

IMPROVEMENT OF OSSIMI PRODUCTIVE TRAITS THROUGH CROSSING WITH CHIOS SHEEP. II- LIVABILITY AND TWINNING PERCENTAGE

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SUMMARY

Livability of lambs was studied in 252 individuals of different genotypes [Ossimi (O), Chios (C), 1/2C x 1/2O and 3/4C x 1/4O] to evaluate the effect of crossing Chios breed with Ossimi on livability at 15, 30, 60, 120, and 180 days of age. Moreover, 155 adult ewes (37 Ossimi, 50 Chios and 68 1/2C x 1/2O) were used to study the effect of crossing Chios rams with Ossimi ewes on twinning percentage. The experiment was carried out during the period from September 1991 to October 1993 at Mallawi Research Station.

Differences in livability of lambs due to genetic groups were significant at 30, 60 ($P<0.05$), 120 and 180 days of age ($P<0.01$). The highest figure was 89.3% for backcross lambs, followed by 1/2C x 1/2O (83.8%). The lowest value was 65.1% for Chios lambs at 180 days of age. The hybrid vigor was 14.29% and 34.84% for first and back crosses, respectively. No significant difference was found for sex, type of birth, season of lambing and age of dam on livability of lambs at all ages studied except sex effect at 15 days of age which was significant ($P<0.01$).

Livability of lambs was significantly regressed on their birth weights. This relationship was positive and equal to 12, 13, 10, 10 and 10%/kg change in birth weight at 15, 30, 60, 120 and 180 days of age, respectively.

Twinning percentage was significantly influenced by genetic groups. Chios ewes had the highest twinning (60.5%), while Ossimi ewes had the lowest value (12.4%). The F1 (1/2C1/2O) ewes were intermediate between its parents (29.5%). The superiority of 1/2C1/2O ewes over Ossimi ewes in twinning percentage was 142%. Season of mating and weight or age of dam had no significant effect on twinning percentage. However, the twinning percentage of winter mating ewes was higher than that of summer mating ones (40.2 vs 28.1%). Ewes aging >3<4 years had the highest twinning

percentage (39%), while ewes aging 4 years or more had the lowest value (29.1%).

Keywords: Ossimi, Chios, crossing, livability, twinning, Improvement

INTRODUCTION

Twinning percentage and livability of lambs are two of the most important traits in lamb production. Crossing local sheep with exotic breeds is a fast method for improving the efficiency of lamb production. Positive effect of crossbreeding on twinning percentage and livability of lambs have been reported by several investigators (Aboul-Naga *et al.*, 1972; Rasttogi *et al.*, 1982; Hassan and Sallam, 1988; Hassan, 1993 and Hassan and Marzouk, 1997).

Chios sheep are recognized as one of the prolific subtropical breeds. This breed is characterized by high milk production (267 kg in 220 days), high prolificacy (1.8 lambs / ewe lambing), early sexual maturity (first mated at 8 to 9 months of age) and satisfactory growth rate (0.20 to 0.25 kg/day (Mason, 1967; Louca, 1972; and Lawlor *et al.*, 1974).

Crossing with prolific breeds of sheep has the potential to increase production through improvement of litter size of crossbred ewes, but it may have a negative effect on body weight of crossbred lambs at birth (Dickerson *et al.*, 1975 and Boujenane *et al.*, 1991). Lamb livability has generally been reported to be higher for crossbred than purebreds (Aboul-Naga, 1977; Hassan *et al.*, 1985; Hassan, 1993 and Hassan and Marzouk, 1997).

Local Ossimi sheep is poor in prolificacy (1.13 lamb/ewe, Hassan, 1988). This trait needs to be improved to increase the available and marketable mutton. Crossbreeding with prolific breeds of sheep has the potential to increase production through improvement of litter size of crossbred ewes.

The objective of this study was to examine the effect of crossing Chios breed with Ossimi on twinning percentage and livability of lambs.

MATERIALS AND METHODS

The data used in this study were obtained from the Experimental Farm of Mallawi Research Station belonging to Animal Production Research Institute, Ministry of Agriculture, during the period from September, 1991 to October 1993. Lambs (252) of four genotypes; 45 Ossimi (O), 75 Chios (C), 55 1/2C 1/2O (F1) and 76 3/4C 1/4O (P1), were used in this study. Livability of lambs born alive was evaluated in terms of survival (0=dead and 1= alive) at 5, 30, 60, 120 and 180 days of age.

Moreover, 155 adult ewes (37 Ossimi, 50 Chios and 68 1/2C 1/2O) were used to study the effect of crossing Chios rams with Ossimi ewes on twinning percentage.

Ewes were mated for the first time at the age of one year and rams at two years. The system of three lambing per two years was adopted. Mating per breeding season lasted for one month. Lambs born were kept with their dams till weaning at 2 months of age. Dams were weighed at the 4th days after parturition. Birth weight was recorded within 24 hours from birth and weaning weight was recorded at two months of age.

Lambs were gradually fed on a starter (decorticated cotton seed meal 30%, ground corn 20%, rice bran 20%, wheat bran 20%, corn grain gluten meal 6%, lime stone 2.5%, bone meal 1% and Salt 0.5%). Green corn plants (Darawa) in summer and Berseem during winter until 4 months of age were offered. In summer and autumn the flock grazed on crop residues and green fodder whenever available.

The adult animals were fed pellets of concentrate mixture (51.9 TDN and 8.5 DP), (0.5 to 1.0 kg/head/day) according to their physiological stage.

From November to May, the animals grazed Berssem (*Trifolium alexandrinum*) when it was available. The animals were allowed to drink twice a day.

Lambs born from September to February were considered winter lambing and those born from March to August were considered summer lambing.

Statistical analysis.

Data of the present study were analyzed using general linear model (GLM) SAS, (1989).

The model used to analysis livability was as follows: (Model 1)

$$Y_{ijklmno} = U + B_i + X_j + T_k + S_l + A_m + b_1(X_{1ijklmn} - \bar{X}_{1ijklmn}) + b_2(X_{2ijklmno} - \bar{X}_{2ijklmno}) + (BS)_{il} + e_{ijklmno}$$

$Y_{ijklmno}$ = an observation of livability for each lambs;

U = general mean, common element to all observations;

B_i = the effect due to the i th breeding group, $i=1,2,3,4$;

X_j = the effect due to j th sex, $j=1$ (male), 2 (female);

T_k = the effect due to k th type of birth, $k=1$ (single), 2 (twin);

S_l = the effect due to the l th season of lambing, $l=1$ (winter), 2 (summer);

A_m = the effect due to the age of dam, $m=1$ (less than 2 yrs), 2 (≥ 2 yrs & < 3yrs), 3 (≥ 3 yrs & < 4yrs) and 4 (≥ 4 yrs);

$b_1(X_{ijklm} - \bar{X}_{ijklm})$ = Regression coefficient of livability on weight of dam;

$X_{ijklm} - \bar{X}_{ijklm}$ = the deviation of the body weight of dam from its mean;

$b_2(X_{2ijklmn} - \bar{X}_{2ijklmn})$ = Regression coefficient of livability of lambs on their birth weight;

$X_{2ijklmn} - \bar{X}_{2ijklmn}$ the deviation of birth weight from its mean;

$(BS)_{il}$ = the effect due to interaction between genotype and season of lambing;

$e_{ijklmno}$ = random error associated with the individual observation and assumed to be independently and randomly distributed ($\sigma, \sigma^2 e$).

The model used to analysis the twinning percentage was as follows:(Model 2)

$$Y_{ijkl} = U + B_i + S_j + A_k + b(X_{ijkl} - \bar{X}_{ijkl}) + (BS)_{ij} + e_{ijkl} \quad \text{Where:}$$

Y_{ijkl} = an observation of twinning percentage for each ewe;

U = general mean, common element to all observations;

B_i = the effect due to the i th breeding group, $i = 1(O), 2(C)$ and $3(1/2C\ 1/2O)$;

S_j = the effect due to the j th season of mating, $j = 1(\text{winter}), 2(\text{summer})$;

$b(X_{ijkl} - \bar{X}_{ijkl})$ = Regression coefficient of twinning percentage on body weight of dam;

$X_{ijkl} - \bar{X}_{ijkl}$ = The deviation of the body weight of dam from its mean;

$(BS)_{ij}$ = the effect due to interaction between genotype and season of mating;

e_{ijkl} = random error associated with the individual observation and assumed to be independently and randomly distributed (σ, σ^2e).

The other symbols of the model were as these mentioned previously in model 1. Tests of significance for difference among means of different levels within each factor or classification were done according to orthogonal contrast. Hybrid vigor or superiority% was estimated by the following equation of Lasley (1965).

RESULTS AND DISCUSSION

Least squares means and tests of significance of factors affecting livability of lambs at 15, 30, 60, 120 and 180 days of age are presented in Table 1. Genetic group of lambs significantly affected ($P < 0.05$ or $P < 0.01$) livability at 30, 60, 120 and 180 days of age.

At 180 days of age; crossbred lambs 3/4C 1/4O had the highest value of livability (89.3%) followed by 1/2C 1/2O (83.8%), while Chios lambs had the lowest value (65.1%). Differences in livability between purebred Ossimi and Chios were significant ($P < 0.01$ or $P < 0.05$) at all ages studied in favour of Ossimi lambs (83.8 vs 65.1 at 180 days of age). The differences between crossbred lambs 1/2C 1/2O (F1) and 3/4C 1/4O (P1) were significant ($P < 0.01$) and in favour of P1 at 15 and 30 days of age only. Whereas differences between purebred (O and C) and crossbred (1/2C 1/2O; 3/4C 1/4 O) lambs were significant ($P < 0.01$) at 15, 30 and 180 days of age (Table 2).

The hybrid vigor of livability for the backcross (3/4C 1/4O) recorded higher values than the F1(1/2C 1/2O) at all age intervals studied (14.29 vs. 34.84 at 180 days of age). This may be due to the higher milk yield of dams (1/2C 1/2O) of the backcross lambs than dams (Ossimi) of the first cross (85.4 vs 55.7 kg milk yield during lactation season, Hassan, 1995).

Table 1. Least squares means (LSM) \pm SE, hybrid vigor (H%) and regression coefficient of factors affecting livability of lambs at different ages

Item	No	15 days	H%	30 days	H%	60 days	H%	120 Days	H%	180 days	H%
Overall mean	252	91.4 \pm 5.0		89.0 \pm 5.1		85.6 \pm 6.1		81.8 \pm 6.2		80.4 \pm 6.4	
Genetic group:		NS									
Ossimi (O)	45	90.9 \pm 5.2		90.7 \pm 5.6		89.1 \pm 6.1		86.3 \pm 6.6		83.4 \pm 6.9	
Chios (C)	76	85.1 \pm 4.9		77.4 \pm 5.2		71.7 \pm 5.6		66.3 \pm 6.0		65.1 \pm 6.3	
1/2C 1/2O	55	91.9 \pm 5.6	11.66	91.9 \pm 6.0	15.19	91.8 \pm 6.5	19.74	85.3 \pm 7.0	15.07	83.8 \pm 7.3	14.29
3/4 C 1/4O	76	87.7 \pm 4.2	20.87	96.1 \pm 4.5	25.49	89.6 \pm 4.9	26.39	89.1 \pm 5.3	32.85	89.3 \pm 5.5	34.84
Sex:		**		NS		NS		NS		NS	
Male	119	86.4 \pm 3.7		85.3 \pm 3.9		82.0 \pm 4.3		78.4 \pm 4.6		76.0 \pm 4.8	
Female	133	96.1 \pm 3.7		92.7 \pm 4.0		89.3 \pm 4.3		85.1 \pm 4.6		84.8 \pm 4.9	
Type of birth:		NS		NS		NS		NS		NS	
Single	78	94.5 \pm 4.9		91.8 \pm 5.2		87.6 \pm 5.6		85.6 \pm 6.0		83.8 \pm 6.3	
Twin	174	88.0 \pm 3.4		86.2 \pm 3.6		83.7 \pm 3.9		79.9 \pm 4.2		77.0 \pm 4.4	
Season of Lambing:		NS		NS		NS		NS		NS	
Winter	145	91.3 \pm 3.4		90.9 \pm 3.6		89.4 \pm 3.9		85.5 \pm 4.2		85.4 \pm 4.4	
Summer	107	91.1 \pm 4.2		87.1 \pm 4.4		81.9 \pm 4.8		78.0 \pm 5.2		75.4 \pm 5.4	
Age of dam:		NS		NS		NS		NS		NS	
< 2 yr	14	97.8 \pm 9.1		94.4 \pm 9.7		92.5 \pm 10.5		88.7 \pm 11.3		89.6 \pm 11.8	
\geq 2 yr	39	90.3 \pm 5.4		86.5 \pm 5.8		84.1 \pm 6.3		80.9 \pm 6.7		80.2 \pm 7.1	
\geq 3 yr	60	88.3 \pm 4.3		89.6 \pm 4.6		82.8 \pm 5.0		76.5 \pm 5.4		73.4 \pm 5.6	
\geq 4 yr	139	88.5 \pm 3.2		85.5 \pm 3.3		83.1 \pm 3.6		81.5 \pm 3.9		77.4 \pm 4.1	
Regression of livability on birth weight		**	0.12 \pm 0.03	**	0.13 \pm 0.04	**	0.10 \pm 0.04	**	0.10 \pm 0.04	**	0.10 \pm 0.04
Intercept			0.44 \pm 0.24		0.46 \pm 0.25		0.46 \pm 0.27		0.65 \pm 0.29		0.63 \pm 0.31

Values of regression coefficient of livability trait on dam weight were nearly zero. **= P<0.01, * = P<0.05, NS= not significant.

Table 2. Orthogonal comparisons between means of livability at different ages

Genetic groups	15 days	30 days	60 days	120 days	180 days
O vs C	**	**	*	**	**
F1 vs P1	**	**	NS	NS	NS
O&C vs F1&P1	**	**	NS	NS	*

These results agree with those reported by Mousa (1991) on Ossimi, Awassi, Chios and their crosses; Hassan (1993) and Hassan and Marzouk (1997) on Ossimi, Saidi and their crosses with Chios breed. They found that differences in livability due to genetic groups were significant and crossbred lambs had a higher value of livability during the first six months of age than purebred ones.

Livability of female lambs was higher than male ones at all ages studied (Table 1). It ranged between 84.8 to 96.1% for females and between 76.0 to 86.4 % for male lambs. Differences in livability due to sex were not significant at all periods studied, except at 15 days (96.1 vs 86.4%) which was significant ($P > 0.01$).

These results are in agreement with those found by Aboul-Naga *et al.* (1972), Malik and Acharya (1972); Galal *et al.* (1974) and Hassan and Sallam (1988), but disagree with those found by Majid *et al.* (1981).

Single born lambs had higher livability value than twin ones at all ages studied. It ranged between 83.8% to 94.5% for singles and between 77 to 88% for twin lambs, but the differences were not significant (Table 1). This superiority of single born lambs may be due to the higher birth weight of single lambs and better chance to suckle greater amount of milk in comparison with twin-born lambs. These results are consistent with those reported by Sidwell and Miller (1971), Galal *et al.* (1974) and Hassan (1993).

Generally, livability of lambs born in winter was higher than in summer born ones, but the difference was not significant (Table 1). This result may be due to the moderate weather conditions and the availability of the green forage during winter season, while in summer the animals are suffering from heat stress, shortage of supply and susceptibility to summer diseases. These results agree with those reported by El-Kimary (1975) and Hassan (1993) who reported that summer born lambs had lower livability than winter born ones.

The effect of age of dam on livability of lambs was not significant for all periods studied (Table 1). Supporting results are those of Galal *et al.* (1974); El-Kimary (1975) and Hassan (1993). However, Afifi *et al.* (1984) reported that age of dam was a source of variation and had a significant effect on livability of lambs up to 120 and 180 days of age.

Livability of lambs was significantly ($P < 0.01$) affected by their birth weight. The coefficients of regression were 0.12 ± 0.03 and 0.13 ± 0.04 at 15 and 30

days of age respectively. While at 60, 120 and 180 days, coefficients were equal, being 0.10 ± 0.04 (Table 1). These results indicated that an increase in birth weight of one kg was associated with 12, 13 and 10 percent improvement in livability at 15, 30 and 180 days of age, respectively. Similar results were reported by Galal *et al.* (1974). They found that an increase in birth weight of one kilogram was associated with nearly 8, 9 and 11% improvement in livability% at 7, 60 and 120 days of age, respectively. Also, Mousa (1991) found that lamb livability was significantly affected by birth weight ($P < 0.01$). He added that an increase of one kg in birth weight of lambs above the average of the flock was expected to increase livability by 21%.

Least squares means and tests of significance of factors affecting twinning percentage are tabulated in Table 3. Genetic groups of ewe had a significant effect on twinning percentage ($P < 0.01$). Purebred Chios ewes had the highest twinning percentage (60.5%), followed by F1 crossbred ewes (1/2C 1/2O), being 29.5%, while Ossimi ewes had the lowest value 12.4%. Hybrid vigor of twinning percentage was negative (-38%) for F1 crossbred ewes (1/2C 1/2O). Crossing between Chios rams and Ossimi ewes produced a prolific crossbred ewe. This seems to be the most rapid and feasible method for increasing twinning rate in our local breeds. It was expected that twinning percentage of F1 crossbred ewes would have an intermediate value between its parents. The superiority of 1/2C 1/2O ewes over Ossimi ewes in twinning percentage was 142%.

Table 3. Least squares means \pm standard errors (LSM \pm SE) and regression coefficient for factors affecting twinning percentage

Item	No	LSM \pm SE.	H%
Overall mean	155	33.7 \pm 7.0	
Genetic group:		**	
Ossimi (O)	37	12.4 \pm 7.1	
Chios (C)	50	60.5 \pm 6.8	
1/2C 1/2O	68	29.5 \pm 5.6	-38.0
Season of mating:		NS	
Winter (Sept, Jan)	69	40.2 \pm 6.3	
Summer (May)	86	28.1 \pm 5.0	
Age of dam:		NS	
< 2 yr	15	35.4 \pm 11.3	
\geq 2 yr	33	32.7 \pm 7.4	
\geq 3 yr	28	39.4 \pm 8.1	
\geq 4 yr	79	29.1 \pm 4.3	
Regression coefficient of twinning percentage on ewe weight		NS	
		0.062 \pm 0.13	

These results agree with those reported by Louca, (1972) Lawlor (1974), Branford and Boylan (1981) and Marzouk (1986).

The twinning percentage of ewes mated in winter season was higher than ewes mated in summer (40.2 vs 28.0%), but the difference was not significant. Supporting results are those of Hassan and Sallam (1988) who found that twinning percentage of winter mating season was higher than in summer mating season (23.8 vs 10.6%).

The effect of age of dam on twinning percentage was not significant (Table 3). However, ewes ageing >3<4 had high twinning percentage (39.4%), while ewes ageing 4 years or more had the lowest percentage (29.1%). This result can be explained in the light of the fact that ewes of medium age (3-4 yr) has a mature body size and better body confirmation. Moreover, in this interval of age ewes are higher in ovulation rate and have convenient uterine cavity capable of bearing twins. Similar trend was reported by Branford and Boylan (1981), Hassan and Sallam (1988) and Hassan and Marzouk (1997).

Weight of dam had no significant effect on twinning percentage of lambing ewes, Regression coefficient of twinning percentage on dam's weight was positive (0.062). This result followed the same trend of that reported by Hassan and Sallam (1988) and Curl *et al.* (1975).

Table 4. Orthogonal comparisons between means of twinning percentage

Genetic groups	Twinning
O vs C	**
O vs F1	NS

CONCLUSION

Out of these researches in the field of crossing Egyptian Ossimi with exotic Chios breed, it could be concluded that these crosses showed a considerable improvement in body weights, some carcass traits and livability of their lambs. Comparable results were also observed in milk yield and twinning percentage.

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تحسين الصفات الإنتاجية للأغنام الأوسيمي عن طريق خلطها مع أغنام الكيوس.
٢- حيوية الحملان ونسبة التوائم

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١- قسم الإنتاج الحيواني - كلية زراعة - جامعة المنيا، ٢- معهد بحوث الإنتاج الحيواني - القاهرة

أجرى هذا البحث بمحطة بحوث الإنتاج الحيواني - بملوى و التابعة لمعهد بحوث الإنتاج الحيواني لدراسة صفة الحيوية على عدد ٢٥٢ رأساً من الحملان والتي تتبع أربعة تراكيب وراثية هي سلالة الكيوس المستوردة والأوسيمي المحلية واثنان من الخلطان الناتجة من خلطهما معا وهما (٢/١ كيوس ٢/١ أوسيمي ، ٤/٣ كيوس ٤/١ أوسيمي) بالإضافة الى عدد ١٥٥ نعجة من سلالة الكيوس والأوسيمي والخليط الأول الناتج من خلطهما معا لدراسة صفة ولادة التوائم ذلك خلال الفترة من سبتمبر ١٩٩١ الى أكتوبر ١٩٩٣ وذلك بهدف دراسة تأثير عملية الخلط على معدل حيوية الحملان وكذلك على نسبة الولادات التوائم للنجاح. وأظهرت النتائج مايلي:

١. كان تأثير السلالة معنوي على صفة حيوية الحملان عند الأعمار ٣٠، ٦٠، ١٢٠، ١٨٠ يوماً في حين كان تأثيرها غير معنوي عند عمر ١٥ يوماً.
٢. تفوقت الحملان الخليطة في نسبة الحيوية حيث كانت حملان الخليط الرجعي أعلاهما (٨٩,٣%) في حين كانت حملان الكيوس أقلها (٦٥,١%) عند عمر ١٨٠ يوماً وقد أظهرت النتائج قوة هجين موجبة لصفة الحيوية (١٤,٢٩، ٣٤,٨٤ % للخليط الأول والرجعي على التوالي).
٣. قد كان تأثير كل من الجنس ونوع الولادة وموسم الولادة وعمر الأم غير معنوي على صفة حيوية الحملان فيما عدا تأثير الجنس عند عمر ١٥ يوماً فقد كان معنوياً جداً.
٤. وجد ان معامل انحدار حيوية الحملان على اوزان ميلادها كان معنوي جداً وكانت قيم معاملات الانحدار موجبة وتتراوح ما بين ١٠ و ١٣% لكل زيادة مقدارها واحد كيلو جرام حتى وزن الميلاد.
٥. وكان تأثير السلالة معنوي على نسبة الولادات التوائم وقد سجلت أغنام الكيوس أعلى نسبة توائم (٦٠,٥ %) بينما سجلت اغنام الأوسيمي أقل نسبة توائم (١٢,٤) إلا أن اغنام الخليط

الأول (٢/١ كيبوس ٢/١ أوسيمي) سجلت قيمة وسيطة (٢٩,٥ %) وكانت قوة الهجين سالبة (-٣٨ %).

٦. وجد ان الأختلافات الراجعة لموسم التزاوج و أعمار الأمهات كانت غير معنوية الا ان موسم التلقيح شتاءا قد سجل قيم أعلى (٤٠,٢ %) عن موسم التلقيح صيفا (٢٨,١ %) وقد سجلت النعاج التي عمرها ٣ سنوات و أقل من أربعة أعلى نسبة توائم (٣٩,٤ %) في حين أن النعاج التي عمرها ٤ سنوات فأكثر قد سجلت أقل نسبة توائم (٢٩,١ %).