

## Effect of colostrum feeding on the serum immunoglobulin level in Saanen crossbred kids

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### Abstract

Generally the immune system of ruminant neonates is poorly developed and even during the pregnancy period maternal antibodies are unable to pass to the fetus. The offspring will be protected from the diseases if they received enough immunoglobulin present in the colostrum. The objective of the study was to determine the serum immunoglobulin G concentration in kids fed with single or divided doses of good quality colostrum. Ten newborn Saanen crossbred kids were divided equally into two groups fed with 200 ml of colostrum once within the first hour (0 hr) post kidding (C200-1, n=5) or 100 ml colostrum twice within the first hour and eight hours post kidding (C100-2, n=5). The amount of colostrum collected from the doe offered to the kids was calculated based on 10% of the kid's body weight. Results showed that the mean body weights of kids were not significantly different ( $P>0.05$ ) among the feeding groups. There was also no significant difference ( $P>0.05$ ) between C200-1 and C100-2 groups for Ig G concentration in blood serum at kidding, 8, 24, 40, 192, 288, 360 and 720 hours post kidding and calculated Apparent Efficiency Absorption (AEA) after 40 hours of first feeding. Concentration of Ig G in blood serum and AEA after 40 hours of first feeding of C100-2 group were higher ( $P>0.05$ ) than those of C200-1 group. This study recommends that Saanen crossbred neonates be fed with colostrum twice (0 and 8 hours) on the first day of their life to make sure they received adequate amount of Ig G for their later immunity.

**Key words:** Colostrum, Immunoglobulin G, Apparent Efficiency Absorption

### Introduction

Newborns of cattle and goat do not have an immune system due to their type of placentation, whereby the antibodies from the dam are unable to pass to the fetus during the pregnancy period (Morrison, 1986). However, antibodies, also known as immunoglobulin, accumulate and are excreted through the milk as colostrum (Waterman, 1998). The concentration of immunoglobulin in the milk will determine the quality of the colostrum, and it can be classified as high, medium or low quality colostrum (Fleener and Stott, 1979). The colostrum is produced after parturition for the first 3 days, and the concentration of the immunoglobulin decreases in the post kidding period (Waterman, 1998).

The newborns receive passive immunity from colostrum, and this will prevent and protect them from becoming susceptible to infectious diseases or fight against any pathogens (Dale *et al.*, 2009). The immunoglobulin stays in the newborn blood circulation for a certain period until their immune systems start to develop. The high survival rate or mortality of the newborns is very much dependent on the colostrum intake. The newborns will receive adequate amount of immunoglobulin if they are fed with adequate quantity of high quality colostrum immediately after birth. Most of the researchers had focused on calves, where the study was conducted to determine the quantity of colostrum for maximum immunoglobulin absorption (Stott *et al.*, 1979c; Jaster, 2005). The objective of this

study was to determine the quantity and frequency of feeding high quality colostrum to newborn kids.

## Materials and Methods

### *Animals and Treatments*

The study was carried out at Field 2, Animal Science Department, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Selangor, Malaysia. Ten newborn Saanen crossbred kids were used and assigned in a completely randomized design to two treatment groups: the first group fed with 200 ml of colostrum once within half an hour after kidding (time 0 hr) (C200-1) and the second group fed with 100 ml colostrum twice within half an hour after kidding and eight hours later (time 8 hr) (C100-2). At the other feeding periods, kids were given fresh milk.

The amount of colostrum fed to kids was calculated based on the recommendation that kids should consume colostrum equivalent to about 10% from their body weight (Schoenian, 2009). Immediately after birth, the kids were separated from their does to make sure the kids received the right amount of colostrum according to the treatment. The kids were then hand-fed until weaned on fresh milk.

Colostrum given to the kids was measured immediately using a colostrometer to estimate its quality. High quality colostrum contains higher than 50 mg/ml of immunoglobulin G, moderate quality colostrum contains between 22 to 50 mg/ml of Ig G and poor quality colostrum has Ig G concentration lower than 22 mg/ml. Accurate reading of colostrum quality was done to ensure that adequate amount of colostrum was fed to the kid. Colostrum obtained from the does was of excellent quality. Excess colostrum was stored at -20°C and used to replace the medium or poor quality colostrum

so that all kids received only high quality colostrum according to the treatment

### *Samplings and IgG Analysis*

Blood was collected from the kids via jugular vena puncture at 0 (immediately after kidding), 8, 24, 40, 192, 288, 360 and 720 hours post kidding prior to feeding with colostrum or whole milk. Blood was collected at an 8-hour interval until 40 hours of life. Further blood collection was conducted at 192, 288, 360 and 720 hours. Blood samples were chilled overnight at 4°C storage temperature. Serum from the blood and colostrum were separated by centrifuging at 500 g for 5 minutes and later stored at -20°C for further analysis.

The colostrum and milk were centrifuged at 13000 g for 10 minutes. Supernatant was separated and stored at -20°C for further analysis. Both serum and supernatant were measured for IgG using Enzyme-Linked Immunosorbent Assay (ELISA) kit (IMMUNO-TEK Goat IgG) as suggested by Chigerwe *et al.* (2005).

### *Data Analysis*

Data were analyzed as one-way ANOVA with repeated measures for 2 factors, time of feeding and dosage of colostrum, on serum IgG concentration using SPSS 16.0 Statistical Package 2007.

## Results and Discussion

Table 1 shows the weekly body weight of the kids between treatments, C200-1 and C100-2, from day 1 (week 0) until the fourth week. The initial mean birth weight for C200-1 and C100-2 groups were 2.24 kg and 2.38 kg, respectively. The mean body weight of kids was not significantly different ( $P>0.05$ ) between the treatment groups.

Table 1. The weekly mean body weight (kg ± SE) of kids fed with single dose (C200-1) and divided dose (C100-2) of colostrums

Treatment	Week				
	0	1	2	3	4
C200-1	2.24 ± 0.14	3.10 ± 0.18	3.70 ± 0.29	4.20 ± 0.39	4.44 ± 0.48
C100-2	2.38 ± 0.39	3.15 ± 0.42	3.72 ± 0.51	4.24 ± 0.50	4.39 ± 0.56

Figure 1 shows the ADG between treatment groups throughout the experimental period. There was no significant

difference (P>0.05) in the ADG between the treatment groups, with C100-2 group (78.04 g) higher than C200-1 group (74.86 g).

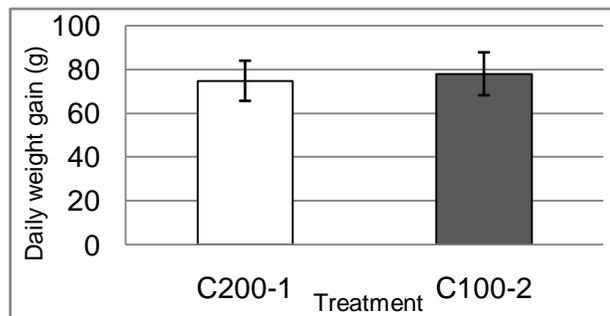


Figure 1. Average daily weight gain of kids fed with single dose and divided dose of colostrum

Table 2 shows that there was no significant difference (P>0.05) between the treatments, C200-1 and C100-2, in serum Ig G concentration of kids at every hour of blood collection. Table 3 shows that the maximum Ig G concentration within 40 hours post birth was at 40<sup>th</sup> hour for the C200-1 treatment group and 24<sup>th</sup> hour for the C100-2 treatment

group. The trend of rising Ig G concentration with time in both treatment groups within the 40 hours post kidding. The Ig G concentration 24 hours after birth showed that C100-2 treatment group had a higher concentration than C200-1 treatment group. The concentration of the Ig G fluctuated at hours 192, 288, 360 and 720.

Table 2. The mean Ig G concentration (mg/ml±se) in blood serum according to time (hours) of kids fed with single dose (C200-1) and divided dose (C100-2) of colostrums

Treatment	Time (hours)						
	8	24	40	192	288	360	720
C200-1	20.9±4.96	30.0±9.61	33.6±5.65	37.0±10.64	34.2±8.29	36.1±11.12	35.8±13.33
C200-2	26.0±5.94	35.5±15.46	31.4±10.84	30.6±8.78	44.3±12.39	21.7±8.15	27.7±11.15

Table 3 shows the AEA of Ig G in kids between treatment groups, C200-1 and C100-2, was not significantly different ( $P>0.05$ ). Treatment

group C100-2 showed higher percentage of AEA than C200-1.

Table 3. The mean of Apparent Efficiency of Absorption (AEA)(percentage  $\pm$ SE) of Ig G in kids 40 hours after first colostrum meal

Treatment	AEA (%)
C200-1	37.43 $\pm$ 6.31
C100-2	46.71 $\pm$ 16.12

Body weight at birth and at weekly intervals for the duration of four weeks showed that kids fed with a single dose or a divided dose of colostrum displayed a similar trend of body weight increment with time. This could be due to the similar amount of colostrum that the kids received in the first day of their life, but different proportion they received in their first hour of life. This result further supported the finding of Jaster (2005), who also found no significant difference in body weight in calves fed with different amounts and concentration of Ig G. In Canary Caprine kids (Arguello *et al.*, 2004) and in lambs (Bekelele *et al.*, 1992) it was shown that no significant difference in Ig G concentration in blood was indicated on birth weight below 1.5 kg with birth weight over 3 kg.

Throughout the present study, ADG of the kids in C200-1 and C100-2 treatment groups was not significantly different with each other. But the ADG of C100-2 treatment group was 4.24 % higher than C200-1 treatment group. This might probably be due to their mean birth weight been higher than the C200-1 treatment group. Larger body weight will have higher average daily weight gain compared smaller body weight (Vincent, 2005).

The rate and pattern of colostral immunoglobulin in blood serum of the kids were dependent on the concentration of Ig G in the colostrum they consumed (Matte *et al.*, 1982). The quality of colostrum was given in this study was 95.26 mg/ml for C200-1 treatment group and 75.99 mg/ml for C100-2

treatment group. The quality of the colostrum given was excellent (more than 50 mg/ml Ig G). Although the concentrations of Ig G in blood serum of kids for both treatment groups were not significantly different, but the C100-2 treatment group was higher in Ig G compared with C200-1 treatment group. This was probably be due to the kids in C100-2 treatment group received high quality colostrum at the second feeding whereas the C200-1 treatment group only consumed fresh milk containing low level of Ig G beyond the first feeding onward.

These results on the Ig G concentration generally supported the previous study on calf's Ig G concentration (Jaster, 2005) who found the Ig G concentration in newborns fed two times or divided dose was significantly higher in calves. AEA of C100-2 treatment group was 24.79% higher than C200-1 treatment group. This phenomenon occurred probably due to various factors such as the Ig G concentration in the colostrum, maturation of intestinal cells, increased abomasal activity, and development of intestinal secretions (digestive enzymes) (Staley, 1985). In calves, Stott and Fellah (1983) reported that calves that were fed 1 L of colostrum absorbed Ig G more efficiently than the calves fed the same mass of Ig G in 2 L. The excessive amount of colostrum might have caused inhibition in immunoglobulin absorption, particularly with increase of time (age) (Stott *et al.*, 1979c). Stott *et al.* (1979c) also proposed that 2 L of colostrum may be the maximum or optimum amount to be fed to calves. A limited number of surface receptors carries Ig G from the

intestinal wall to the blood stream. There is no longer a means of Ig G to be transported when all receptors become saturated (Jaster, 2005). Moreover, when a newborn is fed with large amount of low quality of colostrum there is no adequate absorption. Thus, these factors would similarly affect kids because they are in the same group type of placentation.

### Conclusion

The Ig G concentration and apparent efficiency of absorption of Ig G were higher in kids fed with divided dose of good quality colostrum of 100 ml at 0 hour and 8 hours later compared to the kids fed 200 ml colostrum at one time at birth.

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