left in incubator in 55-60 °C for 10 minutes for evaporating the alcohol particularly. After this step, preparation of propolis tincture was completed.

Propolis tincture was given to calves 2 cc using syringe (5cc) with spiral pipette from the first day of birth until the end of the trial. Syringe was cleaned with alcohol before and after using. Calves in trial were weighted after birth, at the 1<sup>st</sup> week, at the 3<sup>rd</sup> week and the end of research (at the 5<sup>th</sup> week). Also body measurements (withers height, body length, sacrum height, shoulder length, chest length, sacrum length, chest depth, chest perimeter, front shin girth perimeter, leg perimeter, head length, forehead length and width, face length) were recorded at the 2<sup>nd</sup> day of birth and at the end of the research. Fecal score was visually monitored daily using the method described by Larson et al. [16], regarding the fluidity of feces. Feces were classified as normal (1) soft (2) loose (3), watery (4) or liquid consistency (5).

Data were analyzed with SPSS, [17] statistic program using following model. Treatment were introduced as independent variables, birth weight were used as co-variable. Means were compared with Scheffe test. Fecal score values were analyzed using chi-square test [18].

$$Y_i = \mu + t_i + b(x-x) + e_i$$

$Y_i$  = observation of traits

$\mu$  = general mean

$t_i$  = the effect of treatment

$b$  = regression coefficient of birth weight for observed traits

$e_i$  = error

## Results

'Ls' means and standard error of live weight gain and body measurements for control and propolis groups of female and male calves were presented in Table 2. During trial, total live weight gain mean was found 10.95 and 13.75 kg for female calves, 16.04 and 16.47 kg for male calves in control and propolis groups, respectively. Daily weight gain means were 312.88 and 392.83 g for female calves, 458.31 and 470.31 g for male calves in control and propolis groups, respectively. Although, propolis had significant effect on female calves for total and daily weight gain ( $P < 0.05$ ), there was no significant difference between control and propolis groups for male calves. It was shown the birth weight, weight at 7<sup>th</sup>, 21<sup>st</sup>, and 35<sup>th</sup> days (final weight) of female and male calves for control and propolis groups in Figure 1. Variance analysis results have showed that, differences for birth weight, weight at 7<sup>th</sup>, 21<sup>st</sup> day between control and propolis groups were non significant. Significant difference was determined between two groups in females for weight at 35<sup>th</sup> day.

In our research, higher body measurements were observed

**Table 2:** 'Ls' means and standard error of body measurements and live weight for propolis and control group according to gender.

Measurements	Female calves				Male calves			
	Control		Propolis		Control		Propolis	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Live weight, (kg)	39.50 ± 2.20	51.70 ± 0.72b	42.00 ± 2.20	54.50 ± 0.72 a	45.75 ± 1.28	63.37 ± 2.26	48.60 ± 1.15	63.80 ± 1.98
Withers height, (cm)	69.00 ± 0.98	75.88 ± 1.37	70.50 ± 0.98	77.72 ± 1.37	73.00 ± 0.98	79.79 ± 0.66b	75.80 ± 0.88	82.37 ± 0.58a
Body length, (cm)	67.80 ± 1.92	74.66 ± 0.86b	71.20 ± 1.92	77.74 ± 0.86a	72.13 ± 0.83	81.51 ± 1.28	70.90 ± 0.74	79.99 ± 1.13
Sacrum height, (cm)	72.60 ± 1.01	77.04 ± 1.11	72.60 ± 1.01	77.96 ± 1.11	75.00 ± 0.83	81.19 ± 0.85	77.60 ± 0.74	83.24 ± 0.75
Shoulder length, (cm)	26.00 ± 1.24	28.79 ± 0.44b	25.40 ± 1.24	30.51 ± 0.44a	27.75 ± 0.38	30.62 ± 0.39	27.40 ± 0.34	30.50 ± 0.34
Chest length, (cm)	39.70 ± 1.17	43.40 ± 0.57	39.90 ± 1.17	44.79 ± 0.57	42.00 ± 0.88	45.92 ± 0.73	42.30 ± 0.79	46.96 ± 0.64
Sacrum length, (cm)	24.90 ± 0.69	26.35 ± 0.40	24.20 ± 0.69	26.76 ± 0.40	26.50 ± 0.74	28.09 ± 0.47	25.90 ± 0.66	28.82 ± 0.41
Chest depth, (cm)	27.80 ± 0.88	31.00 ± 0.70	27.10 ± 0.88	30.99 ± 0.70	28.38 ± 0.61	31.67 ± 0.76	29.70 ± 0.55	32.74 ± 0.66
Chest perimeter, (cm)	79.80 ± 1.62	92.29 ± 1.19	79.60 ± 1.62	90.31 ± 1.19	82.25 ± 1.15	95.14 ± 1.25	82.20 ± 1.03	94.49 ± 1.09
Front shin girth perimeter,(cm)	11.90 ± 0.22	11.89 ± 0.32	11.45 ± 0.22	12.11 ± 0.32	12.38 ± 0.18	12.83 ± 0.18	12.10 ± 0.16	12.24 ± 0.16
Leg perimeter, (cm)	38.00 ± 0.99	43.42 ± 1.01	37.90 ± 0.99	43.08 ± 1.01	41.50 ± 0.42	44.17 ± 0.72	41.00 ± 0.38	44.37 ± 0.63
Head length, (cm)	21.20 ± 0.50	22.16 ± 0.51	21.10 ± 0.50	22.84 ± 0.51	22.13 ± 0.38	23.13 ± 0.27	22.70 ± 0.34	23.50 ± 0.23
Forehead length, (cm)	12.20 ± 0.25	12.75 ± 0.37	11.60 ± 0.25	12.86 ± 0.37	12.25 ± 0.42	13.25 ± 0.21	12.90 ± 0.38	13.40 ± 0.19
Forehead width (cm)	12.80 ± 0.24	13.10 ± 0.34	13.00 ± 0.24	13.40 ± 0.34	12.50 ± 0.31	13.78 ± 0.25	13.40 ± 0.28	13.87 ± 0.22
Face length, (cm)	9.00 ± 0.45	9.42 ± 0.31	9.50 ± 0.45	9.98 ± 0.31	9.88 ± 0.27	9.88 ± 0.35	9.80 ± 0.24	10.09 ± 0.31
1st week live weight, (kg)	41.82 ± 0.37		42.94 ± 0.37		52.09 ± 0.77		50.83 ± 0.68	
3rd week live weight (kg)	45.55 ± 0.52		46.45 ± 0.52		56.18 ± 1.37		57.25 ± 1.20	
Total live weight gain, (kg)	10.95 ± 0.72b		13.75 ± 0.72a		16.04 ± 2.26		16.47 ± 1.48	
Daily weight gain, (g)	312.88 ± 20.63b		392.83 ± 20.63a		458.31 ± 64.53		470.50 ± 56.67	

**abc:** Means of the final measurements in the same row within each gender, with different letters differ significantly ( $P < 0.05$ )

in propolis group compared with control group. Final withers height of female for propolis and control group was 75.88 and 70.50 cm, final withers height of male for propolis and control group was 79.79 and 82.37 cm, respectively. Final withers height difference between two groups for males was found significant ( $P < 0.05$ ) but was no significant for females. Besides, body length differences between two groups were found significant only for female calves ( $P < 0.05$ ). Final body length was found 74.66 and 77.74 cm for female calves, 81.51 and 79.99 cm for male calves in control and propolis groups, respectively. Sacrum height, chest and sacrum length were found higher in propolis group than in control group. Sacrum height, chest and sacrum length of female calves in propolis group were 77.96 cm, 30.51 cm and 26.76 cm; 77.04; 43.40; 26.35 cm in control group, respectively. Sacrum height, chest and sacrum length of male calves in propolis group were 83.24, 46.96 and 32.74 cm respectively, 83.24, 46.96 and 32.74 cm respectively in control group. Although, shoulder length was found higher in propolis groups compared with in control groups for females (30.51 cm Vs 28.79 cm) but shoulder length in males was higher in control group (30.50 cm versus 30.62 cm). Chest perimeter both in females and males was higher in control group compared with propolis group (respectively for propolis and control group 90.31 cm versus 92.29 cm in females, 94.49 cm versus 95.14 cm in males). Chest depth was particularly higher in control group for females (31.00 cm versus 30.99 cm), higher in propolis group for males (31.67 cm versus 32.74 cm). Front shin girth perimeter for females was found higher in propolis group compared with control group (11.89 cm versus 12.11 cm), but males showed higher values in control groups compared with propolis group (12.83 cm versus 12.24 cm). Leg perimeter for females in control group (43.42 and 43.08 for control and propolis group), for males in propolis group was particularly high (44.17 and 44.37 for control and propolis group). Head and forehead length, forehead width, face length was higher in both females and males of propolis group compared with control group. Head and forehead length, forehead width, face length

of female calves in control group were 22.16, 12.75, 13.10, 9.42 cm, in propolis group 22.84, 12.86, 13.40, 9.98 cm, respectively. The same measurements of male calves in control group were 23.13, 13.25, 13.78 and 9.88 cm, in propolis group were 23.50, 13.40, 13.87 and 10.09 cm. On the other hand, during trial period, diarrhea events were observed in control group also one male calf died. But, it had not observed any diarrhea events in propolis group (Table 3). Fecal score in propolis group differed significantly than control group in second and third week ( $P < 0.05$ ). It was observed that after weaning the calves in propolis group remained with the score close to 1, with an indication of health in calves.

## Discussions

The main cause of body weight loss, delaying growth, even calf loss during neonatal period is diarrhea originated from *E. coli* [19]. According to Webster [1], calves primarily should stay alive before weaning then they should be prevent from severe diseases in order not to delaying of growth. Likewise, Kaya et al. [20] have found higher daily live gain in calves which were reared with acidified whole milk because of any diarrhea event was no realized compared with in calves which were reared normal milk. But, researcher reported that daily weight differences between these groups found to be non significant. The literature considers that the calf has diarrhea when fecal score is above 3 Larson et al. [16]. Most of the fecal score data observed throughout the experimental period of propolis group, was below 2, confirming propolis prevent calves from diarrhea and improve live weight gain and growth. Likewise, Kwon et al, [12] reported that propolis could be use for both preventive and treatment in neonatal calf diarrhea. Also Kaal [18], Greceanu and Enciu [21] reported that propolis was very effective natural product for many pathogen bacteria types. Hegazi and Abd El-Hady [22] reported that propolis has positive effect on growth of livestock. Besides, Corleteanu [23] found that calves treated with propolis have better growth performance than calves in

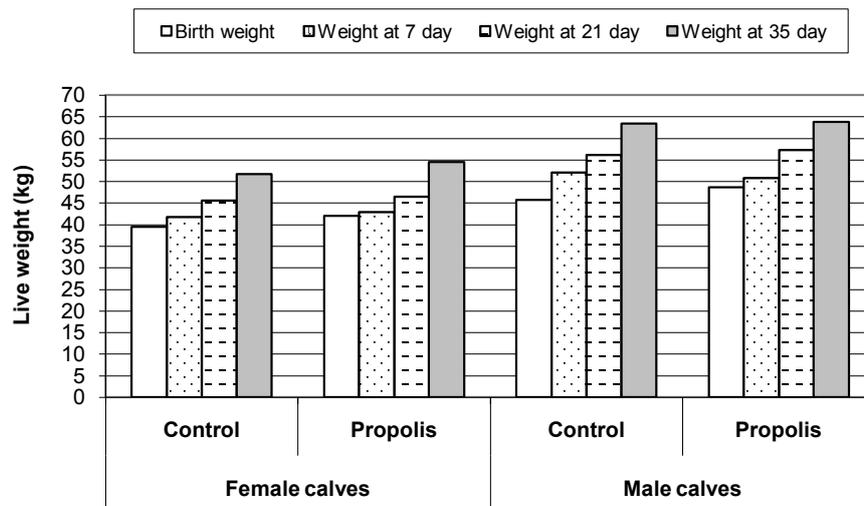


Figure 1: Live weight in control and propolis groups according to gender.

**Table 3:** Fecal score of calves (1=normal – 4=watery).

Week	Fecal Score	Female (%)		Male (%)		General (%)	
		Control	Propolis	Control	Propolis	Control	Propolis
1	1	30	50	44.4	44.4	36.8	47.4
	2						
	3	10			11.1	5.3	
	4	10				5.3	
P		0.287		0.343		0.361	
2	1		30	11.1	44.4	5.3	36.8
	2		20	11.1	11.1	31.6	15.8
	3	50		22.2		10.5	
P		0.04		0.155		0.02	
3	1	10	50	11.1	55.6	10.5	52.6
	2	40		22.2		31.6	
	4			11.1		5.3	
P		0.01		0.06		0.002	
4	1	50	50	22.2	55.6	36.8	52.6
	2			11.1		5.3	
	4			11.1		5.3	
P				0.2		0.289	
5	1	50	50	22.2	55.6	36.8	52.6
	2			11.1		5.3	
	4			11.1		5.3	
P				0.2		0.289	

control group whereas Sarker and Yang [24] found lowest weight observed in propolis fed calves, controversial.

### Conclusion

As a result of this study, it was shown that propolis serve to rear healthy calves and also improve live weight gain and growth. In our study, very low dose (2 cc) propolis tincture has been given to calves. In order to show its effect on growth exactly, different doses of propolis should be used in trials. But, it is evident that propolis is a suitable natural product for ecological animal production.

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