ZOOTECHNIE, GENETIQUE et REPRODUCTION

Communications

Genetic parameters for pre-weaning growth traits of Mehraban Iranian fat-tailed sheep

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Les auteurs ont utilisé les données provenant de 975 agneaux, nés pendant les saisons d'agnelage de 1984-1990 et issus de 18 béliers, en vue d'analyser les paramètres génétiques suivants : poids à la naissance, poids au sevrage, gain quotidien avant sevrage, poids corporel à 30, 60 et 90 jours. Ces paramètres génétiques ont été calculés à partir des corrélations entre les demi-frères paternels. L'héritabilité pour le poids à la naissance, le poids au sevrage, le gain quotidien avant sevrage et le poids corporel à 30 et 60 jours ont été respectivement de : 0,35, 0,44, 0,33, 0,36, 0,39. Les corrélations génétiques étaient le plus souvent élevées et toutes positives, particulièrement entre le poids au sevrage et le poids à 60 jours (0,77). La corrélation phénotypique correspondante était également positive et élevée (0,80). Aucun antagonisme génétique n'a été décelé parmi les caractères étudiés. La réponse à la sélection pondérale entre 60 et 90 jours devrait constituer un moyen efficace.

Mots clés : Ovin Mehraban - Agneau - Paramètre génétique - Croissance - Gain de poids - Héritabilité - Corrélation génétique - Iran.

Introduction

Among the most economically important characteristics of meat animals apart from conformation are body weight and rate of gain, particularly at the time when animals have the highest potential value for meat. Hence, a decision of notable economic importance to livestock breeds concerns the particular traits and phase of an animal's growth upon which to base selection for improving weight and rate of gain. The potential for genetic improvement of a trait is largely dependent upon its heritability and its genetic correlations with other traits. Its heritability could vary with the age of the animal. The phenotypic and genetic correlations among traits mays also vary. Therefore, it becomes important to estimate heritabilities and correlations at various ages of animals to be selected. No information regarding genetic and phenotypic parameters for body weight and pre- and post-weaning growth rate is available for the fat-tailed Mehraban sheep. Knowledge of these parameters is imperative since they are the prerequisites for the estimation of growth rates and for the development of successful breeding schemes.

The aim of the present study was to estimate the genetic parameters for weight and/or rate of gain in the Mehra-

ban breed considered as simple traits. The Mehraban sheep is raised in the region of Hamadan, western Iran. It can be considered as a farm sheep and is kept in the region permanently. Ranges are the main feed source during spring, summer and autumn but it also utilizes farm residuals and is hand-fed during the late autumn and winter months. The nutritional level for the breed is medium to low. The sheep involved in this study were maintained under farm conditions in Mehraban (85 km north of Hamadan). They were grazed on a range which was medium in vegetation and some barley was available during the autumn. The animals received supplemental feed during the autumn and winter months and were hand-fed completely for about six months of the year. The basic diet consisted of alfalfa hay, barley and dried sugar beet pulp.

Material and methods

Data on birth weight, pre-weaning daily gain and weaning weight traits analyzed in this study were collected from 975 Mehraban lambs, progeny of 18 rams, born during the 1984-1990 lambing seasons. All lambs were weighed at birth, then every 10 days until weaning. The lambs were weaned at 90 days of age. The sex, type of birth, age of dam and year of birth effects were considered fixed effects. Statistical analysis was performed using least-squares procedures (10). The statistical model was used as follows:

$$Y_{ijklmno} = \mu + a_i + b_{ij} + s_k + t_l + p_m + c_n + e_{ijklmno}$$

where: $Y_{ijklmno}$ is the weight at a particular age or gain in weight during a particular period of the oth individual of the kth sex, out of a dam of mth age, of ith sire, of lth type of birth and nth year;

μ = overall mean;

a_i is the random effect of the ith sire (i = 1,..., 18);

b_{ij} is the random effect of ith sire within jth dam;

s_k is the fixed effect of kth sex of lambs (1 = male, 2 = female);

t_l is the fixed effect of lth type of birth (1 = single, 2 = twin);

p_m is the fixed effect of mth age of dam (m = 1,..., 6) 6 classes corresponding to 1,2,3,4,5 and 6 years old;

c_n is the fixed effect of the year of birth (n = 1,..., 6) from 1984 to 1990;

$e_{ijklmno}$ is a random element assumed normally and independently distributed.

Within and among sire components of variance adjusted for these, other measured sources of variation for the different traits were estimated. Estimates of heritabilities and all correlations were based upon variance and covariance components using the method of paternal half-sibs.

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Revue Élev. Méd. vét. Pays trop., 1994, 47 (2) :235-238

235

Communication

Heritabilities were estimated as :

$$h^2 = \frac{4\sigma^2 s}{\sigma^2 s + \sigma^2 e}$$

where: $\sigma^2 s$ = variance between sires; $\sigma^2 e$ = variance within sires. The genetic correlations were calculated as:

$$\frac{\sigma^2 sij}{\sqrt{\sigma^2 s \cdot \sigma^2 sj}}$$

where ij are indices corresponding to traits i and j, $\sigma^2 sij$ is the covariance between i and j, $\sigma^2 si$ and $\sigma^2 sj$ are the variance for the trait i and j respectively. Standard errors were computed from formulae given by HARVEY (10) and SWINGER et al. (23). The first order interactions among the factors influencing birth weight, weaning weight and daily gain from birth to weaning were not significant.

Results and discussion

Variance components and heritabilities

Means, standard error and coefficients of variation for weights and gains during the pre-weaning period are presented in table I. The genetic and phenotypic variances along with the heritabilities of the characteristics studied are given in table I. Genetic variances, phenotypic variances and heritabilities increased with advancing age.

The heritability estimate (table I) for birth weight (0.35) was lower than estimates reported by CHO et al (5) for Corriedal breed, SIREGAR (20) for Priagan breed, BURFENING (4) for the Rambouillet breed and DASS et al. (8) for Bikaneri sheep (0.44, 0.43, 0.92, 0.45, respectively). This trait was higher than estimates reported by POONIA et al. (16) for Corriedal, MAUI et al. (12) for Merino, MAVROGENIS et al. for CHIOS (13) (0.26, 0.10, 0.13, respectively). Similar estimates were reported by MORRISON et al. (14) for Hampshire and ERCANBRACK (9) for the Rambouillet and Tharghee breeds. The estimation weaning weight heritability in the present study (0.44) was higher than those reported by POONIA et al. (16), MAUI et al. (12), SIREGAR (20) and MAVROGENIS et al. (13) (0.22, 0.28, 0.35, 0.22). It was lower than the values obtained by WALEED (25), SHIEKH et al. (17), SINGH et al. (19) (0.51, 0.89, 0.93). Similar results were also reported by CHO (5), PEREIRA (15) and SHRESTHA et al. (18). There are several estimates of heritability of pre-weaning daily gain and most of them are low. POONIA et al. (16), SIREGAR (20) and THRIFT (24) reported estimates ranging from 0.09 to 0.22. SHRESTHA et al. (18) and SINGH et al. (19) gave a high estimate of 0.50. The present estimate of 0.33 is intermediate between these extreme values. The heritability estimates reported here indica-

te that genetic improvement of weight at 60 days or at 90 days (weaning weight) in the Mehraban sheep can be achieved through selection.

Genetic correlations

Genetic correlations between body characteristics were all significant, positive and relatively high. The estimates of genetic correlations between birth weight, 30 and 60 days of age, weaning weight and daily gain from birth to weaning (table II), are of general interest in selection for these characteristics in the Mehraban breed. Low genetic correlations were found by SIREGAR (20) and MAVROGENIS (13) for birth weight, weaning weight and pre-weaning growth rate, but STOBART et al. (22), ABDULKALIQ (1) and MARTIN et al. (11) reported very high genetic correlations between weights at different pre-weaning ages and weaning weight, ranging from 0.66 to 1.0.

Phenotypic correlations

Phenotypic correlations between body weights were all significant and positive (table II). The estimate of 0.55 for the correlation between birth and weaning weight is similar to the estimate reported by MAUI et al. (12). MAVROGENIS (13) and THRIFT et al. (24) found the correlation between weaning weight and pre-weaning growth rate to be 0.88. The corresponding estimate in the present study is 0.88. The estimated correlation of 0.51 between birth weight and pre-weaning daily gain was higher than reported by MAVROGENIS (13), BONAITI et al. (3) and THRIFT et al. (24). The phenotypic correlations followed the pattern of corresponding genetic correlations all positive but higher. As expected, correlations among successive weights were higher than others. Estimated heritabilities indicate that mass selection for rapid growth would be effective. Live weight as a selection criterion would be a better trait to select for, mostly because of its ease of measurement compared with growth rate.

Conclusion

On the basis of the evidence presented in this paper, it appears that the most desirable selection criterion would be body weight at 90 days of age. It should be better than birth weight, 30 and 60 days of age or pre-weaning growth rate, since it is much less influenced by maternal effects obscuring the genotype for growth or creating bias. The influence of non-genetic effects was defined and described in detail in an earlier study (2). The high correlations ensure that the selection applied at weaning will induce an improvement in later weights. Furthermore, although the generation interval may not be considerably shortened, decrease costs should certainly be observed, since culled lambs would leave the herd earlier. However, attention should be given to the impact of weight-oriented selection, which may affect other production features in meat production favorably or unfavorably. This problem requires further investigation.

ZOOTECHNIE, GENETIQUE et REPRODUCTION

TABLE I *Means, standard error, genetic and phenotypic variances, heritabilities and standard error of heritability for pre-weaning traits in Mehraban sheep.*

Trait	Number of lambs	Mean	s.e.	Genetic variance	Phenotypic variance	h²	s.e.
Birth weight (kg)	975	3.92	0.13	0.7064	2.0183	0.35	0.14
Body weight (kg) : At 30 days At 60 days	957 945	11.76 17.93	0.12 0.14	0.8655 1.3633	2.4053 3.4822	0.36 0.39	0.26 0.20
Weaning weight at 90 days (kg)	938	22.34	0.33	1.8560	4.1701	0.44	0.19
Average daily gain (g) : Birth to weaning	938	209	0.08	0.5472	1.6583	0.33	0.16

s.e. : standard error, h² : heritability.

TABLE II *Genetic and phenotypic correlations among pre-weaning traits.**

Trait	Birth weight	Weaning weight at 90 days	Body weight (30 days)	Body weight (60 days)	Average daily gain: birth to weaning
Birth weight	—	0.45 ± 0.17	0.65 ± 0.14	0.49 ± 0.13	0.44 ± 0.15
Weaning weight (at 90 days)	0.55	—	0.64 ± 0.14	0.77 ± 0.12	0.79 ± 0.11
Body weight : At 30 days At 60 days	0.72 0.58	0.68 0.80	— 0.83	0.67 ± 0.12 —	0.55 ± 0.19 0.67 ± 0.14
Average daily gain: Birth to weaning	0.51	0.88	0.65	0.78	—

* Genetic correlations and s.e. above the diagonal phenotypic correlations below the diagonal.

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Communication

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BATHAEI (S.S.), LEROY (P.L.). Genetic parameters for pre-weaning growth traits of Mehraban Iranian fat-tailed sheep. *Revue Élev. Méd. vét. Pays trop.*, 1994, **47** (2): 235-238

Data corresponding to 975 lambs, progeny of 18 rams, born during the 1984-1990 lambing seasons, were used to estimate genetic parameters for birth weight, weaning weight, pre-weaning daily gain, and body weight at 30, 60 and 90 days of age. Genetic parameters were estimated from paternal half-sib correlations. Heritabilities for birth weight, weaning weight, pre-weaning daily gain, and body weight at 30 and 60 days of age were 0.35, 0.44, 0.33, 0.36, 0.39 respectively. Genetic correlations were mostly high and all positive, especially between weaning weight and weight at 60 days of age (0.77). The corresponding phenotypic correlations were mostly high and positive (0.80). No genetic antagonisms were found among the characteristics that were studied. Response to selection for weight at 60 or 90 days of age should be effective.

Key words : Mehraban sheep - Lamb - Genetic parameter - Growth - Liveweight - Heritability - Genetic correlation - Iran.

Heritability of growth traits in local chickens at 6 weeks in Nigeria

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EBANGI (L.A.), IBE (S.N.). Héritabilité des caractères de croissance chez des poules de race locale âgées de 6 semaines au Nigeria. *Revue Élev. Méd. vét. Pays trop.*, 1994, **47** (2) : 238-240

Les valeurs de l'héritabilité du poids corporel, de la longueur de la cuisse, de celle du bréchet et de la profondeur de la poitrine pour les poules indigènes du Nigeria âgés de 6 semaines, ont été obtenues à partir des données d'un modèle imbriqué. Cent soixante-dix poussins des deux sexes, issus de 5 coqs fécondant chacun 4 poules par insémination artificielle ont été utilisés. A l'éclosion, les poussins étaient marqués à l'aile et leur pedigree établi à partir des ascendants. Les moyennes de ces caractères étaient respectivement de 114,97 g, 3,48 cm, 3,35 cm et 3,22 cm pour le poids corporel, la longueur de la cuisse, celle du bréchet et la profondeur de la poitrine. L'héritabilité estimée à partir du père, de la mère et de la combinaison des indices de variance pour le poids corporel, la longueur de la cuisse et la profondeur de la poitrine était respectivement de 0,41, 0,66 et 0,36 ; 0,58, 0,14 et 0,36 et 0,58, 0,36 et 0,48. Ces mêmes valeurs, calculées à partir des parents et des indices de variance, étaient respectivement de 0,34 et 0,17 pour la longueur du bréchet. Ces résultats montrent que l'héritabilité à 6 semaines est moyenne ou élevée pour les caractères considérés.

Mots clés : Poule - Croissance - Héritabilité - Poids - Mensuration corporelle - Insémination artificielle - Nigeria.

Introduction

Information on genetic parameters of growth traits in the Nigerian local chicken is comparatively scanty in the literature. NWOSU (6) obtained heritability estimates for 4-, 8-, 12-, 16- and 20- week body weight as 0.36, 0.38 and 0,37 ; 0.32, 0.36 and 0.34 ; 0.36; 0.38 and 0.37 ; 0.40, 0.49 and 0.44 and 0.33, 0.43 and 0.38 from sire, dam and combined variance components, respectively. OLUYEMI (7) obtained a heritability of 0.31 for 12-week body weight. There was no report in the available literature on heritability of shank length, keel length and breast width. The aim of this study, therefore, is to contribute further information regarding heritability of body weight (W) using local chickens at 6 weeks and to estimate heritability of other growth traits such as shank length (SL), keel length (KL) and breast width (BW) at this age.

Material and methods

The chicks for the experiment were obtained from matings between sires and dams randomly selected from a base population of random-bred, non-selected local fowls maintained at the University Poultry Teaching and Research Farm.

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238

Revue Élev. Méd. vét. Pays trop., 1994, 47 (2) : 238-240