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ORIGINAL ARTICLE

Effects of different weaning programs on growth of Saanen kids

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ABSTRACT

The aim of the study reported here was to compare the performances of kids reared according to three different weaning programs. In the first program (T1), the dams were not milked in the evening and the kids accompanied their dams from 17.00 hours until the next morning. In the second program (T2), the dams of the kids were milked at 17.00 hours and then the kids accompanied their dams until the next morning, being separated from their dams at 08.00 hours. In the third program (T3), the kids were subjected to the T1 program for the first 4 weeks of the study, and to the T2 program for the last 4 weeks of the study. The kids in all the groups were weaned at 8 weeks of age. The weaning programs had significant effects on average daily weight gains (ADG) of the kids during weeks 1–4 and weeks 1–8 of the study ($P < 0.05$). In the weeks 1–8 period, the kids on the T1 program had a higher ADG than those on the T2 program ($P < 0.05$). However, the kids on T1, T2 and T3 programs had similar ADG post-weaning. The dry matter intake of the starter feed of the kids of the T3 program was higher than that of the kids of the T1 and T2 programs. The results of the present study indicated that the three weaning programs did not result in any significant effect on the growth of Saanen kids. Hence, the T3 program can be used if the starter feed intake is desirable.

Key words: *dairy goat, growth, weaning.*

INTRODUCTION

Goat milk is a valuable product. Weaning kids in a reasonably short period of time is important for the conservation of goat milk. However, the farmer has an ethical duty to meet the nutrient requirements of the animals. Therefore, kids should be reared so as to obtain maximum performance at a low cost. The milk feeding of kids starts with the consumption of colostrum postpartum. Different milk feeding programs can be used (Morand-Fehr *et al*. 1982; Keskin & Bicer 2001; Genandoy *et al*. 2002; Ferreira & Thornton 2004; Ugur *et al*. 2004; Pala *et al*. 2005). The results of various studies indicate that a milk feeding program does not affect the health and growth of kids negatively, but the stimulation of concentrate feed consumption is recommended (Morand-Fehr *et al*. 1982; Genandoy *et al*. 2002; Ferreira & Thornton 2004; Ugur *et al*. 2004; Pala *et al*. 2005). Animals which consume enough concentrate feed in addition to enough milk perform higher than those which do not (Morand-Fehr *et al*. 1982). In addition, the rumen of animals develops faster in those that consume enough concentrate feed in the early period (Zitnan *et al*. 1999). Programs used in kid rearing should stimulate feed intake. Davis *et al*. (1998) reported that feeding with a restricted amount of milk stimulated the starter feed intake of kids.

Small dairy ruminants produce 25% of their total milk in 30 days of lactation (McKusick *et al*. 2001). Therefore, kid rearing should be productive in order to benefit from the milk of high yielding animals in farms where kids are naturally reared by suckling their dams. This study had two aims: (i) the comparison of

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kids who suckle the full udder of their dams in the morning and evening with those that suckle the full udder in the morning and an empty udder in the evening; and (ii) the effect of a reduction in the amount of suckled milk in the second half of the program on the growth of kids.

MATERIALS AND METHODS

A total of 34 Saanen kids born at Yahya Cavus Research and Training Center, Faculty of Agriculture, Canakkale Onsekiz Mart University, were used in the present study. The kids spent three days with their dams (eight dams for each group) following parturition. The kids were allocated to one of the three treatment groups 3 days after birth. Each group was housed in a $6 \times 6 \times 2.2$ m indoor stall. Each stall was divided into two sections, one for the dams and one for the kids. The kids were able to enter the dams' sections through a special gate. The dams were confined to their own section. The kids were allocated to treatment groups based on their birth weight, gender and birth type. The rearing programs are described below:

Treatment 1 (T1)

The dams were not milked in the evening and the kids accompanied their dams from 17.00 hours until the next morning. The kids were separated from their dams at 08.00 hours. Then the dams were milked by hand. The kids were weaned at 8 weeks of age.

Treatment 2 (T2)

The dams were milked at 17.00 hours. Following the milking, the kids accompanied their dams overnight. The dams were not milked in the morning and were separated from the kids at 08.00 hours. Then the dams were milked. The kids were weaned at 8 weeks of age.

Treatment 3 (T3)

The kids in this treatment were subjected to the T1 program for the first 4 weeks of the study and to the T2 program for the last 4 weeks of the study, then weaned at 8 weeks of age.

The daily milk yield of dams was measured 4 weeks after parturition as the milk yield control of the dams. Starter feed and roughage were offered *ad libitum* to kids from the first week of the study onwards. The recording of starter feed intake was on a group basis and started when all the groups had their final number of kids. The starter feed intake of the kids was recorded from weeks 3 to 10 of the study, and the roughage (vetch hay) intake of the kids was recorded from weeks 8 to 10 of the study. The nutrient compositions of the feeds were determined as described by the Association of Official Analytical Chemists (AOAC) (1990) and is presented in Table 1. The kids were weighed weekly and their live body weights (BW) were recorded. In addition, the withers height and chest girth of the kids were taken at 1, 4, 8 and 12 weeks of age. The study was terminated when the kids reached 12 weeks of age.

Table 1 Chemical composition of starter feed and roughage

Nutrients	Starter feed	Roughage
DM (%)	87.80	91.90
Ash (% DM)	7.85	9.03
Ether extract (% DM)	4.32	2.91
Crude fiber (% DM)	10.02	31.44
Crude protein (% DM)	17.31	16.21
NFE (% DM)	60.50	40.41

DM, dry matter; NFE, nitrogen-free extract.

Traits analyzed were BW, ADG, total gains in withers height (WHG) and total gains in chest girth (CGG). Data were analyzed using the GLM procedure of SAS (1999). All two–way interactions were included in the initial model; those found to be non-significant were deleted in later analyses. Because there were numerous contrasts to be made in the interaction comparisons, difference tests were adjusted by the Tukey (1953) method. Since the data were unbalanced, adjustments were approximated using a method defined by Kramer (1956).

The statistical model was:

$$Y_{ijklm} = \mu + A_i + B_j + C_k + D_l + E_m + Ac_{ik} + BC_{jk} + e_{ijklm}$$

where;

Y_{ijklm} = BW, ADG, WHG, CGG,
μ = overall mean,
A_i = effects due to gender of the kid (male, female),
B_j = effects due to birth type (single, twin),
C_k = effects due to treatment (1, 2, 3),
D_l = covariate, age of dam in months,
E_m = covariate, first milk control of the dam,
AC_{ik} = effects due to interaction between gender and treatment,
BC_{jk} = effects due to interaction between birth type and treatment,
e_{ijklm} = random error term.

RESULTS

Data on BW and weekly ADG are presented in Table 2. The treatments did not result in any significant change on the final live BW of the kids in all the treatment groups (Table 2). The treatments had significant effects on ADG at 1–4, 1–8 and 4–8 weeks ($P < 0.05$). In the period 1–8 weeks, the ADG of the T2 kids was lower than that of the T1 kids ($P < 0.05$) but was similar to the ADG of the T3 kids. There was no significant difference between the ADG of the T1 and T3 kids in the 1–8 week period. In the post-weaning period, the ADG of the T3 kids tend to be higher than that of the T1 and T2 animals. The least square means of the ADG of the T1, T2 and T3 kids for 1–12 weeks were 185 ± 4, 172 ± 4 and 174 ± 5 g, respectively. The ADG of T1, T2 and T3 kids were close to each other.

The WHG of the T1 kids was higher than that of the T2 and T3 kids for 1–4, 1–8 and 1–12 weeks of age (Table 3). However, this difference was not significant. The effects of treatments on CGG were not statistically significant for 1–4, 1–8 and 1–12 weeks of age. However, the CGG of T1, T2 and T3 kids were different for weeks 4–8 ($P < 0.05$).

In the study, the dry matter intake of the starter feed was determined on a group basis. The kids of the T3 group consumed more starter feed than those of T1 and T2 for weeks 3–4, 4–5, 4–6 and 8–10 . The increased consumption of starter feed in T3 kids became more apparent from 4 weeks onwards (Table 4). The feed efficiency (DM consumed, kg/weight gain, kg) of the T1, T2 and T3 groups for weeks 8–10 was 4.6, 3.9 and 3.8, respectively.

The male kids developed better than the female kids (Tables 2,3). The ADG, WHG and CGG of male kids were generally higher than that of the females. In contrast, the WHG of female kids for weeks 1–4 was higher than that of male kids. No incidence of morbidity or mortality of kids was observed throughout the study.

DISCUSSION

The ADG of T1 and T3 kids for weeks 1–4 were similar. In contrast, the ADG of T1 and T2 kids and of T2 and T3 kids were statistically different ($P < 0.05$). Similarly, the WHG and CGG of T1 and T3 kids were higher than those of T2 kids. However, the difference among the treatments was not statistically significant (Table 3). These findings are normally to be expected. In fact, the kids of the T1 and T3 groups suckled the full udder of their dams both in the morning and the evening for the first 4 weeks of the study. In contrast, the kids of T2 group suckled the full udder only in the morning and suckled the empty udder of their dams in the evening.

Table 2 Live weight and daily weight gains of kids

Parameter	Treatments			Gender	
	T1 $n = 11$ $\overline{X} \pm S_{\overline{X}}$	T2 $n = 11$ $\overline{X} \pm S_{\overline{X}}$	T3 $n = 12$ $\overline{X} \pm S_{\overline{X}}$	Male $n = 16$ $\overline{X} \pm S_{\overline{X}}$	Female $n = 18$ $\overline{X} \pm S_{\overline{X}}$
Weights (kg) at:					
Birth	4.1 ± 0.1	3.8 ± 0.1	3.8 ± 1.2	4.2 ± 0.1	3.7 ± 0.1**
Weaning	15.3 ± 0.7	13.9 ± 0.7	15.0 ± 0.8	15.6 ± 0.6	13.8 ± 0.6*
Final	18.9 ± 0.9	17.7 ± 0.9	19.0 ± 1.0	19.9 ± 0.8	17.2 ± 0.7*
Daily weight gains for weeks (g):					
1–4	212 ± 8[a]	187 ± 8[b]	218 ± 9[a]	219 ± 7	192 ± 6*
1–8	190 ± 7[a]	165 ± 7[b]	170 ± 8[ab]	190 ± 7	165 ± 7**
1–12	185 ± 4	172 ± 4	175 ± 5	194 ± 4	161 ± 3**
4–5	200 ± 15	206 ± 15	201 ± 17	220 ± 15	201 ± 17
4–6	225 ± 11	190 ± 11	193 ± 13	230 ± 10	175 ± 9**
4–8	221 ± 11[a]	189 ± 11[b]	175 ± 12[bc]	216 ± 9	175 ± 8**
4–12	175 ± 6	167 ± 6	158 ± 7	185 ± 5	149 ± 5**
8–10	148 ± 21	156 ± 21	175 ± 24	170 ± 18	150 ± 16
8–12	133 ± 9	142 ± 9	147 ± 10	154 ± 8	127 ± 7*

Significant differences between male and female are indicated by *$P < 0.05$; **$P < 0.01$. [a,b,c]Row values with different superscripts differ ($P < 0.05$). T1, the dams were not milked in the evening and the kids accompanied their dams from 17.00 hours until the next morning; T2, the dams were milked at 17.00 hours and then the kids accompanied their dams until they were separated from them at 08.00 hours; T3, the kids were subjected to the T1 program for the first 4 weeks of the study, and to the T2 program for the last 4 weeks of the study.

Table 3 Total gain in withers height and chest girth of kids

Week	Treatments			Gender	
	T1 $n = 11$ $\bar{X} \pm S_{\bar{x}}$	T2 $n = 11$ $\bar{X} \pm S_{\bar{x}}$	T3 $n = 12$ $\bar{X} \pm S_{\bar{x}}$	Male $n = 16$ $\bar{X} \pm S_{\bar{x}}$	Female $n = 18$ $\bar{X} \pm S_{\bar{x}}$
Withers height (cm):					
1–4	8.2 ± 0.4	6.6 ± 0.4	8.0 ± 0.7	7.0 ± 0.5	8.2 ± 0.5
1–8	11.8 ± 0.6	10.3 ± 0.6	11.5 ± 0.6	11.6 ± 0.5	10.9 ± 0.4
4–8	3.6 ± 0.6	3.6 ± 0.6	3.5 ± 0.6	4.1 ± 0.5	2.6 ± 0.4**
8–12	6.0 ± 0.9	5.6 ± 0.8	4.7 ± 1.0	6.5 ± 0.8	4.3 ± 0.7*
Chest girth (cm):					
1–4	12.5 ± 0.9	11.9 ± 0.9	14.9 ± 1.0	14.7 ± 0.8	11.5 ± 0.7**
1–8	17.4 ± 0.9	16.8 ± 0.9	17.6 ± 1.0	19.3 ± 0.8	15.3 ± 0.7**
4–8	4.9 ± 0.3[a]	4.8 ± 0.3[a]	2.7 ± 0.4[b]	4.6 ± 0.4	3.7 ± 0.4
8–12	5.3 ± 0.8	5.2 ± 0.8	5.0 ± 0.9	5.0 ± 0.7	5.4 ± 0.6

Significant differences between male and female are indicated by $*P < 0.05$; $**P < 0.01$. [a,b]Row values with different superscripts differ ($P < 0.05$). T1, the dams were not milked in the evening and the kids accompanied their dams from 17.00 hours until the next morning; T2, the dams were milked at 17.00 hours and then the kids accompanied their dams until they were separated from them at 08.00 hours; T3, the kids were subjected to the T1 program for the first 4 weeks of the study, and to the T2 program for the last 4 weeks of the study.

Table 4 Starter feed intake on a g/kid/day (group basis)

Week	Treatments		
	T1	T2	T3
3–4	7.3	8.2	9.5
4–5	16.0	14.8	20.6
4–6	14.3	15.4	21.4
8–9	242.3	198.5	300.2
8–10	265.5	231.3	318.4

T1, the dams were not milked in the evening and the kids accompanied their dams from 17.00 hours until the next morning; T2, the dams were milked at 17.00 hours and then the kids accompanied their dams until they were separated from them at 08.00 hours; T3, the kids were subjected to the T1 program for the first 4 weeks of the study, and to the T2 program for the last 4 weeks of the study.

The effect of the treatments on ADG for weeks 4–6 was not statistically significant. Likewise, the treatments had no effect on ADG for weeks 4–12, 8–12 and 1–12. The ADG of T1, T2 and T3 kids for weeks 1–12 were very close to each other (Table 2). The ADG of kids of all the groups for weeks 1–12 were higher than those reported by Goetsh *et al*. (2001), Ferreira and Thornton (2004) and Ugur *et al*. (2004).

The ADG for 8–10 weeks of T1, T2 and T3 kids were 148 ± 21, 156 ± 21 and 175 ± 24 g, respectively. The kids of the T3 group had the highest growth rate in this period. Such a trend is also apparent for weeks 8–12 (Table 2). The kids of the T3 group had a different suckling program after 4 weeks of the study. In this regard, the kids who suckled the full udder of their dams both in the morning and the evening throughout the first 4 weeks of the study were allowed to suckle their dams after the evening milking. This change, most probably, stimulated starter feed intake. However, the numerical difference in the ADG of the T3 kids over the T1 and T2 kids was not statistically significant. Similar findings with calves were also reported by Yanar *et al*. (1997).

Weaning is one of the crucial events in the life of kids (Morand-Fehr *et al*. 1982; Ugur *et al*. 2004). Kids have to meet their nutrient requirements from dry feeds after this process. Therefore, kids that are good at consuming dry feed at the time of weaning have advantages. In addition, getting kids accustomed to dry feed as early as possible is important for their physiological development (Zitnan *et al*. 1999). The findings of the present study indicate that the kids of the T3 groups were better in starter DM intake around weaning (Table 4). The starter intake of the T3 kids for 3–4 weeks was 16% and 30% higher than that of the T2 and T1 kids, respectively. The increase in starter DM intake by the T3 kids was more apparent from week 4 onwards. The kids of the T3 group consumed 59% and 117% more starter DM intake than T1 and T2 kids for weeks 4–8 . The average starter DM intakes of the T1, T2 and T3 groups for weeks 8–9 were 242.3, 198.5 and 300 g, respectively.

The kids of the T2 group consumed less dry feed than T1 and T3 kids (Table 4), therefore utilizing feed more efficiently, and had a similar growth performance post-weaning (Tables 2,3). In addition, the

starter DM intake of the T2 kids was higher than the findings reported by Goetsh *et al*. (2001) and similar to the findings of Genandoy *et al*. (2002).

Conclusion

The results of the present study indicate that three rearing programs did not result in any significant effect on the growth of Saanen kids. However, it suggestes that the T3 program can be preferred if the starter feed intake of kids is to be ensured.

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