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NOTE ON AGE AND BODY WEIGHT AT PUBERTY IN MEHRABAN IRANIAN FAT-TAILED EWE LAMBS

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SUMMARY

Data on 436 Mehraban fat-tailed ewe lambs collected during 1985 to 1988 were analysed. A 4-year study of factors affecting age and body weight at puberty in Mehraban ewe lambs showed that the year of birth did not affect age at puberty but body weight at puberty. Sires significantly influenced age and body weight at puberty with body weight being more important than age. Sire-group correlation of age at puberty between years was low while that of body weight was relatively high. Date of birth within the year had a significant effect on age and body weight at puberty. Ewe lambs born late in the lambing season were lighter and younger at puberty. High pre-weaning growth rate and heavy weaning weight were associated with early puberty and heavy body weight at puberty. Age and body weight at puberty averaged 244·7 (s.d. 13·9) days and 44·1 (s.d. 2·4) kg respectively. Heritability estimates for age and body weight at puberty were 0·14 and 0·37 respectively.

INTRODUCTION

Puberty is an important reproductive phenomenon in ewe lambs. Extreme delay in reaching puberty will have a detrimental effect on breeding efficiency when ewe lambs are bred to lamb at one year of age. In breeding programmes, mating female lambs at the earliest possible age can lead to a reduction in the generation interval and the progress of genetic selection may be accelerated (Joakimsen, 1969). Puberty in ewe lambs is influenced by breed and level of nutrition (Cameron *et al.*, 1983; Faure *et al.*, 1987), breed and sire (Cameron *et al.*, 1983; Lahlou-Kassi *et al.*, 1989), season (Michailidis *et al.*, 1988) and growth rate (Fuentes *et al.*, 1987; Bathaei, 1993). Knowing the effects of these factors is useful for establishing a successful breeding programme. However, no information regarding these effects and no estimate of heritability of age or body weight at puberty are available for the Mehraban sheep. The purpose of this study was to provide some of these estimates.

MATERIALS AND METHODS

Flock and management

The study was conducted in an experimental flock at Hamadan in the west of Iran (latitude 33° 55′ N, longitude 35° 48′ E). Data were collected, during a 4 year period, from 1985 to 1988, on 436 Mehraban ewe lambs. Ewes were sired by 19 rams with 15 of the rams siring ewes each year. Lambing season in each year was from mid-February to mid-April. Each ewe lamb was identified at birth and birth weight was recorded. Ewe lambs were weaned at 90 days of age. After weaning the lambs were placed on range without supplementary feeding.

Starting 2 months after weaning, mature vasectomised rams equipped with marking colour were continuously placed with the ewe lambs. Ewe lambs were checked for colour marks and oestrus twice daily. A ewe lamb was considered in oestrus if she had

a colour mark on her rump or tail head or if she stood to be mounted by a ram. A ewe lamb was considered to have reached puberty at the time of the first oestrus. Body weight at puberty was interpolated from the body weights before and after the first oestrus. Records were kept for the following variables: date of birth (DB), birth weight (BW), 90 day body weight or weaning weight (WW), average daily gain from birth to weaning (ADGBW), age and body weight at puberty, gain from weaning to puberty (GWP), and average daily gain from weaning to puberty (ADGWP).

Statistical analysis

These data were analysed by least-squares procedures (Harvey, 1985). Sources of variation considered in the analyses were year of birth (1984 to 1988), type of birth (single or twins), age of dam (2 to 6 years) and sires within years. The analysis of sire differences was on an intra-year basis, therefore a sire's progeny born in different years were treated as different sire groups. Three factor interactions (type of birth × sires within years, type of birth × age of dam, and age of dam × sires within years) were tested for significance. Since none were found to be significant the data were reanalysed as suggested by Harvey (1985) without the interaction terms in the model. The effects of DB, BW, WW, ADGBW, GWP and ADGWP on age and body weight at puberty were determined by including these effects in the latter model. Sires within years and the error term were considered to be random effects. All other classifications were considered to be fixed effects.

Estimates of heritabilities and all correlations were based upon variance and covariance components using the method of paternal half-sibs (Harvey, 1985). Standard errors were computed from formulae given by Swinger *et al.* (1964) and Harvey (1985).

RESULTS

The mean values and standard deviations of various traits associated with puberty are presented in Table I. Correlations among the various traits associated with puberty are shown in Table II.

DISCUSSION

For most traits, only one of the years (1988) differed significantly ($P < 0{\cdot}05$) from the other 3 in producing heavier and slightly faster-growing ewe lambs, which were born about a week later than the average for the combined data and which had reached puberty 3 weeks earlier than average.

This difference must be associated with seasonal fluctuations in quantity and quality of pasture, which accounted for some of the variations in body growth patterns of early and late born lambs. Ewe lambs on higher spring nutritional level were younger and heavier at puberty while those on a lower nutritional level were much older but only slightly heavier at puberty. Similar results were reported by Dyrmundsson and Lees (1972) and Dyrmundsson (1987). Age of dam and type of birth had no significant effect on age and body weight at puberty.

Among the rams used each year, one sired ewe lambs whose average age at puberty differed significantly ($P < 0{\cdot}05$) between years while another ram sired ewe lambs whose average body weight at puberty differed significantly ($P < 0{\cdot}05$) between years.

There were highly significant differences among sire-groups in body weight at puberty in different years ($P < 0{\cdot}001$). After correcting body weight at puberty for the effect of DB, BW, WW, ADGBW, GWP and ADGWP, differences between

TABLE I

Mean values and standard deviations of various traits associated with puberty in Mehraban ewe lambs (1985 to 1988)

Trait	Combined data (1985–1988) $n = 436$
Age at puberty (days)	244·5 ± 13·9
Body weight at puberty (kg)	44·1 ± 2·4
Birth weight (kg)	4·0 ± 0·6
Day of birth[1]	57·5 ± 1·1
Average daily gain from birth to weaning (g)	210 ± 0·06
Weaning body weight (90 days)	22·7 ± 1·5
Gain from birth to weaning (kg)	18·73 ± 0·50
Gain from weaning to puberty (kg)	22·9 ± 2·3
Average daily gain from weaning to puberty (g)	110 ± 0·09

[1] Day 1 is first of January.

sire-groups were still significant ($P < 0·001$). Differences between sire-groups were significant for age at puberty only in 1986 and 1987 ($P < 0·05$). After correction for DB, BW, WW, ADGBW, GWP and ADGWP, these differences disappeared. Cameron *et al.* (1983) and Lahlou-Kassi *et al.* (1989) reported that breed of sire affected age and weight at puberty. In this study, it appears that sires had a greater effect on body weight at puberty than on age at puberty.

Age at puberty was significantly affected only by DB ($P < 0·05$) and ADGWP ($P < 0·05$) while body weight at puberty was significantly affected by DB, ADGBW, WW and ADGWP ($P < 0·001$). Birth weight had no significant effect on age and body weight at puberty. Similar finding were reported by Fuentes *et al.* (1987), Nuryadi *et al.* (1986) and Michailidis *et al.* (1988).

The correlation 0·58 ($P < 0·001$) between age and body weight at puberty indicated that ewe lambs that were older at puberty tended to be heavier at puberty. The correlation of −0·21 ($P < 0·05$) between DB and age at puberty indicated that ewe lambs that were born later in the year reached puberty at a younger age. These results were in agreement with other investigators (Dyrmundsson and Lees, 1972; Younisa *et al.*, 1978; Silva *et al.*, 1987). This appears to be the result of puberty being delayed until sufficient forage was available in the spring for ewe lambs to start growing (Fuentes *et al.*, 1987; Dyrmundsson and Lees, 1972). Little or no association

TABLE II

Phenotypic correlations among traits associated with puberty in Mehraban ewe lambs

Traits[1]	Age at puberty	Body weight at puberty	Date of birth	GBW	Weaning weight	GWP	ADGWP
Age at puberty	–						
Body weight at puberty	0·58**	–					
Date of birth	−0·21*	−0·09	–				
GBW	−0·28*	0·41*	0·06	–			
Weaning weight	−0·25*	0·43*	0·09	0·93**	–		
Gain WP	0·67**	0·71**	−0·12	−0·40*	−0·33*	–	
ADGWP	0·56**	0·49**	−0·11	−0·48**	−0·23*	0·95**	–

* $P < 0·05$; ** $P < 0·001$.

[1] GBW—gain from birth to weaning; GWP—gain from weaning to puberty; ADGWP—average daily gain from weaning to puberty.

between date of birth and body weight at puberty was found as indicated by the low correlation −0·09.

Ewe lambs which grew faster pre-weaning tended to reach puberty at an earlier age and at heavier body weight. This result agrees with those of Younisa *et al.* (1978). The correlations between age at puberty and ADGBW and WW were −0·28 and −0·21 respectively, while those between body weight at puberty and ADGBW and WW were 0·41 and 0·43 respectively. These observations are similar to those of Fuentes *et al.* (1987). The correlation coefficients between age at puberty and GWP, ADGWP were 0·67, 0·56, respectively ($P < 0·001$) and between body weight at puberty and GWP and ADGWP were 0·71, 0·49, respectively ($P < 0·001$). These results indicate that ewe lambs that grew most rapidly after weaning tended to be heavier and older at puberty. Growth rate between birth and weaning was faster (average daily gain 210 g) than between weaning and start of grass growth in the spring (100 g). With availability of grass, growth again became more rapid (130 g/day). The fact that the majority of ewe lambs showed their first oestrus in October indicates that puberty was delayed, even though the ewe lambs may have been old enough, until sufficient feed became available so they could acquire the necessary body weight. All ewe lambs then tended to reach puberty rapidly. Consequently, ewe lambs that were born early were older at puberty.

The estimate for heritability of age at puberty was 0·14 (s.e. 0·05) while that of body weight at puberty was 0·37 (s.e. 0·07). The genetic correlation of age with body weight at puberty was positive but not particularly high (0·23; s.e. 0·09). The heritability estimate for age at puberty in this study was lower than that reported by Ch'ang and Rae (1970) and Burfening *et al.* (1971).

Ewe lambs of this breed seem to attain puberty at an earlier age (7 to 8 months old) than many other breeds of sheep in Iran (Bathaei, 1993). This characteristic might be exploited to contribute to improved efficiency of production in breeding programmes through increasing lamb production per ewe and per year.

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