IJAS Iranian Journal of Applied Animal Science

Performance and Measures of Stress in Lambs Weaned at 45 and 90 Days

Short Communication

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Received on: 24 Jan 2015
Revised on: 20 Apr 2015
Accepted on: 14 May 2015
Online Published on: Dec 2015

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Online version is available on: www.ijas.ir

ABSTRACT

A study was conducted to evaluate effects of age at weaning on various growth characteristics and stress measures of Zandi lambs. The lambs were weaned at 45 and 90 days of age. The body weights and average daily gain (ADG) were monitored during the experimental period and 5 months of age. Cortisol, glucose, blood urea nitrogen (BUN) and lamb behavior (agitation, vocalization) were recorded before and after weaning. After separation, lambs weaned at 45 d of age had greater agitation scores and bleats. Furthermore, serum cortisol, glucose and BUN concentration were higher for lambs at a weaning age of 45 d. The ADG and weaning and 5-months weights were similar. The results of the present study indicated that there is no significant difference in the growth traits of Zandi lambs, weaned at 45 or 90 days of age, and suggested that lamb could be weaned at 45 days of age.

KEY WORDS growth, lamb, stress, weaning.

INTRODUCTION

The traditional management practice of early weaning is used to improve production efficiency by maximizing the reproductive potential of the dam and allows for marketing or specialized feeding of offspring (Myers *et al*. 1999) and by maximizes the quantity of milk available to humans. It is possible to increase milk quickly by early weaning of lambs and feeding with starter feed, a well-proven practice (Todorov, 2012). Early weaning imposed by the breeder, however can induce an important stress for ewe and lamb (Orgeur *et al*. 1997). Some stressors can induce suppression on some aspects of the immune system having negative effects on animal health, welfare (Orgeur *et al*. 1997) and performance, as the release of glucocorticoid hormones coincides with a decrease in growth hormones (Kuhn *et al*. 1990). A reduction in growth rate may also result from the decrease of the quantity of food ingested or from an impairment of digestive function caused by weaning stress. Few existing studies concerning the effects of early weaning on growth and behavioral traits of calves (Myers *et al*. 1999; Price *et al*. 2003; Haley *et al*. 2005) but limited reported data on the early weaning in lamb are available (Piccione *et al*. 2007; Piccione *et al*. 2013). Therefore the aim of this study was that early weaning of Zandi lambs will not reduce growth rate or increase stress levels in lambs compared to normal-age weaned lambs. The aim is then to examine the hypothesis using weight, behaviour and blood sampling.

MATERIALS AND METHODS

The study was conducted with 20 male and single born Zandi lambs, reared in the Research Farm of Faculty of Agriculture, University of Tehran, whcih were weaned at 45 (group A) or 90 (group B) days of age (10 lambs for

each group). After birth, the lambs remained with their dams for 1 week. From the second week to 45 or 90 days of age, they were allowed to spend the night with their dams and removed before their dams went to pasture in the morning. The lambs were also offered starter and good quality hay (alfalfa) in this period. Roughage and concentrate feed were given *ad libitum*.

At age of 45 or 90 d, lambs weaned gradually and separated from dams in two days. At the first and second days before weaning, lambs were removed from their dams for 2 and 4 h, respectively. At the third day, lambs were separated completely from their mothers by moving them to a different barn with pens, prohibiting visual contact and vocal communication.

For behavioral observations, lambs were observed for 3 h/d (from 0900 to 1200). Observations began 2 d before weaning, and were continued for 4 d after weaning. Scan sampling (Schichowski *et al*. 2008) was used at 30 min intervals to count the total number of vocalizations (bleats) from each lamb for 1 min, on a rotating basis (Schichowski *et al*. 2008). At the start of each 30-min interval, scores for agitation were recorded for each lamb. Three different scores were used: 0= no agitation ('normal' behavior, i.e. feeding, resting, lying, standing or play behavior), 1= agitation (no 'normal' behavior, i.e. moving around, head or leg moving) and 2= high agitation (continuously moving, restlessness, vocalization).

Blood samples were taken from the jugular vein of lambs 2 d before weaning and were continued for 4 d after weaning. The serum was separated after centrifugation at 1800 g for 10 min and stored at -18 ˚C until analysis. Stored serum samples were analyzed for cortisol, glucose and BUN by commercial kits (Pars Azmoon, Tehran, Iran) using the spectrophotometer (Jenway, 6105, Jenway, Felstead, England). Live weight was recorded at birth, weaning and 5 months of age. The data were analyzed by SAS 9.1 version statistical package (SAS, 2002). Because blood metabolites and behavioral data (bleat/min and agitation score) measured over time, a repeated measures approach using ANOVA with mixed linear models in SAS was used. The statistical model that using in this study was:

$$Y_{ijk} = \mu + D_i + C_{(i)j} + T_k + (D \times K)_{ik} + \varepsilon_{ijk}$$

Y_{ijk}: dependent variable.
μ: overall mean.
D_i: effect of treatment.
$C_{(i)j}$: random effect of lamb.
T_k: effect of sampling time.
$(D \times K)_{ik}$: interaction between treatments and sampling time,
ε_{ijk}: experimental error.

When differences were significant ($P<0.05$), means were separated using Duncan's test. All housing and care conformed to the standard recommended by the "Guide for the care and use of laboratory animals" and directive 86/609CEE.

RESULTS AND DISCUSSION

The results of various weights of lambs at birth, weaning, and 5 months of age, including ADG from birth to 5 months of age are presented in Table 1. No differences were observed in weight of lambs at birth, weaning or at 5 months of age. The ADG between birth and 5-month of age did not differ between lambs weaned at an age of 45 or 90 d.

Table 1 Weights and average daily gain (ADG) of lambs weaned at 45 and 90 d

Parameter	Group A (45)	Group B (90)	SEM	P-value
Birth weight (kg)	3.60	3.54	0.15	0.78
Weaning weight (kg)	17.57	19.61	1.12	0.15
5 months (kg)	36.58	37.43	2.05	0.76
ADG birth-5 months (g/d)	193.5	205.7	35.0	0.47

SEM: standard error of the means.

Number of bleats was greatest in lambs weaned at an age of 45 d ($P<0.05$; Figure 1).

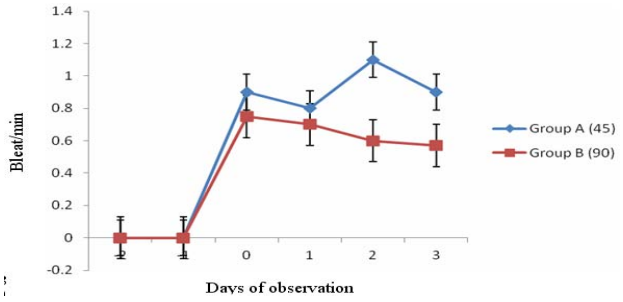

Figure 1 Differences between bleats / min (every 30 min between 0900 and 1200) before (d -1 to -2) and after weaning (d 0 to 3). Day 0 is when lambs were separated from their dams, completely

No vocalization occurred on the days before weaning. Animals weaned at an age of 45 d showed greater scores of agitation compared to animals weaned at an age of 90 d ($P<0.05$). All groups showed no agitation before weaning (Figure 2).

Age of weaning affected blood cortisol, glucose and BUN concentration ($P<0.01$). Lambs weaned at 45 days had higher levels of the hormone and metabolites (Table 2). The age of bleeding affected cortisol concentration without any effects on glucose and BUN content. The serum level of cortisol was higher before weaning and decreased after weaning (Figure 3).

Table 2 Blood metabolites of lambs weaned at 45 and 90 d

Parameter	Group A (45)	Group B (90)	SEM	P-value	
				Group	Day
Cortisol (ng/mL)	1.55	0.91	0.07	< 0.001	0.02
Glucose (mg/dL)	58.8	51.1	1.1	0.0001	0.13
Blood urea nitrogen (mg/dL)	21.0	18.2	0.3	< 0.001	0.16

SEM: standard error of the means.

The birth weights of lambs in both experimental groups were not different. This indicated that both of the groups were composed of animals with similar birth weight values at the beginning of the study. Weaning and 5-months weights were not different between groups. Among various early weaning studies, there were inconsistent results in lamb, kid and calf.

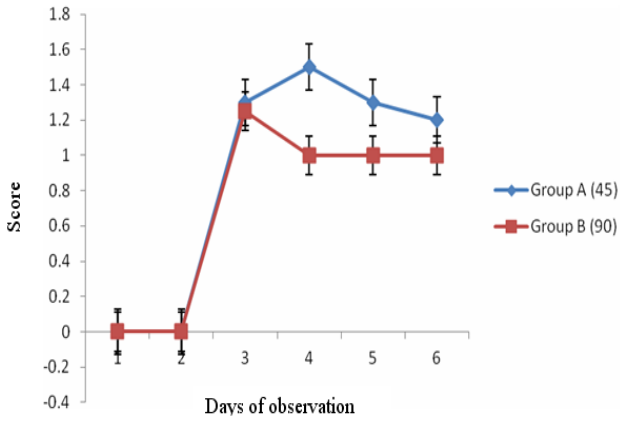

Figure 2 Agitation score (1=no agitation, 2=agitation and 3=high agitation) before (d -1 to -2) and after weaning (d 0 to 3). Day 0 is when lambs were separated from their dams, completely

Ugur *et al.* (2004) reported higher weaning weight in Sannan kids weaned at an age of 60 day rather than 45 day. However, those authors found no differences in the live weight of 3-and 4-month-old kids. Similar results were reported by Cañeque *et al.* (2001), who indicated lambs that remained with their dams displayed a better growth rate than early weaned lambs, in consequence of the longer period of milk consumption. However, in their study live weight at slaughter was the same for these two groups.

In other hand, in agreement with our results, Winter (1985) weaned calves at 3, 5 and 7 weeks of age and reported no differences in average daily gain (ADG) and dry matter intake (DMI) pre and post-weaning. Other research showed calves weaned earlier were not different from calves weaned conventionally in feed intake, ADG and feed efficiency (Kehoe *et al.* 2006). In the study by Schichowski *et al.* (2008) lambs weaned at age of 8 week had greater ADG compare to lambs weaned at age of 16 week. Kuhn *et al.* (1990) stated that daily growth rate may be reduced by stress, because the release of glucocorticoid hormones is accompanied with reduced growth hormone production, which may lead to decreased feed intake. However, in our study ADG of early weaned lambs (45 d) was similar to lambs weaned at 90 d of age. This is somewhat surprising, since later weaned animals would have been expected to benefit from the additional milk received by the ewe. The availability of high quality concentrates may have allowed early weaned lambs to compensate for the loss of maternal milk by increased feed intake, resulting in a greater total intake of energy. In kids, Ugur *et al.* (2004) reported no significant differences between early weaned (45 d of age) and normal-age (60 d of age) weaned kids in ADG. Different management conditions in different farms could be the reason for variation in the live weight of the animals (Ugur *et al.* 2004). Zandi lambs can be successfully weaned at 45 days of age provided that they are accustomed to concentrate feed and roughage as early as possible.

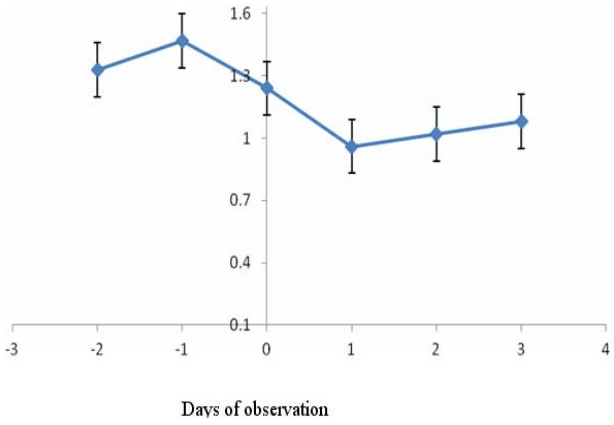

Figure 3 The effect of sampling time on serum cortisol (ng/mL; day 0 is when lambs were completely separated from their dams)

As expected, results showed that younger weaned lambs had more stresswhen compared with older lambs based on the observed blood metabolites and behavioral parameters. Although in some studies plasma cortisol response to isolation was not affected by rearing conditions (Napolitano *et al.* 2002a; Napolitano *et al.* 2002b), other authors (Napolitano *et al.* 2003) observed a lower cortisol response in ewe-reared animals than in artificially reared lambs that were early weaned. Plasma cortisol response after separation from dam is related to age (Napolitano *et al.* 2008). Younger animals are still largely dependent on mothers and maternal separation can determine a higher cortisol response in these animals (Napolitano *et al.* 1995), whereas in

older animals, a lower perception of stress may reduce differences between dam-suckled and early weaned lambs.

High levels of glucose and BUN could be related to increasing of cortisol. Cortisol enables glucose availability which stimulates hepatic gluconeogenesis (Sherwood, 1995) and reduces glucose utilization (Gudev *et al*. 2007).

Early weaned lambs bleating more than conventional weaned lambs. Increased vocalization rates in lambs occur after a stressor such as separation (Cockram *et al*. 1993). When lambs are, even temporarily, separated from mothers they show evident signs of stress represented by increased levels of bleating and locomotion (Alexander, 1977). The relationship between the ewe and its lambs disengages with age of the offspring and as the lambs become more autonomous (Orgeur *et al*. 1997).

The intervals between suckling increase with age, indicating that 90-day-old lambs are more accustomed to a separation from the mother than younger lambs. With age, the distance between mother and young becomes longer. Older lambs also move more frequently and further from the ewe than younger lambs, and they do not vocalize as much as younger ones. Younger lambs show more activity and agitation, such as running around in the stable and searching for their dam.

CONCLUSION

Results of this study clearly demonstrate that lambs weaned at 45 days of age can be successfully weaned. However, lambs weaned at age of 90 day vocalized less and showed less behaviors indicative of agitation after separation compare with animals weaned at 45 day of age. Nevertheless, because detailed information on the possible benefits of alternative weaning procedures are lacking, further investigations on modified systems are needed.

ACKNOWLEDGEMENT

The authors would like to acknowledge the financial support of University of Tehran for this research.

REFERENCES

Alexander G. (1977). Role of auditory cues in mutual recognition between ewes and lambs in Merino sheep. *Appl. Anim. Ethol.* **3,** 65-81.

Cañeque V., Velasco S., Díaz M., Pérez C., Huidobro F., Lauzurica S., Manzanares C. and González J. (2001). Effect of weaning age and slaughter weight on carcass and meat quality of Talaverana breed lambs raised at pasture. *J. Anim. Sci.* **73,** 85-95.

Cockram M.S., Imlah P., Goddard P.J., Harkiss G.D. and Waran N.K. (1993). The behavioural, endocrine and leucocyte response of ewes to repeated removal of lambs before the age of natural weaning. *Appl. Anim. Behav. Sci.* **38,** 127-142.

Gudev D., Ralcheva S., Yanchev I., Moneva P., Peeva T., Penchev P. and Ilieva I. (2007). Effect of weaning on some plasma metabolites in buffalo calves fed diets with or without supplemental chromium picolinate. *Italian J. Anim. Sci.* **6(2),** 547-550.

Haley D.B., Bailey D.W. and Stookey J.M. (2005). The effects of weaning beef calves in two stages on their behavior and growth rate. *J. Anim. Sci.* **83,** 2205-2214.

Kehoe S.I., Dechow C.D. and Heinrichs A.J. (2006). Effects of weaning age and milk feeding frequency on dairy calf growth, health and rumen parameters. *Livest. Sci.* **110,** 267-272.

Kuhn C.M., Pauk J. and Schanberg S.M. (1990). Endocrine responses to mother-infant separation in developing rats. *Dev. Psychobiol.* **23,** 395-410.

Myers S.E., Faulkner D.B., Ireland F.A. and Parrett D.F. (1999). Comparison of three weaning ages of cow calf performance and steer carcass traits. *J. Anim. Sci.* **77,** 323-329.

Napolitano F., Marino V., De Rosa G., Capparelli R. and Bordi A. (1995). Influence of artificial rearing on behavioural and immune response of lambs. *Appl. Anim. Behav. Sci.* **45,** 245-253.

Napolitano F., Braghieri A., Cifuni G.F., Pacelli C. and Girolami A. (2002a). Behaviour and meat production of organically farmed unweaned lambs. *Small Rumin. Res.* **43,** 179-184.

Napolitano F., Cifuni G.F., Pacelli C., Riviezzi A.M. and Girolami A. (2002b). Effect of artificial rearing on lamb welfare and meat quality. *Meat Sci.* **60,** 307-315.

Napolitano F., Annicchiarico G., Caroprese M., De Rosa G., Taibi L. and Sevi A. (2003). Lambs prevented from suckling their mothers display behavioural, immune and endocrine disturbances. *Physiol. Behav.* **78,** 81-89.

Napolitano F., De Rosa G. and Sevi A. (2008). Welfare implications of artificial rearing and early weaning in sheep. *Appl. Anim. Behav. Sci.* **110,** 58-72.

Orgeur P., Mavric N., Yvore P., Bernard S., Nowak R., Schaal B. and Levy F. (1997). Artificial weaning in sheep: consequences on behavioural, hormonal and immune-pathological indicators of welfare. *Appl. Anim. Behav. Sci.* **58,** 87-103.

Price E.O., Harris J.E., Borgwardt J.E., Sween M.L. and Connor J.M. (2003). Fence line contact of beef calves with their dams at weaning reduces the negative effects of separation on behavior and growth rate. *J. Anim. Sci.* **81,** 116-121.

Piccione G., Borruso M., Fazio F., Giannetto C. and Caola G. (2007). Physiological parameters in lambs during the first 30 days postpartum. *Small Rumin. Res.* **72,** 57-60.

Piccione G., Arfuso F., Monteverde V., Vazzana I., Zumbo A. and Faggio C. (2013). Monitoring of some metabolic parameters in comisana lambs during the neonatal period. *Large Anim. Rev.* **19,** 133-137.

SAS Institute. (2002). SAS®/STAT Software, Release 9.1. SAS Institute, Inc., Cary, NC. USA.

Schichowski C., Moors E. and Gauly M. (2008). Effects of weaning lambs in two stages or by abrupt separation on their behavior and growth rate. *J. Anim. Sci.* **86,** 220-225.

Sherwood L. (1995). Human Physiology, from Cells to Systems. Brooks/Cole, Pacific Grove, CA, USA.

Todorov N. (2012). Weaning lambs of dairy breed at 20 days of

age and cheap rearing with whole grain and pelleted protein concentrate (review). *Arch. Zootech.* **15(3),** 23-37.

Winter K.A. (1985). Comparative performance and digestibility in dairy calves weaned at three, five, and seven weeks of age. *Canadian J. Anim. Sci.* **65,** 445-450.

Ugur F., Savas T., Dosay M., Karabayır A. and Atasoglu C. (2004). Growth and behavioral traits of Turkish Saanen kids weaned at 45 and 60 days. *Small Rumin. Res.* **52,** 179-184.