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Effect of Inbreeding on Pre-Weaning Growth Traits of Barki and Rahmani Lambs

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ABSTRACT

Data on 704 Barki and 732 Rahmani lambs born at Alexandria University Experimental Station between 1991 and 2014 were utilized in this investigation to evaluate the effects of inbreeding of lambs and ewes on birth weight (BW), weaning weight (WW) and average daily gain (ADG) from birth to weaning. Inbreeding coefficients of lambs and ewes were estimated using Wombat program by fitting a univariate animal model for each breed separately. Least squares analysis of variance indicated that means of BW, WW and ADG of Barki lambs were 3.69 and 20.53 kg and 139.71 g, respectively. The respective values for Rahmani lambs were 3.54 and 20.09 kg and 137.81 g.The means of lamb and ewe inbreeding coefficients were 0.0616 and 0.0434 for Barki and 0.0845 and 0.0552 for Rahmani.The effects of season and year of birth, sex of lamb, type of birth and parity on all studied traits of both breeds were significant ($P<0.01$ or $P<0.05$) except the effect of year of birth on BW and effects of parity on WW and ADG of Barki lambs which were not significant. Linear regression coefficients of studied traits on inbreeding of lambs were not significant for both breeds except that of ADG of Rahmani lambs which was significant ($P<0.05$). On the other hand, linear regression coefficients of lambs studied traits on their ewes inbreeding were significant ($P<0.01$) for Barki breed. The corresponding coefficients for Rahmani breed were significant ($P<0.01$) for WW and ADG but not for BW. The regression coefficients of Barki lambs BW, WW and ADG on lambs inbreeding coefficients were -0.0032 and 0.0275 kg and 0.2107 g, and were 0.0031 and -0.0384 kg and -0.3906 g for Rahmani, respectively. The corresponding estimates of Barki BW, WW and ADG on ewes inbreeding coefficients were -0.0182 and -0. 2104 kg and -1.6110 g and those for Rahmani were -0.0035 and -0.1041 kg and -0.8329 g, respectively. In General, the current results indicated that inbreeding level of ewes had greater detrimental effects than that of lambs on lambs' growth traits especially for Barki breed. Therefore, inbreeding should be avoided in this flock of Barki and Rahmani sheep through utilizing planned mating or introducing breeding rams from other sheep flocks.

Keywords: *Inbreeding, pre-weaning growth traits, Barki, Rahmani, lambs.*

INTRODUCTION

Sheep population in Egypt approached six million heads in 2016, and contributed to about 7.42 % of the national total red meat supply (FAO, 2018). Barki and Rahmani sheep are two of the three major sheep breeds in the country.

Inbreeding, resulting from mating closely related animals, occurs as a consequence of small flock size or practicing selective breeding strategies. Inbreeding problem is the result of an accumaltion of deleterious recessive allels. When the animal becomes homozygous for these recessive allels because of inbreeding, the animal fitness is reduced. Close inbreeding increases the level of homozygosity more than that of mild inbreeding. The impact of the former are, therefore, more marked than of the latter type of breeding. Small flocks suffer more deterioration in fittness than large flocks.

Studies on various sheep breeds have shown reduction in birth and weaning weights of lambs due to increases in levels of inbreeding of lambs or ewes (MacKinnon and Notter 2003, Alsheikh, 2005, Van Wyk *et al.* 2009 and Mokhtari *et al.* 2014). On the contrary, sevral investigations on sheep growth have indicated negligible increases in birth weight (Akhtar *et al.* 2000, Negussie *et al.* 2002 and Yeganehpur *et al.* 2016), weaning weight (Akhtar *et al.* 2000 and Hussain *et al.* 2006) and pre-weaning average daily gain (Hussain *et al.* 2006) of inbred lambs. Ceyhan *et al.* (2009) reported that the increase in inbreeding of lambs' resulted in a significant increase in birth weight of lambs. Moreover, Negussie *et al.* (2002) reported that the increase in ewes inbreeding level resulted in negligible increase in birth and weaning weights of lambs. In addition, Ceyhan *et al.* (2009) indicated that inbreeding level of ewes had greater detrimental effects than that of lambs on lambs' growth traits.

The objective of this study was to evaluate effects of lamb and ewe inbreeding on birth and weaning weights and pre-weaning average daily gain of Barki and Rahmani lambs.

MATERIALS AND METHODS

Source of data:

Data used in this investigation were from the records of the sheep flock located in the Experimental Station, Faculty of Agriculture, Alexandria University. This flock has been predominately closed to outside breeding. The records used were relevant to 704 and 732 Barki and Rahmani lambs presenting 20 and 21 rams and 205 and 214 ewes, respectively. These records covered the period from 1991 to 2014. Descriptive statistics and distribution of the data are found in Table 1.

Flock management:

Animals were housed in semi closed pens, fed on Egyptian clover (*Trifolium alexandrinum*) during winter and spring and on stubble and Egyptian clover hay and/ or fodder sorghum (*Sorghum bicolor)* during summer and autumn. Supplementary concentrates feeding of about 0.25 kg / head were offered daily all year round.

The flock was managed for round year lambing. Females were first mated at about 18 months of age. Rams and ewes were selected as yearlings on the basis of visual appraisal of type and size rather than on a pre-set intensive selection programme. Corrective mating scheme was practiced with regard to maintain the flock close to breeds' conformation. The generated negative assortative mating may have resulted in a slower than expected increase in the measurable inbreeding. Once the ewe entered the breeding flock, there is no chance for culling until the end of its productive life. Lambs were weighed 12-24 hours after birth to the nearest 0.01 kg. They were weaned at about 4 months of age.

Inbreeding coefficients of both lambs (F_L %) and ewes (F_E %) were derived from the additive relationship matrix using the Wombat programme fitting univeriate animal models (Meyer, 2006). The mean F_E for both breeds

was assumed to be zero in 1991 and 1992. Annual trend in inbreeding was estimated by averaging inbreeding coefficient of both lambs and ewes within each year.

Statistical Analysis:

Least squares analysis of variance was utilized to test the significance of the fixed effects of season of birth (4 seasons), year of birth (8 periods), sex of lamb (male and female), type of birth (single and twin) and parity (1 to 7 and above) on birth weight (BW), weaning weight (WW) and average daily gain (ADG) from birth to weaning. Months of birth were classified by season of the year into autumn (September, October and November), winter (December, January and February), spring (March, April and May) and summer (June, July and August). Years of birth from 1991-2014 were classified to eight periods (1= 1991-1993, 2=1994 - 1996, 3=1997 - 1999, 4=2000 – 2002, 5= 2003-2005, 6= 2006-2008, 7= 2009-2011 and 8= 2012-2014). Data were analyzed for each breed separately using GLM procedure (SAS 2008). The statistical model fitted was:

$$Y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + p_m + \beta_1 (FL_{ijklm}) + \beta_2 (FE_{ijklm}) + e_{ijklmn}$$

where, Y_{ijklm}**: either BW, WW or ADG;** μ**: an underlying constant specific to each trait;** a_i**: the fixed effect of** i^{th} **season of birth (i=1,2,3 and 4);** b_j**: the fixed effect of** j^{th} **year of birth (j=1,2,3……8);** c_k**: the fixed effect of** k^{th} **sex (k=1 and 2);** d_l**: the fixed effect of** l^{th} **type of birth (l=1 and 2);** p_m**: the fixed effect of** m^{th} **parity (m=1,2,3…..7);** β_1**: the linear regression coefficient of each studied trait on inbreeding coefficient of lamb, (co-variable 1),** FL_{ijklm}**: the deviation of lamb inbreeding coefficient from overall lambs inbreeding coefficients mean;** β_2**: the linear regression coefficient of each studied trait on inbreeding coefficient of ewe, (co-variable 2),** FE_{ijklm}**: the deviation of ewe inbreeding coefficient from overall ewes inbreeding coefficients mean, and** e_{ijkl}**: random residual assumed to be independent normally distributed with mean zero and variance** σ_e^2.

RESULTS AND DISCUSSION

The overall means of BW, WW and ADG of Barki lambs were 3.69 and 20.53 kg and 139.71 g, respectively, the corresponding values for Rahmani lambs were 3.54 and 20.09 kg and 137.81 g, respectively (Table 1). Means of BW, WW and ADG of Barki lambs were relatively higher than those (3.56 kg, 19.29 kg and 131.02 g, respectively) reported by Gad and El-Wakil (2013) and means of Rahmani lambs were relatively higher than those (3.42 kg, 19.49 kg and 135.00 g, respectively) reported by Abbas *et al*. (2010) on other experimental flocks of Barki and Rahmani sheep in Egypt.

Table 1. Basic statistics and distributions of data for birth weight (BW, kg), weaning weight (WW, kg) and average daily gain (ADG, g) of Barki and Rahmani lambs.

Items	Barki			Rahmani		
	BW	WW	ADG	BW	WW	ADG
Mean	3.69	20.53	139.71	3.54	20.09	137.81
SD (kg)	0.59	4.61	36.46	0.59	4.41	34.74
CV (%)	16.01	22.46	26.10	16.61	21.95	25.21
No. of sires	20	20	20	21	21	21
No. of dams	205	197	197	214	195	195
No. of lambs	704	636	636	732	629	629
No. of ram lambs	363	331	331	358	304	304
No. of ewe lambs	341	305	305	374	325	325
No. single lambs	633	570	570	478	416	416
No.of twin lambs	71	66	66	254	213	213
No. of noninbred lambs	317	286	286	221	198	198
No. of inbred lambs	387	350	350	511	431	431
No. of noninbred ewes	115	112	112	106	100	100
No. of inbred ewes	90	85	85	108	95	95
Mean of F_L (%)	6.16	6.26	6.26	8.45	8.03	8.03
SD (%)	7.71	7.75	7.75	8.78	8.46	8.46
Mean of F_E (%)	4.34	4.33	4.33	5.52	5.42	5.42
SD (%)	6.48	6.53	6.53	8.21	8.23	8.23
Lamb inbreeding trend %	-0.343 ^{NS}	-	-	0.142^{NS}	-	-
Ewe inbreeding trend %	0.579 ^{NS}	-	-	0. 710 ^{NS}	-	-

F_L (%): inbreeding coefficient of lambs; F_E (%): inbreeding coefficient of ewes
NS: Not significant (P>0.05)

A- Nongenetic effects:

The effects of season and year of birth, sex of lamb, type of birth and parity on BW, WW and ADG were significant (P<0.01or P<0.05) except the effects of year of birth on BW and parity on WW and ADG of Barki lambs were not (Table 2). Similar significant effects of the above factors on pre-weaning growth traits of lambs of different sheep breeds have been documented (Tariq *et al*. 2010, Ceyhan *et al.* 2011, Senemari *et al.* 2011, Javed *et al.* 2013, Rahimi *et al.* 2014, Simeonov *et al.* 2015, Mellado *et al*. 2016, Tohidi *et a*l. 2016, Marufa *et al.* 2017 and Farrag *et al.* 2018).

Table 2. Effects of nongenetic factors and lamb and ewe inbreeding on birth weight (BW), weaning weight (WW) and average daily gain (ADG) of Barki and Rahmani lambs.

Source of variation	Barki				Rahmani			
	df*	BW	WW	ADG	df*	BW	WW	ADG
Season ofbirth	3	*	**	**	3	**	**	**
Year of birth	7	NS	**	**	7	**	**	**
Sex of lamb	1	**	**	**	1	**	**	**
Type of birth	1	**	**	**	1	**	**	**
Parity	6	**	NS	NS	6	**	**	*
Inbreeding of lambs	1	NS	NS	NS	1	NS	NS	*
Inbreeding of ewes	1	**	**	**	1	NS	**	**
Error		(683)	(615)	(615)		(711)	(608)	(608)

NS: Not significant (P>0.05); *: Significant (P< 0.05); **: Highly significant (P< 0.01)

B- Inbreeding coefficients:

Numbers of inbred Barki and Rahmani lambs were higher than those noninbred, inbred lambs constituted 54.97 and 69.81% of total Barki and Rahmani lambs in Barki and Rahmani, respectively (Table 1). The means of F_L % were 6.16 and 8.45 % for Barki and Rahmani breeds, respectively (Table 1). Similar to this, F_L mean of 8.08 % was reported by Mokhtari *et al.* (2014) for Iran-Black sheep. Contrary, very low means of F_L ranging from 0.03 to 2.25 % have been reported by Akhtar 2000, Negussie *et al.* 2002, Alsheikh 2005, Mandal *et al.* 2005, Hussain *et al.* 2006, Barczak *et al.* 2009, Ceyhan *et al.* 2009, Ceyhan *et al.* 2011 and Dorostkar *et al.* 2012 for various sheep breeds. Hence, the current F_L means for Barki and Rahmani breeds are higher than those depicted in the literature due to differences in mating systems, breeding strategy or flock size.

Number of inbred ewes was lower than that of nonbred for Barki and about equal for Rahmani, inbred ewes constituted about 43.90 and 50.47 % of total ewes for the respective breeds with means F_E %of 4.33 % and 5.52 % for the two breeds, respectively (Table 1). Whereas, Mandal *et al.* (2005) reported a mean F_E of 0.90 % for Indian Muzffarnagari sheep.

Generally, F_L of Barki breed showed nonsignificant negative trend of 0.343 % (Table 1). The yearly means $F_L$for Barki breed were the highest between 1991 and 1996, decreased in 1997, fluctuated between 3 and 8 % from 1998 to 2005, reached a bottom of 1 % in 2006 and 2 % in 2007, fluctuated from 5 to 8 % from 2008 to 2013 and then decreased to be zero in 2014 (Figure 1). The bottom values of mean F_L obtained in 1997, 2006 and 2014 were because of introducing of exotic Barki breeding rams to the flock. Despite of the nonsignifcant positive trend in F_E of Barki breed (0.579 %) between 1991 and 2014 (Table 1), the observed fluctuations were a consequance of introducing exotic breeding rams. The mean F_E for Barki breed was assumed to be zero in 1991 and 1992, increased from 1993 to reach the peak in 1998 and then showed fluctuated decreases from 1999 to 2014 (Figure 1).

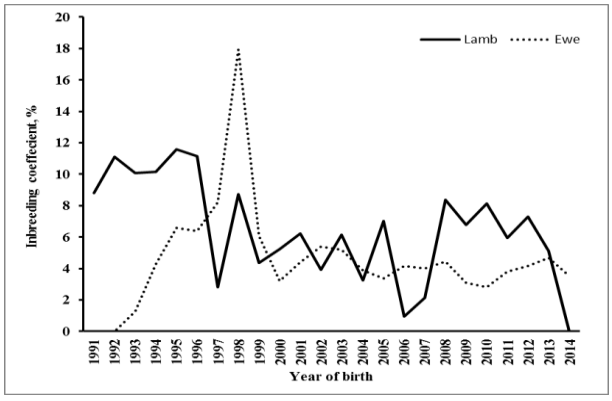

Figure 1. Mean of inbreeding coefficient (%) of Barki lambs and ewes by year of birth.

The general trend of F_L for Rahmani breed was nonsignificantly positive (0.142 %) (Table 1).The mean $F_L$fluctuated from 6 to 12 % between 1991 and 1998, increased to reach a peak of 15 % in 2000, decreased sharbly in 2001 to reach about 7 % and continued around that value from 2002 to 2005, decreased sharbly to approach zero in 2006 and 2007, increased gradually from 2008 to reach about 12 % in 2010, decreased in 2011 and fluctuated around 7 % in 2012 and 2013 (Figure 2). The sharp decline in the mean of F_L to reach zero in 2006 and 2007 was again due to the introduction of pure Rahmani breeding rams from another expertimental flock. Generally, F_E trend for Rahmani was nonsignificant positive (0.710 %) (Table 1). The mean of F_E of the Rahmani flock was assumed to be zero in 1991 and 1992, increased from 1993 to reach a peak in 1998 to 2000, decreased to 6 % in 2001 and then flacutated slightly between 2002 and 2006, decreased in 2007 to reach about 3 % and fluctuated around that value from 2008 to 2011, and increased gradually up to 2014 (Figure 2).

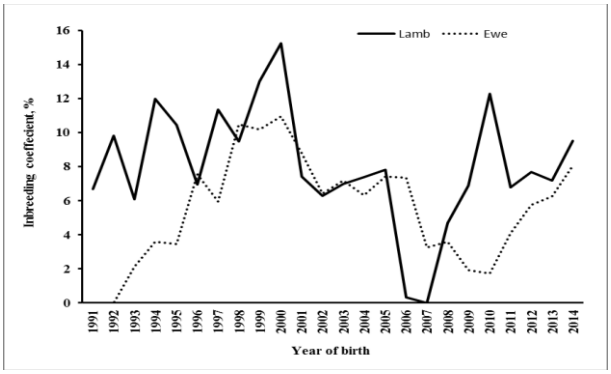

Figure 2. Mean of inbreeding coefficient (%) of Rahmani lambs and ewes by year of birth.

C- Inbreeding Effect:

Linear regression coefficients of BW, WW and ADG on F_L of barki lambs (b_1) were -0.0032 and 0.0275 kg and 0.2107 g, respectively. The corresponding values for Rahmani lambs were 0.0031, -0.0384 kg and -0.3906 g, respectively (Table 3). These regression coefficients were not significant except that of ADG of Rahmani lambs ($P<0.05$). In Pakistan, Akhtar *et al.* (2000) reported also nonsignificant regression coefficients of BW and WW and ADG on inbreeding of Hissardale lambs being 0.0009, 0.0213 kg and -0.0001 g for the respective traits. Also, Negussie *et al.* (2002) reported nonsignificant regression coefficients of BW and WW of 0.0035 and -0.0063 kg, respectively on inbreeding of Horro lambs in Ethiopia.In Egypt, Alsheikh *et al.* (2005) obtained negative significant ($P<0.05$) regression coefficients of BW and WW on inbreeding of Barki lambs being -0.006 and -0.015 kg, respectively. In India, Mandal *et al.* (2005) reported negative significant ($P<0.01$) regression coefficients of BW and WW on inbreeding of Muzaffaragari lambs being -0.010 and -0.048 kg, respectively. Hussain *et al.* (2006) depicted negative significant ($P<0.01$) regression coefficients of BW, WW and ADG on inbreeding of Thalli lambs in Pakistan being -0.051, 0.083 and 0.105 kg for the respective traits. In Poland, the calculated positive or negative regression coefficients of BW on inbreeding of lambs ranged from -12.09 to 16.0 g depending on sheep line were reported by Barczak *et al.* (2009). Ceyhan *et al.* (2009) showed significant ($P<0.01$) positive regression coefficient of BW and nonsignificant negative regression coefficients of WW and pre-weaning weight gain on inbreeding of Gokceada lambs in Turkey. Van Wyk *et al.* 2009 found significant ($P<0.01$) negative regression

coefficients of BW and WW on inbreeding of Elsenburg Dormer lambs in South Africa being -0.006 kg and -0.093 kg, respectively. Ceyhan *et al.* (2011) depicted significant (P<0.01) negative regression coefficients of BW and nonsignificant negative of WW on inbreeding of Sakiz lambs in Turkey being -0.0245 and -0.0234 kg, respectively. Dorostkar *et al.* (2012) documented nonsignificant negative regression coefficients of BW and significant (P<0.05) negative of WW on inbreeding of Moghani lambs in Iran being -0.007 and -0.291 kg, respectively. Mokhtari *et al.* (2014) reported significant (P<0.05) negative regression coefficiensts of BW and nonsignificant negative of WW on inbreeding of lambs of Iran-Black sheep being -0.007 and -0.037 kg. Also in Iran, Yeganehpur *et al.* (2016) showed nonsignificant regression coefficients of BW and WW on inbreeding of Lori lambs being 4.5 and -10.3 g, respectively. In Egypt, Farrag *et al.* (2018) depicted nonsignificant negative regression coefficients of BW and WW and significant (P<0.05) negative of ADG on inbreeding of Saidi lambs being -0.0045 and -0.0195 kg and -0.169 g, for the respective traits. Rashidi *et al.* (2018) reported nonsignificant regression coefficients of BW (2.45, -1.27 and -3.49 g) and significant (P<0.01 or P<0.05) regression coefficients of WW (29.35, -25.12 and -42.20 g) on inbreeding of lambs of Baluchi, Iran-Black and Zandi sheep in Iran, the repective regression coefficients for ADG were nonsignifcant for Baluchi (3.28 g) and significant (P<0.05 or P<0.01) for Iran-Black (-0.30) and Zandi sheep (-4.00 g). The variation in the magnitude of the effect of inbreeding on pre-weaning growth traits could be attributed to the intensity of inbreeding, flock genetic diversity, and durationan and objectives of the practiced breeding systems and genetic selection plans.

Linear regression coefficients of BW, WW and ADG of barki lambs on F_E (b_2) were -0.0182 and -0.2104 kg and -1.6110 g, respectively (Table 3). The corresponding values for Rahmani flock were -0.0035 and -0.1041 kg and -0.8329 g for the respective traits. All regression coefficients were significant (P<0.01) except that of Rahmani lambs BW. In Ethiopia, Negussie *et al.* (2002) obtained nonsignificant positive regression coefficients of BW and WW of Horro lambs on ewes inbreeding being 0.0012 and 0.0036 kg, respectively. Alsheikh *et al.* (2005) depicted nonsignificant negative regression coefficients of BW (-0.006 g) and WW (-0.003 g) of Barki lambs on inbreeding of ewes. In India, Mandal *et al.* (2005) reported nonsignificant positivere gression of BW (0.005 kg) and nonsignificant negative of WW (-0.029 kg) of Muzaffaragari lambs on inbreeding of ewes. Ceyhan *et al.* (2009) demonstrated nonsignificant positive regression coefficient of BW and significant (P<0.05) positive regression of WW and pre-weaning weight gain of Gokceada lambs on inbreeding of ewes in Turkey. Van Wyk *et al.* (2009) depicted significant (P<0.01) negative regression coefficient of BW (-0.006 kg) and of WW (-0.041 kg) of the Elsenburg Dormer lambs on inbreeding of ewes in South Africa. Moreover, Mokhtari *et al.* (2014) reported significant (P<0.01 and P<0.05) negative regression coefficient of BW (-0.017 kg) and of WW (-0.062) of lambs on inbreeding of ewes of Iran-Black sheep. In view of the current results, ewe inbreeding value had detrimental effects on pre-weaning growth traits of Barki and Rahmani lambs in this flock.

Table 3. Regression coefficients of studied traits of Barki and Rahmani lambs on both inbreeding of lambs (b_L) and ewes (b_E).

Breed	Trait	Lambs $b_1 \pm SE$	Ewes $b_2 \pm SE$
Barki	BW (kg)	-0.0032^{NS} ±0.0034	-0.0182** ±0.0040
	WW(kg)	0.0275^{NS} ±0.0285	-0.2104** ±0.0327
	ADG (g)	0.2107^{NS} ±0.2242	-1.6110** ±0.2583
Rahmani	BW (kg)	0.0031^{NS} ±0.0031	-0.0035^{NS} ±0.0032
	WW(kg)	-0.0384^{NS} ±0.0246	-0.1041** ±0.0250
	ADG (g)	-0.3906* ±0.1941	-0.8239** ±0.1974

BW: birth weight; WW: weaning weight; ADG: average daily gain
NS: Not significant (P>0.05); *: Significant (P< 0.05); **: Highly significant

CONCLUSION

The in nbreeding level of Barki lambs caused nonsignificant reduction in BW, but resulted in nonsignificant increase in WW and ADG. An opposite trend was obseved in the growth traits of Rahmani lambs. Inbreeding of lambs caused nonsignificant increases in BW and reduction in WW but significant decline in ADG. On the other side, inbreeding level of ewes gave rise to significant reduction in BW, WW and ADG of Barki and also in WW and ADG of Rahmani lambs. Generally, the results indicated that inbreeding level of ewes had greater detrimental effects than that of lambs on lambs' growth traits especially for Barki breed. Moreover, the intentional use of inbreeding in genetic improvement of sheep flocks has limited impact.

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تأثير التربية الداخلية على صفات النمو قبل الفطام للحملان البرقى والرحمانى

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اجري هذا البحث باستخدام بيانات سجلات لحملان عددها 704 برقى و732 رحماني مولودة خلال الفترة من 1991-2014م في محطة بحوث جامعة الإسكندرية. ذلك من أجل تقييم تأثيرالتربية الداخلية لكل من الحملان والنعاج على وزن الميلاد، وزن الفطام ومعدل النمو اليومي من الميلاد حتي الفطام للحملان. تم تقدير معامل التربية الداخلية للحملان والنعاج بتحليل البيانات لكل سلالة على حدها بواسطة نموذج الحيوان Univariate Animal Model بإستخدام برنامج Wombat. بعد إضافة قيم معامل التربية الداخلية للحملان والنعاج لملف البيانات لكل سلالة تم تحليل البيانات بطريقة الحد الأدنى للمربعات باستخدام برنامج الSAS. أوضحت النتائج أن المتوسط العام كان 3.69 كجم لوزن الميلاد و20.53 كجم لوزن الفطام و139.71 جم لمعدل النمو اليومي للحملان البرقي وكان 3.54 كجم, 20.09 كجم و137.81 جم لنفس الصفات على الترتيب للحملان الرحماني. كما أوضحت النتائج أن المتوسط العام للتربية الداخلية للحملان والنعاج كان 0.0616 و 0.0434 لسلالة البرقي وكان 0.0845 و0.0552 لسلالة الرحماني. كانت تأثيرات موسم الميلاد، سنة الميلاد، جنس الحمل، نوع الميلاد وترتيب موسم الميلاد معنوية (P< 0.05 أو P<0.01) على الصفات موضع البحث للسلالتين فيما عدا أن سنة الميلاد ليس لها تأثيراً معنوياً على وزن الميلاد للحملان البرقي وترتيب موسم الميلاد لم يكن له تأثيراً معنوياً على وزن الفطام ومعدل النمو اليومي لحملان نفس السلالة. كانت معاملات الانحدار للصفات على معامل التربية الداخلية للحملان غير معنوية في السلالاتين فيما عدا بالنسبة لصفة معدل النمو اليومي للحملان الرحماني حيث كان معامل الانحدار معنوياً (P< 0.05). كانت معاملات الانحدار للصفات علي معامل التربية الداخلية للنعاج معنوية جداً (P<0.01) لكل الصفات للحملان البرقي وكان معامل الانحدار غيرمعنوي لوزن الميلاد ومعنوياً جداً (P<0.01) لوزن الفطام ومعدل النمو اليومي للحملان الرحماني. كانت تقديرات معاملات الانحدار للصفات على معامل التربية الداخلية للحملان -0.0032 كجم، 0.0275 كجم و0.2107 جم بالنسبة لصفات وزن الميلاد، وزن الفطام ومعدل النمو اليومي لسلالة البرقي وكانت 0.0031 كجم، -0.0384 كجم و -0.3096 جم للحملان الرحماني لنفس الصفات علي الترتيب. أما بالنسبة لتقديرات معامل الانحدار للصفات علي معامل التربية الداخلية للنعاج كانت -0.0182 كجم، -0.2104 كجم و-1.6110 جم بالنسبة لصفات وزن الميلاد، وزن الفطام ومعدل النمو اليومي على الترتيب لسلالة البرقي وكانت -0.0035 كجم، -0.1041 كجم و-0.8239 جم لنفس الصفات على الترتيب للحملان الرحماني.

أظهرت نتائج البحث بصفة عامة أن التربية الداخلية للنعاج لها تأثيراً محدداً لصفات النمو قبل الفطام للحملان في السلالتين أكثر من تأثير التربية الداخلية للحملان وخصوصاً لسلالة البرقي. لذا يجب تجنب حدوث التربية الداخلية في القطيع موضع البحث وذلك عن الطريق التزاوج المخطط أو إدخال كباش من قطعان بحثية أخري إلي هذا القطيع.