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EFFECT OF INBREEDING ON BIRTH AND WEANING WEIGHTS AND LAMB MORTALITY IN A FLOCK OF EGYPTIAN BARKI SHEEP

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Introduction

Barki is one of the three major Egyptian sheep breeds (Galal et. al., 2001). A nucleus flock of Barki sheep was started at Ras El-Hekma Desert Research Station since1957 for the purpose of conservation, the study of its characteristics and improving its production. The flock was later transferred to Maryout research station in 1971. This flock was reduced during the last 40 years from over one thousand heads in the sixties of the last century to about 300 head in 2002 due to different reasons (mainly financial). Frequent purchases of rams or ewes were added to the flock to avoid inbreeding. However, during the past ten years, no new introductions were made and the flock thus became closed. In a breeding program, the inbreeding coefficient (F) and the rate of annual inbreeding (ΔF) should be monitored because of their impact on production and on the estimation of genetic parameters. Moreover, the rate of increase in inbreeding (ΔF) is an indicator of how many years a flock can be kept before reaching a critical inbreeding level (Pante et. al., 1998). The aim of this study was to estimate the levels of inbreeding and investigate the occurrence of inbreeding depression, if any, in birth and weaning weights and lamb mortality from birth to weaning.

Materials and methods

Data included the performance of 2357 Barki lambs born during 17 lambing seasons from 1986 to 2002. Data were collected from a flock of Barki sheep raised at Maryout Research Station, which belongs to the Desert Research Center, Ministry of Agriculture. This station is located some 35 km west of Alexandria, longitudes 30^{o} 57' E and 30^{o} 41' E and latitudes 29^{o} 55' N and 29^{o} 25' N. Animals were housed in semi open sheds. Feeds consisted mainly of concentrate feed mixture (16% crude protein) plus berseem (Trifolium alexantrinum) when available and rice or wheat straw during the period from October to May. During, the rest of the year, berseem was replaced by berseem hay. This mixture was fed once a day and water was available twice daily around noon after feeding and in late afternoon. The breeding season started during September for a period of 35 days. Ewes were joined in mating groups with a fertile ram. The rams were selected according to individual performance and parent-offspring and brothers-sister mating was avoided in order to reduce the inbreeding.Data analysis: Data were analyzed using the General Linear Models (GLM) procedure (SAS, 1998). The model included the effects of sex of lamb (S), type of birth (T), year of birth (Y) and age of dam (A) and the interaction of S*T, S*Y, S*A, T*Y, T*A and Y*A as well as linear partial regression of the trait on inbreeding coefficient of lamb and dam. Age of dam was classified into 4 groups (18 - 29, 30- 41, 42 - 53 and ≥ 54 months). The algorithm of Boldman et. al. (1993) was used to calculate the coefficients of inbreeding utilizing pedigree data of all individuals. Assumptions were made that all lambs in the first year (1986) had an inbreeding coefficient of zero. The annual rate of inbreeding (ΔF_t) was calculated as $\Delta F_t = (F_t - F_{t-1}) / (1-F_{t-1})$ where F_t is the average inbreeding coefficient of individuals born in year t (Falconer and Mackay 1998).

Results and discussion

Inbreeding: Table 1 shows that the average inbreeding coefficient (F) generally increased with the years. The overall average inbreeding coefficient (0.0072) of the lamb was generally less than the values reported in previous studies (0.008 by Stal et. al., 2003; 0.0142 by Elshennawy and Raheem,2000; 0.0121 by Fikse et. al.,1997; 0.009 by Casanova et. al., 1992).

Table 1. Number of lambs, inbred animals percentage (IA%), average of inbreeding coefficient (F), inbreeding rate (ΔF) and range of inbreeding coefficient (RF) during the years from 1986 to 2002 of Barki flock at Maryout station.

Birth years	Number	IA%	F	ΔF	RF
1986	**183**	**0.0**	**0.0000**	**--**	**(0.0000 – 0.0000)**
1987	**163**	**4.9**	**0.0001**	0.01	**(0.00003 - 0.0010)**
1988	**92**	**5.5**	**0.0005**	0.04	**(0.00002 - 0.0016)**
1989	**336**	**2.7**	**0.0002**	-0.05	**(0.00001 - 0.00003)**
1990	**53**	**9.1**	**0.0009**	0.09	**(0.00001 - 0.0040)**
1991	**7**	**13.6**	**0.0027**	0.18	**(0.00012 - 0.0032)**
1992	**62**	**9.9**	**0.0019**	-0.08	**(0.0004 - 0.0020)**
1993	**13**	**14.1**	**0.0021**	0.02	**(0.0001 - 0.0036)**
1994	**118**	**11.8**	**0.0100**	0.80	**(0.0005 - 0.0201)**
1995	**168**	**23.7**	**0.0092**	-0.08	**(0.0055 - 0.0192)**
1996	**286**	**34.5**	**0.0039**	-0.53	**(0.0011 - 0.0074)**
1997	**238**	**33.9**	**0.0109**	0.71	**(0.0043 - 0.0222)**
1998	**180**	**36.7**	**0.0121**	0.12	**(0.0067 - 0.0213)**
1999	**74**	**39.0**	**0.0117**	-0.04	**(0.0078 - 0.0198)**
2000	**121**	**31.1**	**0.0139**	0.22	**(0.0083 - 0.0230)**
2001	**109**	**40.9**	**0.0176**	0.38	**(0.0107 - 0.0267)**
2002	**154**	**33.1**	**0.0170**	-0.06	**(0.0094 - 0.0245)**
Overall	*2357*	*21.5*	*0.0072*	*0.11*	

The values of F were approximated nearest to fourth decimal.
The values of ΔF were percentages and approximated nearest to second decimal.

The estimates of inbreeding coefficient of the lamb during the period from 1986 to 1996 were less than those estimates during the period from 1997 to 2002. This result could be attributed to the fact that all rams used were selected inside the flock during the latter period. Matings were planed so as to avoid parent-offspring and brothers-sister relationship to reduce the inbreeding, but these restrictions were not enough to avoid all relationships paths e.g. their ram aunts and ram grandmother. This result could explained by that, the selection had more discriminating along with classes with higher inbreeding thus eliminating some of the less fit homozygotes (Galal et. al., 1981). Figure 1 illustrates average inbreeding coefficient (F) of animals during the period from 1986 to 2002. Lamb's inbreeding coefficient increased from 1997 to 2002 (last 6 years). The average of inbreeding coefficient of the lamb during these six years was 0.0142, which seems to be similar to those estimated by Afifi et. al (1984) (0.014 and 0.011) in two closed flocks of Egyptian Rahmain and Barki sheep. This value was twice the overall inbreeding coefficient (0.0072). So, it is expected that the level of inbreeding coefficient of the lamb in the coming years will increase with increased relationship between rams and ewes in mating groups unless measures are taken to reverse the trend.

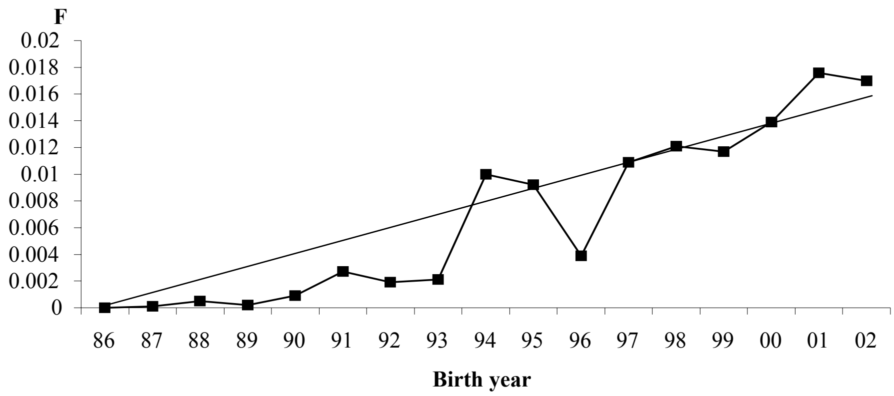

Figure 1. Avearge of inbreeding coefficiente (F) during the period from 1986 to 2002 in a Barki flock

Effect of inbreeding: The effect of inbreeding on the birth (BW) and weaning (WW) weights and lamb mortality (LM) is shown in Table 2. The inbreeding coefficient of the lamb had a significant effect (P<0.05) on BW, while the inbreeding coefficient of the dam had significant effect (P<0.05) on LM. The linear regressions indicated that, each increase of 0.01 of inbreeding coefficient of the lamb was associated with a change of -6g, -15g and +0.06% in its BW, WW and LM, respectively. While, each 0.01 increase in inbreeding coefficient of the dam was associated with a change of -6g, -3g and +0.24 %, respectively. These results are in agreement with Elshennawy and Raheem (2000). Michelle (2003) also reported significant effects of lamb inbreeding on birth, 60 day, and weaning weights while the dam inbreeding had no significant effects on such traits. The present results confirmed the results obtained by Amer and Jobson (2003) on lamb survival. They found that, the inbreeding coefficient of the lamb and of the dam had significant effect (P< 0.05) on the lamb survival (each 0.01of the lamb and of the dam inbreeding coefficient reduction the lamb survival by 0.32 % and 0.71%, respectively). While, Galal, et al. (1981) found that, inbreeding of the dam had no significant effect on survival at 7 days, 30 days, 120 days and 180 days in a flock of Barki sheep. On the other hand, the inbreeding level had more effect on ewe fertility and lamb survival than growth traits i.e. BW and WW as reported by Lamberson and Thomas (1984).

Table 2. Regression coefficients (b) ± SE of birth weight (BW), weaning weight (WW) and lamb mortality (LM) from birth to weaning on coefficient of inbreeding of lamb and of dam of a Barki sheep flock.

Traits	*N*	*Mean*	*Inbreeding of lamb*		*Inbreeding of dam*	
			B	*SE*	*b*	*SE*
BW	*2357*	*3.57 kg*	*-0.006**	*0.0011*	*-0.006*	*0.0001*
WW	*1973*	*16.66 kg*	*-0.015*	*0.0006*	*-0.003*	*0.0001*
LM	*384*	*0.08 %*	*+0.06%*	*0.03%*	*+0.24%**	*0.14%*

P < 0.05

Conclusion

It could be concluded that, the level of inbreeding had a negative significant effect on BW and LM while it had no significant effect on WW. On the other hand, if no new blood is introduced from outside the flock, the level of inbreeding will continue to increase and its negative effect on these traits is expected to increase likewise. Also, the general policy in the flock should be continue to avoid the mating of closely related rams and ewes, while calculation of inbreeding coefficient in the flock should be carried out annually.

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