GENOTYPING OF GROWTH PERFORMANCE GENES IN SOME LOCAL SHEEP BREEDS

By

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B. Sc. Agric. Sc. (Animal Production), Assiut University, 2002

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ABSTRACT

Sherif Awad Aziz Melak: Genotyping of Growth Performance Genes in Some Local Sheep Breeds, Unpublished PhD of Agriculture Sciences Thesis, Department of Animal Production, Faculty of Agriculture, Ain Shams University, 2019.

This study aimed to investigate possibilities of utilizing both quantitative and molecular genetics tools for genetic improvement of growth performance in Egyptian Barki and Rahmani sheep. Estimate genetic parameters of body weights using random regression model as one of quantitative genetic tools was the first objective of this study. The second objective was discovering and genotyping some single nucleotide polymorphism (SNP) as a method of molecular genetics. In addition, to study some non-genetic factors affecting sheep body weights.

Records of 3,205 and 13,215 Egyptian Barki and Rahmani lambs were collected from Borg Al-Arab and El-Serw experimental farms belonged to Animal Production Research Institute, respectively. Data were collected from 1984 to 2017 for Barki and from 1972 to 2017 for Rahmani lambs. Data were utilized to estimate (co)variance components and genetic parameters for body weights from birth up to 480 days by the average information REMLF90 (AIREMLF90) software using random regression model with Legendre polynomials (LP). Also, the effects of gender, type of birth, season of birth, year of birth, age of dam at lambing and some of the interactions between those effects on body weights were studied.

Nine candidate SNPs were selected according to individual-based on coefficient of genetic variation (F_{st} values) and the genes that have possible association with growth harboring those SNPs of previous study on Barki lambs. A total of 47 Barki and 40 Rahmani lambs, born in the period from 2013 till 2015 in two generations were utilized to genotype single nucleotide polymorphism. Genomic DNA was extracted from

blood using the salting out extraction technique. Allele Specific Polymerase Chain Reaction (AS-PCR) was used for genotyping in both breeds.

The results showed that the effect of all fixed factors and some interactions were significant for all studied traits (P<0.05) in both breeds except the effect of season of birth at 4wt in Barki and 18wt in Rahmani and the effect of age of dam at 7wt, 17wt and 18wt in Barki lambs. Direct and total heritabilities were generally low to high, ranged from 0.05 to 0.41 and from 0.08 to 0.75 in Barki lambs and from 0.04 to 0.36 and from 0.10 to 0.70 in Rahmani lambs for four months and birth weights, respectively. Heritability trend took three stages: in the beginning, h^2 values had a sharp decline from birth to four months of age followed by a gradual increase to ten and twelve months of age for Barki and Rahmani lambs, respectively, and eventually decreased again to sixteen months of age in both breeds. Additive, genetic and phenotypic correlation coefficients were the lowest between birth weight with other studied traits in both breeds and the highest between weight at ten months of age in Barki and weight at twelve months of age in Rahmani lambs with other studied traits. Therefore, ten and twelve months of age are recommended to be the best criterion for selecting Egyptian Barki and Rahmani lambs for meat production, respectively.

For nine candidate SNPs, no PCR amplicon obtained for SNP3 and SNP7 in either breed. SNP1, SNP2, SNP8 and SNP9 showed only two genotypes that non-significant effect for all body weights in both breeds. Only SNP4, SNP6 and SNP10 showed significant association with some body weights in both breeds. SNP4 showed significant association with body weights from 1wt to 11wt and from 5wt to 18wt in Barki and Rahmani lambs, respectively. SNP6 was significantly associated with body weights from 12wt to 14wt and from 13wt to 18wt in Barki and Rahmani lambs, respectively. SNP10 was significantly associated with body weights from 10wt to 15wt and from 4wt to 9wt in Barki and

Rahmani lambs, respectively. The three significant SNPs were found to be located on or close to three genes that may be associated with body weights and growth performance. SNP4 was downstream *DPYSL5* gene, SNP6 was located within *CYFIP2* gene and SNP10 was located within *SCARB1* gene. Allele A (0.97) and genotype AA (93.3) had the highest frequency, while allele G (0.03) and genotype AG (6.7) had the lowest frequency for SNP2 in Rahmani breed. Results confirmed consistency with Hardy-Weinberg equilibrium for SNP2, SNP4, SNP6, SNP8 and SNP9 in both breeds, while was found to deviate from HWE for SNP1 and SNP10 ($P<0.01$). Therefore, the three SNPs are recommended to use as genetic markers for selecting Egyptian Barki and Rahmani lambs for mutton production.

Key words: Barki and Rahmani sheep, growth performance, genetic parameters and non-genetic factors, Random regression model, single nucleotide polymorphism.

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