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Research Article

A Comparative Study on the Growth and Survival Characteristics of Lambs Produced by the Transfer of In Vitro Produced (IVP) Embryos*

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Abstract: This study was carried out to determine the growth, survival rate and some body measurements until weaning of lambs produced by the the in vitro production (IVP) method in comparison with those of lambs produced by artificial insemination. The lambs in the experimental group were produced by the transfer of IVP embryos developed to the blastocyst stage after the in vitro maturation and fertilisation of oocytes obtained from the ovaries of slaughtered ewes.

The results of this study showed that the lambs produced by the IVP technique had a higher growth rate until weaning than did the lambs in the control group ($P < 0.05$). There were no significant differences between the experimental and control groups in terms of survival rate and body measurements.

It was concluded that the IVP technique, which provides significant improvements in population genetics, could be successfully applied in sheep breeding and could be of help in the improvement of the meat produced from lambs.

Key Words: Growth, in vitro production, Kıvırcık sheep breed, survival rate

İn Vitro Üretilen Embriyoların Transferinden Doğan Kuzuların Vücut Gelişimleri ve Yaşama Güçleri Üzerine Karşılaştırmalı Bir Araştırma

Özet: Bu araştırma, in vitro üretilen kuzuların sütten kesime kadarki büyüme, yaşama gücü ve bazı vücut ölçülerinin suni tohumlama yoluyla üretilen kuzularla karşılaştırmalı olarak belirlenmesi amacıyla yürütülmüştür. Deneme grubundaki kuzular, mezbahadan temin edilen koyun oositlerinin in vitro olgunlaştırılması, fertilizasyonu ve blastosist dönemine kadar in vitro kültürünü takiben embriyo transferi ile elde edilmiştir.

Araştırma bulguları, in vitro üretim tekniği ile elde edilen kuzuların sütten kesime kadar olan tüm dönemlerde kontrol grubuna göre daha fazla canlı ağırlık kazandığı ($P < 0,05$); gruplar arasında yaşama gücü ve vücut ölçüleri bakımından ise herhangi bir farklılık olmadığı yönündedir.

Sonuç olarak, hayvan ıslahında önemli ilerlemeler sağlayabilecek bu tekniğin koyunlarda başarıyla uygulanabileceği ve kuzu eti üretimine katkı sağlayabileceği kanısına varılmıştır.

Anahtar Sözcükler: Büyüme, in vitro üretim, Kıvırcık koyun ırkı, yaşama gücü

Introduction

Animal husbandry today uses industrial practices. Quality market lamb production, which uses well-organised and modern management techniques, is preferred in sheep breeding in developed countries.

To maintain efficiency and profitability in sheep breeding, methods like improving fertility characteristics, shortening lambing intervals, crossbreeding or embryo transfer can be used. The most significant factors in these improvements in terms of animal breeding are the

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shortening of the generation period and the improvement of the litter size per ewe.

Today, by the use of biotechnological methods, it is possible to accelerate the improvement in population genetics and to raise the level of production characteristics, which have greater economic value. By the use of assisted reproduction technologies it is possible to shorten the generation intervals. These methods also make it possible to increase the number of offspring obtained from valuable animals, which had to be slaughtered for any reason.

Studies, have shown that it is possible to obtain lambs by in vitro production. However, some disadvantages were encountered with this method, like the production of lambs with abnormalities or anomalies (anomalies of the head and extremities or large offspring). These disadvantages were thought to originate from factors in the culture media in which the embryo was kept (1-6).

Body measurements are important as they provide an idea about the morphological build-up of the body and reflect the growth and improvement of the lamb after birth. Meat production is also closely related to body size. It has been reported that the body measurements of the lambs should be taken to determine the growth of lambs until maturity (7).

This study was carried out to determine the growth, survival rate and some body measurements until weaning of lambs produced by the IVP method in comparison with those of lambs produced by artificial insemination.

Materials and Methods

The animal material consisted of 8 Kıvırcık lambs, produced by the IVP method (experimental group) and 21 Kıvırcık lambs, used as a control group. The lambs in the experimental group were produced by the transfer of IVP embryos developed to the blastocyst stage after the in vitro maturation and fertilisation of oocytes obtained from the ovaries of slaughtered ewes. The lambs in the control group were produced by artificial insemination. After birth, all the lambs were identified and their birth date, birth type, sex, dam's number and birth weights were recorded. All the lambs were managed under similar care and feeding conditions.

In terms of the live body measurements of the lambs in the experimental and control groups, cidago height (the ground-cidago), breast depth (cidago-sternum) body length (art. humeri-tuber ichii), breast circumference (from the back of the scapulas) and tail length (anus-the end point of the tail) were measured. The heights, lengths and depths were measured by a measurement stick and the circumferences and tail lengths were measured with a tape (7).

The live weight and live body measurements of the lambs were collected by weekly checks from birth until weaning (75^{th} day). The absolute results at 15, 30, 60 and 75 days were calculated by the linear interpolation of the measurement and weight data.

The statistical analyses of the live weights and body measurements were performed by the general linear models (GLM) procedure in SPSS program package (8).

The model below was used to determine the effect ratios of the factors affecting the live weight and body measurements at birth and the other control ages.

$$Y_{ijkl} = \mu + a_i + b_j + c_k + d_{ijkl}$$

In the model;

Y_{ijkl} : Individual observation,

μ : Overall mean,

a_i : Effect of groups (*i* = experiment and control),

b_j : Effect of sex (*j* = female and male),

c_k : Effect of birth type (*k* = single and twins),

d_{ijkl} : Random error.

In the model used, it was assumed that there were no significant interactions among the factors investigated, and the sum of the effects of the subgroups of factors was assumed to be zero.

Results

In this study, the growth, survival characteristics and some live-body measurements until weaning of the lambs, which were produced by the use of the IVP method for the first time in Turkey, were determined in comparison with those of lambs produced by classical methods. Table 1 shows the LSM and standard errors (SE) of the birth weight and body weight at different ages and the significance of the effects of the factors investigated.

Table 1. The least square means and standard errors of the birth weight and weight at different ages and the significance of affecting factors (kg).

Factors	Birth weight			15th day		30th day		60th day		75th day	
	n	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄
Expected means	29	4.41	0.18	7.91	0.46	11.96	0.49	18.10	0.78	20.39	0.95
Group		n.s.		*		*		*		*	
Experimental	8	4.54	0.32	8.86	0.79	13.02	0.83	20.58	1.32	23.63	1.22
Control	21	4.29	0.19	6.95	0.46	10.94	0.49	15.62	0.78	17.14	0.95
Birth Type		n.s.		n.s.		n.s.		n.s.		n.s.	
Single	19	4.47	0.20	8.60	0.48	12.82	0.50	19.38	0.81	22.09	0.99
Twin	10	4.36	0.29	7.22	0.74	11.13	0.78	16.82	1.26	18.69	1.54
Sex		n.s.		n.s.		n.s.		n.s.		n.s.	
Male	14	4.38	0.23	8.01	0.54	12.02	0.57	18.62	0.92	21.49	1.12
Female	15	4.44	0.27	7.81	0.69	11.93	0.72	17.58	1.16	19.29	1.32

n.s.: P > 0.05, *: P < 0.05

The birth weight, and 15, 30, 60 and 75 day weights of the lambs in the IVP and control groups were 4.54 kg, 8.86 kg, 13.02 kg, 20.58 kg and 23.63 kg, and 4.29 kg, 6.95 kg, 10.94 kg, 15.62 kg and 17.14 kg, respectively. The differences in terms of body weight between the lambs produced by the IVP technique and the control group were significant ($P < 0.05$) for all days except for birth weight. The differences with regard to the birth type and sex were not significant ($P > 0.05$) at any time.

In both the experimental and control groups the survival rates of the lambs were 100%.

The results of the cidago height, breast depth, body length, breast circumference and tail length are presented in Table 2. The differences between the lambs produced by the IVP technique and artificial insemination with regard to these body measurements were not statistically significant ($P > 0.05$) until weaning.

Discussion

The body weights of the Kıvırcık lambs at birth, and at 15, 30, 45, 60 and 75 days were 3.58-3.85 kg, 6.86 kg, 8.43-9.51 kg, 12.50 kg, 14.26-15.47 kg and 17.58 kg, respectively, in different studies (9-12). In this study, the body weights of the lambs produced by the IVP technique were higher than the results reported, although, the results of the control group were similar to those in these references.

It was reported that the cidago height, breast depth, body length, breast circumference and breast width were necessary and important for the breeder (7). In studies to determine the body measurements of Kıvırcık and crossbreds, yearlings at the age of 1.5 years were usually used (13-16). Akçapınar et al. (17) reported that in Kıvırcık x Akkaraman (F_1) lambs at 45 and 90 days the cidago heights were 45.22 cm and 50.47 cm, the breast depths were 19.64 cm and 23.32 cm, the body lengths were 44.95 cm and 51.19 cm, the breast circumferences were 54.42 cm and 64.80 cm and the tail lengths were 17.57 cm and 19.36 cm, respectively. These results are in accordance with those of this study.

Our results showed that the lambs produced by the IVP technique had a higher growth rate until weaning than did the lambs in control group. There were no significant differences between the groups in terms of survival rate and body measurements.

It was therefore concluded that the IVP technique, which provides significant improvements in population genetics, can be successfully applied in sheep breeding and could be of help in the improvement of the meat produced from lambs.

Table 2. The least square means and standard errors of some body measurements at different ages (cm).

Factors	Birth			15th day		30th day		60th day		75th day	
	n	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄	x̄	Sx̄
						Cidago height					
Expected means	29	35.79	0.60	36.77	0.52	43.76	0.67	52.19	0.59	54.10	0.55
Grup		n.s.		n.s.		n.s.		n.s.		n.s.	
Experimental	8	35.62	1.01	40.39	0.89	44.15	1.13	52.76	0.99	55.06	0.93
Control	21	35.95	0.60	39.14	0.52	43.37	0.67	51.62	0.58	53.14	0.55
						Breast depth					
Expected means	29	12.40	0.34	14.02	0.28	15.85	0.33	18.78	0.35	20.19	0.31
Grup		n.s.		n.s.		n.s.		n.s.		n.s.	
Experimental	8	12.92	0.58	14.31	0.48	15.97	0.56	19.14	0.60	20.79	0.53
Control	21	11.89	0.35	13.73	0.28	15.74	0.33	18.42	0.35	19.59	0.31
						Body length					
Expected means	29	32.70	0.45	37.49	0.63	41.84	0.65	49.50	0.67	51.30	0.67
Grup		n.s.		n.s.		n.s.		n.s.		n.s.	
Experimental	8	33.30	0.76	38.16	0.95	41.80	1.11	50.71	1.13	52.29	1.14
Control	21	32.09	0.45	36.82	0.63	41.88	0.65	48.29	0.68	50.31	0.67
						Breast circumference					
Expected means	29	38.85	0.70	45.22	0.86	52.48	0.90	63.11	1.03	65.44	1.03
Grup		n.s.		n.s.		n.s.		n.s.		n.s.	
Experimental	8	38.52	0.99	44.95	1.05	52.61	1.53	63.16	1.75	66.28	1.56
Control	21	39.17	0.71	45.50	0.86	52.36	0.90	63.05	1.03	64.59	1.03
						Tail length					
Expected means	29	16.71	0.56	18.82	0.48	21.42	0.53	23.07	0.49	23.31	0.49
Grup		n.s.		n.s.		n.s.		n.s.		n.s.	
Experimental	8	16.77	0.95	18.93	0.82	21.85	0.89	23.50	0.83	24.70	0.82
Control	21	15.65	0.57	18.71	0.48	20.99	0.53	22.63	0.49	22.92	0.48

n.s.: $P > 0.05$

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