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A STUDY ON PSYCHOBIOLOGICAL CONSEQUENCES OF TWO DIFFERENT WEANING METHODS IN GOATS WITH SPECIAL REFERENCE TO HEALTH STATUS, PROFITABILITY AND PERFORMANCE

(With 13 Tables and 7 Figures)

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دراسة عن النتائج السيكولوبيولوجية لإستخدام طريقتين مختلفتين لفطام صغار الماعز مع الإشارة إلى الحالة الصحية والإنتاجيه

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تم إجراء هذه الدراسة على إجمالى عدد ٤٠ رأس من الماعز شملت ٢٠ من الإناث أمهات مأخوذة من سلالة ماعز محلية متماثلة فى العمر تقريبا (٤-٥ سنوات) وسبق لها الولادة عدة مرات و ٢٠ جدى رضيع. تم تغذية أمهات الماعز طوال فترة التجربة على البرسيم و مخلوط المركزات بحرية مطلقة. وقد تم تقسيم إجمالى هذه الحيوانات إلى مجموعتين متساويتين (١٠ أمهات و ١٠ جدى رضيع لكل مجموعة) كما تم أيضا تقسيم المجموعتين كل على حده إلى مجموعتين أصغر شملت كل منها عدد ٥ أمهات + ٥ جدى رضيع لكل مجموعة. تم إستخدام مجموعة منها لدراسة السلوكيات بينما أستخدمت المجموعة الأخرى لدراسة التغيرات الفسيولوجية والصحية الناتجة من وضع هذه الحيوانات تحت ظروف التجربة. وقد تم تسكين هذه الحيوانات فى غرف جيدة الإضاءة والتهوية وتحت الظروف البيئية السائدة وذلك طوال فترة التجربة. تم إجراء وزن الجديان الصغيرة قبل وبعد عمليات الفطام المختلفة وذلك عند عمر شهر و ثلاثة أشهر لتقدير مدى الزيادة فى أوزان هذه الحيوانات وذلك فى نهاية فترة التجربة. أثبتت النتائج التى تم الحصول عليها أن السلوكيات المختلفة لهذه الحيوانات والحالة الصحية وكذلك نسبة هرمون الكورتيزول بدم هذه الحيوانات قد تأثرت تأثيرا معنويا بطريقة الفطام كما أسفرت النتائج عن أفضلية عملية الفطام الفجائى عنه فى حالة الفطام المتدرج. وقد تم التوصية بإستخدام طريقة الفطام الفجائى فى حالة المجترات الصغيرة وعلى الأخص الماعز لما لها من مردود أقل على سيكولوجية وصحة هذه الحيوانات عنها فى حالة الفطام المتدرج.

SUMMARY

Goats are excellent mutton producers due to their proliferacy and early maturity. Psychobiological and health effects of two different weaning methods (progressive and sudden types) have been studied in goats. A total of 40 animals that included 20 multiparous she goats of Egyptian breed (4-5 years) and their 20 kids were used in this investigation. Allover the experiment, goats were adlibitum fed on barseem and commercial concentrate mixture with freely available water. Goats and their kids were divided into two equal groups, each of 10 goats and their 10 kids. Moreover, each group was divided into two subgroups consisting of 5 mothers and their 5 kids, one group for behavioural observations while the other group for physiological and health studies. Mothers and their kids of each subgroup were kept together in a well-lighted and well-ventilated 5x5 m^2 room under the prevalent environmental conditions. Progressive and sudden weaning procedures were carried out. During the daily separation as well as at weaning, kids were penned in another room away from their mothers with barseem and water available adlibitum. Kids were weighed at the start of the experiment (1 month old) and at the end (3 months old) to determine their body weight gain. The obtained results revealed that, sudden weaning process of three months old kids appeared less stressful than progressive one as it induced a less and short lasting behavioural disturbances in both of she-goats and kids with a short lasting cortisol level fluctuation in the serum of she-goats and their kids. While progressive weaning process resulted in significant long lasting disturbances. Both weaning methods had no significant effect on the kid's body weight gain. The present study suggested that, sudden weaning process could be used for small ruminants specially in goats with less health effects and more safety results on their welfare than progressive one.

Key words: *Health status, Behaviour, Psychobiology, Weaning process goats.*

INTRODUCTION

Weaning of domestic mammals is considered as a physiological shock for their offspring and characterized by the replacement of milk by solid food in association with the break-down of the mother-young bond.

This event is often associated with temporary but acute turmoil and changes in behavioural orientations (Fraser, 1968). In small ruminants, lactation is a major factor in the strength of the mother-young bond and any decrease in milk production leads to the distancing of both partners (Orgeur et al., 1998). However, the mother-young relationship do not fade away completely after the end of the suckling period as both partners remain associated several weeks or even months after the termination of lactation (Hinch et al., 1990).

Small ruminants are characterised by the existence of a selective mother-young bond established soon after parturition. Mother is able to recognise its young few hours after parturition (Poindron and Le Neindre, 1980) and young can recognise its mother at about 12 to 24 hours after birth (Nowak et al., 1987). However, the frequency and duration of sucking decrease after four or five weeks and progressively the dam prevents the young from sucking (Gordon and Siegmann, 1991).

In fact, progressive natural weaning has very little apparent negative consequences on social groups of small ruminants. In a natural social environment after the end of suckling, both sexes remain associated with the dam's group until the onset of the sexual season, at which time the young pubertal males leave the females group to join an adult males group until the following sexual season (Grubb and Jewell, 1966). On the contrary, artificial weaning imposed by the breeders involves simultaneously mother-young separation and a drastic modification of the young's habits. This early disturbance can induce an important stress for both partners with an increase in bleating and locomotion activity (Alexander, 1977; Torres-Hernandez and Hohenboken, 1979).

In the present experiment, a comparative study of two different weaning methods of Progressive and sudden were done and observing how she-goats and their kids react with special reference to their physiological, behavioral , hormonal as well as health status.

MATERIALS and METHODS

I-Animals used:

A total of 40 animals, 20 multiparous she goats of Egyptian breed (4-5 years) and their 20 kids were used in this investigation. Allover the experiment, goats were adlibitum fed on barseem and commercial concentrate mixture with freely available water. Goats and

their kids were divided into two equal groups, each of 10 goats and their 10 kids. Moreover, each group was divided into two subgroups consisting of 5 mothers and their 5 kids (one for behavioural observations while the other for health status and other physiological studies). Mothers and their kids of each subgroup were kept together in a well-lighted and well-ventilated 5x5 m^2 room under the prevalent environmental conditions.

II- Weaning procedures:

Weaning procedures were carried out according to Orgeur et al. (1998). The first group was allocated into a progressive weaning process where the kids were separated daily from their mothers from 1 month old to 3 months old (weaning age). The duration of that daily separation was as follows:

- 2 hours/day during the 1st week of separation.
- 4 hours/day during the 2nd week of separation.
- 6 hours/week during the 3rd week of separation.
- 8 hours/week during the 4th week of separation.
- 12 hours/day during the 5th week of separation.
- 14 hours/day during the 6th week of separation.
- 18 hours/day during the 7th week of separation.
- 20 hours/day during the 8th week of separation.

The second group was allocated into suddenly weaning process where the kids were kept with their mothers and weaned suddenly at age of 3 months without any prior separation.

During the daily separation as well as at weaning, kids were penned in another room away from their mothers with barseem and water available adlibitum.

Kids were weighed at the start of the experiment (1 month old) and at the end (3 months old) to determine their body weight gain.

III- Behavioural observations:

Mothers and their kids was observed according to Marten & Bateson (1988); Fordham et al. (1991) using scan sampling method in which a screen was erected at one end of the room so that the observer can observe all the animals at the same time without being seen by them. The behaviour of the mothers and their kids was recorded according to Orgeur et al. (1998) as follows:

- For the first group (progressive weaning process), mothers and their kids were observed daily for 4 consecutive days / week as the following:

-1 hour directly before separation. -1 hour directly after separation.
- 1 hour directly before reunion. - 1 hour directly after reunion.

- For the second group (suddenly weaning process), mothers and their kids were observed for 4 hours/day during the day prior to separation and the following 4 consecutive days.

The behavioural data recorded for goats and their kids were evaluated as those of Orgeur et al. (1998) as the following:

1. No. of high pitched vocalization (vocalization emitted with the mouth open).
2. Time spent resting (lying).
3. Behaviour of stress and restlessness as pawing, sniffing and stamping the ground, lip licking and mouthing the air.

IV- Serum cortisol level in she goats and their kids:

Blood samples (10 ml of each) were collected from she goats and their kids by Jugular veinipuncture and collected on the wall of centrifuge tubes. The sera of the collected samples were separated by centrifugation at 3000 r.p.m. for 30 minutes and were freezed at –80 °C.

For the first group (progressive weaning process), Blood samples were collected from she-goats and their kids on the first day of each separation period, 1 hour before and 1 hour after separation. With regard to she-goats and their kids of the second group (suddenly weaning process), the blood samples were collected on the last day prior to separation as well as on the following 4 consecutive days.

The harvested sera were estimated for their levels of cortisol using TDxFLx system with fluorescence polarization and competitive binding techniques according to Dandliker & Feigen (1970) and Dandliker & Saussure (1973).

V- Statistical analysis: -

Statistical analyses of the collected data were carried out according to procedures of completely random design, SAS (1995).

RESULTS and DISCUSSION

Conditions of domestication almost invariably ensure that weaning is not naturally determined. Most systems of livestock management enforce relatively early separation between young animal and mother is taken away soon after birth. In other farm species, the young are left with their mothers until the young animal has developed feeding activities alternative to nursing. These systems of artificial

weaning are usually carried out abruptly. Both of the separated dam and young vocalise continuously, calling for each other (Barton, 1983a & b).

I- Behavioural observations of she-goats and kids:

In small ruminants, a reciprocal mother-young bond is established at birth and persists under natural conditions (Hinch et al., 1990). However, weaning results in a sudden break of that bond resulting in transient behavioural disturbances as indicated by Orgeur et al., 1998&1999.

a- Number of high pitched vocalization:

In the present study, weaning process was found to affect significantly ($p<0.01$) on the average number of high pitched vocalization emitted either by she-goats or kids whether treated with progressive weaning or sudden weaning method (Tables 1, 2 and 3). On progressive weaning process, the average number of high pitched vocalization emitted by she-goats and kids during the last hour before separation, first hour directly after separation, last hour before reunion and first hour directly after reunion were 6.3, 60.1, 49.4, 9.8 and 16.8, 77.15, 63.4, 15.3 for she-goats and their kids, respectively (Tables 1and 2). Moreover, Figures 1 and 2 illustrated that, this significant increase in high pitched vocalization during the first hour after separation and the last hour before reunion was maintained during the entire experimental period either for she-goats or kids.

With regard to sudden weaning process, the data represented in table 3 showed that, the average number/hour of high pitched vocalization emitted by she-goats and kids during the last day before separation, first day of separation, second day of separation, third day of separation and fourth day of separation were 5.6, 54.4, 32.0, 11.0, 10.0 and 15.0, 68.2, 47.0, 21.4, 18.0, respectively. Moreover, figure 3 indicated that, either she-goats or kids showed a significant increase in the average number/hour of high pitched vocalization during the first and second days of separation while it returned to the pre-weaning average that recorded on the last day before separation during the third and fourth days of separation.

According to Torres-Hernandez & Hohenboken, 1979 and Cockram et al., 1993, high pitched vocalization in small ruminants, either the mother or the young, is one of the most important indications of stress. In the present experiment, the results of high pitched vocalization indicated that, progressive weaning process acted as a more stressful factor than sudden weaning process, either for she-goats or kids. However, in both treatments, the higher number of bleating activity

displayed by kids is likely to reflects the more important role played by the young in the maintenance of the mother-young relationship (Lynch et al., 1992). The present results were found in agreement with Orgeur et al., 1998 (with sheep); Dunlap et al., 1981 and Ellicot et al.., 1981 (with cattle) and McCall et al., 1985 (with horse).

b- Time spent lying:

In the present study, weaning process was found to affect significantly ($p<0.01$) on the time spent lying either by ewes or kids whether treated with progressive or sudden weaning process (tables 4,5 and 8).

On progressive weaning process, the average time spent lying by she-goats and kids during the last hour before separation, first hour directly after separation, last hour before reunion and first hour directly after reunion were 20, 0, 0, 0 and 26, 0, 0, 0 minutes, respectively (Tables 4 and 5). Moreover, the same tables also indicated that, either she-goats or kids were spent 0 minutes lying during both the first hour after separation and the last hour before reunion during the entire experiment, a finding indicated that progressive weaning process was a chronic stressor on both partners (Dantzer et al., 1980; Done-Currie et al., 1984 and grandin, 1997). However, the time spent lying during the first hour after reunion was also 0 minutes either for she-goats or kids. This can be explained by the communication of the kids with their mothers as they spent most of the time in suckling while their mothers stand quietly for them.

With regard to sudden weaning process, the data represented in Table 8 showed that, the average time spent lying by she-goats and kids during the last day before separation, first day of separation, second day of separation, third day of separation and fourth day of separation were 18, 3, 7, 15, 17 and 24, 5, 9, 21, 25 min./hour, respectively. This data indicated that, the average time spent lying/hour was significantly decreased ($p<0.01$) only during the first and second days of separation, a finding indicated a less stressful situation in comparison to progressive weaning process.

c- Behavioural observations of stress and restlessness:

The impact of weaning up on the animal behaviour is extremely difficult. Natural weaning has in fact little apparent negative consequences on social groups of the mother and her young. On the contrary, artificial weaning imposed by the breeders involves a simultaneous mother-young separation and a drastic modification of

their habits, which induce an obvious stress on both partners (Grubb and Jewell, 1966). Alexander, 1977 & Torres-Hernandez and Hohenboken, 1979 during their studies on sheep found that, both ewes and lambs that temporarily separated from each other expressed their distress by an increase in bleating and locomotion activity with some behavioural modifications that help the animal to cope with the stress induced situation.

In the present study, weaning process was found to affect significantly ($p<0.01$) on the behavioural pattern of she-goats (Tables 6,7 and 8). On progressive weaning process, Table 6 indicated that, she-goats showed a significant increase in the average number of pawing the ground and mouthing the air with lip licking during the first hour after separation and the last hour before reunion (12 & 8 for pawing the ground and 5 & 5 for mouthing the air, respectively) and that increase was maintained allover the experimental period.

On sudden weaning process, table 8 indicated that, she-goats showed a significant increase in the average number of pawing the ground and mouthing the air with lip licking during the first day of separation and that increase was maintained with a less but significant manner only during the second day of separation, a finding indicated a less stressful effect that progressive weaning one.

II- Serum cortisol level:

The effect of weaning process on the average level of she-goats as well as kids serum cortisol was in tables 9,10,11 and 12. Weaning process was found to affect significantly ($p<0.01$) on the average serum cortisol level of both.

With regard to progressive weaning process, allover the experimental period, serum cortisol level which measured one hour directly after separation was significantly higher, than that which measured one hour directly before separation, with averages of 0.74 and 0.42 µg/100 ml for she-goats & 0.39 and 0.64 µg/100 ml for kids, respectively (Tables 9 &10 and Fig. 4 &5). However, she-goats and kids treated with sudden weaning process showed a significant increase in their serum cortisol level during the first and second days of separation while it returned to its normal level during the third and fourth days of separation (Tables 11&12 and Fig. 6&7). These findings agrees with kuhn et al., 1990; Pihoker et al., 1993 (with rat); Hennessy and Moorman; 1989; Hennessy et al., 1995 (with Guinea pig); Tsuma et al., 1995 (with sow); Levine et al., 1985 (with Rhesus monkey); Houpt et al., 1984 (with Horse) and Orgeur et al., 1998 & 1999 (with sheep),

indicating a more stressful conditions with intermittent progressive mother-young separation than sudden one.

III- Body weight gain of kids: -

In the present study, table 13 indicated that, body weight gain of kids between one month and three months old was not significantly affected by the method of weaning (6.9 and 7.1 kg with progressive and sudden weaning process, respectively). This finding apparently indicates that, the daily separation of kids from their mothers was not stressful. However, according to Dantzer (1995), performances of animal production are not necessarily related to the optimal welfare. Moreover, a punctual loss in weight due to social disturbances like mother-young separation could be transient and unnoticed with a weighing procedure spaced by short intervals (dantzer and Mormede, 1979).

CONCLUSION

In conclusion, sudden weaning process of three months old kids appeared less stressful than progressive one as it induced a less and short lasting behavioural disturbances in both she-goats and kids and a short lasting cortisol level fluctuation in the serum of she-goats. However, progressive weaning process resulted in a significant long lasting disturbances due to repeated separations at a time when the mother-young bond was strong.

The previous conclusion suggests that, sudden weaning process can be used for small ruminants specially in goats with less health effects and more safety results on their welfare than progressive one. Moreover and to minimize distress, the groups of newly weaned kids and their mothers should be out of sight and sound of each other to overcome the risk of weaning troubles and maintain their normal healthy performance.

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Table (1): - Number of high pitched vocalization emitted by she-goats tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation	One hour directly before reunion	One hour directly after reunion
	----------No./hour----------			
1st week	5.0±1.2	63.0±3.2	49.6±1.6	8.0±1.4
2nd week	7.4±1.6	59.6±2.6	51.0±2.0	10.4±1.4
3rd week	6.0±1.0	61.4±3.0	48.0±1.6	10.0±1.0
4th week	6.8±1.4	60.0±2.0	50.0±2.0	11.4±1.6
5th week	6.0±1.0	58.4±1.4	49.0±2.0	9.6±1.0
6th week	7.0±1.4	60.0±2.0	51.4±2.0	10.0±1.0
7th week	6.0±1.0	58.4±1.6	48.4±1.6	9.0±1.0
8th week	6.2±1.4	60.4±2.6	48.0±1.0	10.4±1.4
Mean	6.3±1.2a	60.1±2.3 b	49.4±1.7 b	9.8±1.2 a

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig. (1): - Number of high pitched vocalization emitted by she-goats tested for progressive weaning process

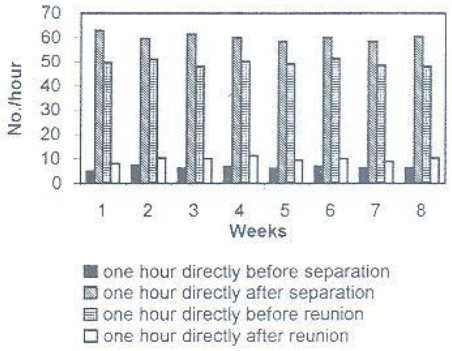

Table (2): - Number of high pitched vocalization emitted by kids tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation	One hour directly before reunion	One hour directly after reunion
	----------No./hour----------			
1st week	15.0±1.4	80.0±1.6	63.6±3.2	14.0±1.2
2nd week	17.4±1.4	76.6±2.0	65.0±2.6	16.4±1.6
3rd week	17.0±1.0	78.4±1.6	62.0±3.0	15.0±1.0
4th week	18.4±1.6	77.0±2.0	64.0±2.0	15.8±1.4
5th week	16.6±1.0	75.4±2.0	63.0±1.4	15.0±1.0
6th week	17.0±1.0	77.0±2.0	65.4±2.0	16.0±1.4
7th week	16.0±1.0	75.4±1.6	62.4±1.6	15.0±1.0
8th week	17.4±1.4	77.4±1.0	62.0±2.6	15.2±1.4
Mean	16.8±1.2 a	77.15±1.7 b	63.4±2.3 b	15.3±1.2a

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig. (2): - Number of high pitched vocalization emitted by kids tested for progressive weaning process

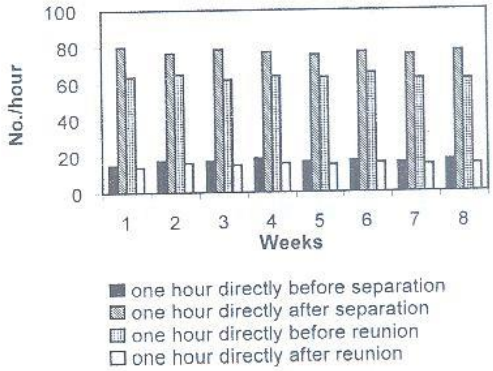

Table (3): - Number of high pitched vocalization emitted by she-goats and kids tested for sudden weaning process

Day / Animal	Last day before separation	1st day of separation	2nd day of separation	3rd day of separation	4th day of separation
	----------No./hour----------				
She-goats	5.6±1.4 [a]	54.4±2.4 [b]	32.0±2.0 [c]	11.0±1.6 [a]	10.0±1.0 [a]
kids	15.0±1.6 [a]	68.2±2.6 [b]	47.0±2.4 [c]	21.4±1.6 [a]	18.0±1.4 [a]

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig.(3): - Number of high pitched vocalization emitted by she-goats and kids tested for sudden weaning process

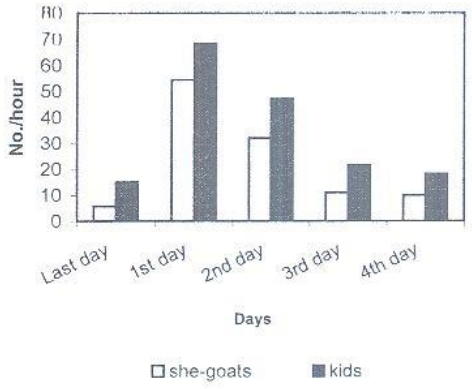

Table (4): - Time spent lying by she-goats tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation	One hour directly before reunion	One hour directly after reunion
	Min./hour			
1st week	22±5	0	0	0
2nd week	18±3	0	0	0
3rd week	23±3	0	0	0
4th week	22±6	0	0	0
5th week	17±3	0	0	0
6th week	24±5	0	0	0
7th week	21±4	0	0	0
8th week	23±3	0	0	0
Mean	20±4 a	0 b	0 b	0 b

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Table (5): - Time spent lying by kids tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation	One hour directly before reunion	One hour directly after reunion
	Min./hour			
1st week	28±3	0	0	0
2nd week	26±3	0	0	0
3rd week	29±3	0	0	0
4th week	26±4	0	0	0
5th week	27±3	0	0	0
6th week	24±2	0	0	0
7th week	26±4	0	0	0
8th week	26±3	0	0	0
Mean	26±3 a	0 b	0 b	0 b

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Table (6): - Behavioral observations of stress and restlessness of she-goats tested for progressive weaning process

Treatment / Week	One hour directly before separation			One hour directly after separation			One hour directly before reunion			One hour directly after reunion		
	No./hour											
	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing
1st week	0	0	0	12±1	0	6±2	8±1	0	4±1	0	0	0
2nd week	0	0	0	11±1	0	4±1	9±1	0	6±1	0	0	0
3rd week	0	0	0	14±2	0	4±1	7±1	0	6±1	0	0	0
4th week	0	0	0	11±1	0	5±2	9±2	0	6±1	0	0	0
5th week	0	0	0	13±1	0	4±1	8±1	0	4±1	0	0	0
6th week	0	0	0	11±1	0	6±2	6±1	0	5±1	0	0	0
7th week	0	0	0	11±1	0	4±1	8±1	0	6±2	0	0	0
8th week	0	0	0	13±2	0	4±1	7±1	0	6±1	0	0	0
Mean	0	0	0	12±1	0	5±1	8±1	0	5±1	0	0	0

Table (7): - Behavioral observations of stress and restlessness of kids tested for progressive weaning process

Treatment / Week	One hour directly before separation			One hour directly after separation			One hour directly before reunion			One hour directly after reunion		
	No./hour											
	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing	Pawing	Sniffing	Mouthing
1st week	0	0	0	0	0	0	0	0	0	0	0	0
2nd week	0	0	0	0	0	0	0	0	0	0	0	0
3rd week	0	0	0	0	0	0	0	0	0	0	0	0
4th week	0	0	0	0	0	0	0	0	0	0	0	0
5th week	0	0	0	0	0	0	0	0	0	0	0	0
6th week	0	0	0	0	0	0	0	0	0	0	0	0
7th week	0	0	0	0	0	0	0	0	0	0	0	0
8th week	0	0	0	0	0	0	0	0	0	0	0	0
Mean	0	0	0	0	0	0	0	0	0	0	0	0

Table (8): - Time spent lying (Min./hour) and behavioral observations (No./hour) of she-goats and kids tested for sudden weaning process

Treatment / Day	She-goats				Kids			
	Lying	Pawing	Sniffing	Mouthing	Lying	Pawing	Sniffing	Mouthing
Last day before separation	18±3 [a]	0 [a]	0	0 [a]	24±2 [a]	0	0	0
1st day of separation	3±1 [b]	9±1 [b]	0	7±1 [b]	5±1 [b]	0	0	0
2nd day of separation	7±1 [b]	5±1 [b]	0	4±1 [b]	9±2 [b]	0	0	0
3rd day of separation	15±2 [a]	0 [a]	0	0 [a]	21±2 [a]	0	0	0
4th day of separation	17±1 [a]	0 [a]	0	0 [a]	25±2 [a]	0	0	0

Figures in the same column with different superscripts differs significantly ($p < 0.01$).

Table (9): - Average serum cortisol level (µg/100 ml) of she-goats tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation
1st week	0.41±0.01	0.74±0.02
2nd week	0.43±0.01	0.77±0.01
3rd week	0.40±0.01	0.71±0.01
4th week	0.41±0.01	0.77±0.02
5th week	0.45±0.01	0.73±0.01
6th week	0.43±0.01	0.75±0.02
7th week	0.43±0.01	0.73±0.01
8th week	0.41±0.01	0.73±0.01
Mean	0.42±0.01 [a]	0.74±0.01 [b]

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig. (4): - Average serum cortisol level (Ug /100 ml) of she-goats tested for progressive weaning process

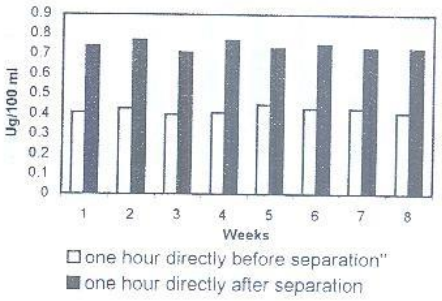

Table (10): - Average serum cortisol level (µg/100 ml) of kids tested for progressive weaning process

Treatment / Week	One hour directly before separation	One hour directly after separation
1st week	0.39±0.01	0.65±0.01
2nd week	0.38±0.01	0.68±0.01
3rd week	0.39±0.01	0.66±0.02
4th week	0.40±0.01	0.63±0.02
5th week	0.38±0.01	0.63±0.01
6th week	0.41±0.01	0.66±0.01
7th week	0.40±0.01	0.62±0.01
8th week	0.39±0.01	0.63±0.02
Mean	0.39±0.01 [a]	0.64±0.01 [b]

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig. (5): - Average serum cortisol level (Ug /100 ml) of kids tested for progressive weaning process

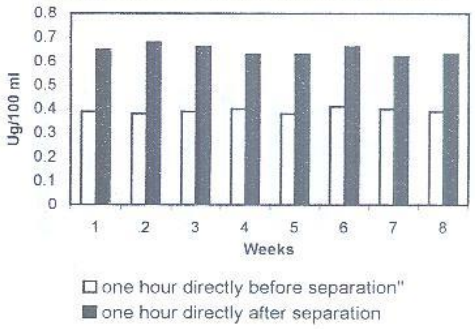

Table (11): - Average serum cortisol level (µg/100 ml) of she-goats tested for sudden weaning process

Days / Animal	Last day before separation	First day of separation	Second day of separation	Third day of separation	Fourth day of separation
She-goat	0.42±0.01 [a]	0.82±0.02 [b]	0.61±0.01 [c]	0.49±0.01 [a]	0.44±0.01 [a]

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig.(6): - Average serum cortisol level (ug /100 ml) of she-goats tested for sudden weaning process

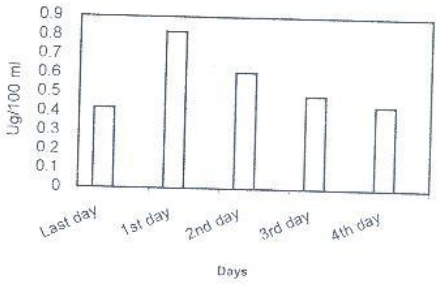

Table (12): - Average serum cortisol level (µg/100 ml) of kids tested for sudden weaning process

Days / Animal	Last day before separation	First day of separation	Second day of separation	Third day of separation	Fourth day of separation
Kids	0.41±0.01 [a]	0.75±0.02 [b]	0.64±0.01 [b]	0.47±0.01 [a]	0.42±0.01 [a]

Figures in the same raw with different superscripts differs significantly ($p < 0.01$).

Fig.(7): - Average serum cortisol level (ug /100 ml) of kids tested for sudden weaning process

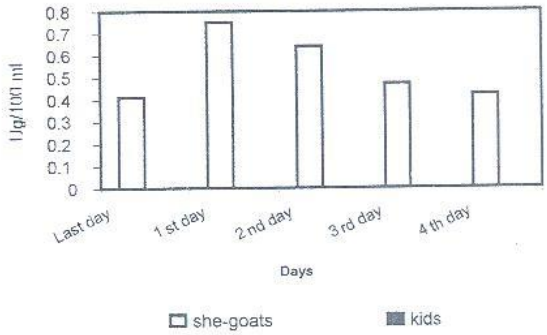

Table (13): - Effect of weaning process on the body weight gain of kids

Weaning process	Initial weight (one month old)	Final weight (three months old)	Weight gain
	----------kg----------		
Progressive	4.2±0.3	11.1±0.9	6.9±0.6
Sudden	4.9±0.5	12.0±1.1	7.1±0.6