Tropical and Subtropical Agroecosystems

SHORT NOTE [NOTA CORTA]

HERITABILITY OF MILK YIELD IN A POPULATION OF RABBITS UNDER THE CONDITIONS OF THE VALLEY OF MEXICO

[HEREDABILIDAD DE LA PRODUCCION DE LECHE EN UNA POBLACION DE CONEJAS BAJO CONDICIONES DE EL VALLE DE MEXICO]

Benjamín Gómez-Ramos[1*], José Herrera-Camacho[2], Ruy Ortiz-Rodríguez[1], José Candelario Segura-Correa[3] and Carlos Miguel Becerril-Pérez[4]

[1]Facultad de Medicina Veterinaria y Zootecnia-Universidad Michoacana de San Nicolás de Hidalgo. Km 9.5 Carretera Morelia-Zinapécuaro. Tarímbaro Michoacán, México. CP58880. roschberith@hotmail.com ruyortiz@hotmail.com.; [2]Instituto de Investigaciones Agropecuarias y Forestales- Universidad Michoacana de San Nicolás de Hidalgo. Km 9.5 Carretera Morelia-Zinapécuaro. Tarímbaro Michoacán, México, josheca@hotmail.com.; [3]Universidad Autónoma de Yucatán, Campus de Ciencias Biológicas y Agropecuarias. A.P. 4-116 Col. Itzimná, 97100. Mérida, Yucatán, México segura52@hotmail.com.; [4]Especialidad de Postgrado en Ganadería. Colegio de Postgraduados. Campus Córdoba, Carretera Federal México-Veracruz km 348. CP 94946 Amatlán de los Reyes, Veracruz. México, color@colpos.mx.

**Corresponding author*

SUMMARY

Variance components and heritability of milk production were estimated for a population of 114 does (42 New Zealand White (NZW), 24 Californian (CAL), 37 NZW x CAL, and 37 CAL x NZW) in the Mexican Valley. Does were daughters of 21 sires and 53 dams which included 300 litters and 2375 milk yield records. Milk yield (MY) was calculated weighing each litter 8 times, before and after milking. Statistical analysis was carried out by using an individual animal model, which included the fixed effects of breed group, kidding number (1, 2, 3), number of nipples (8, 9, 10), kidding month (January-February, March-April, May-June, July-August), pregnant state (pregnant does and empty does), the covariates days of lactation, days of pregnancy and litter size, and the direct and residual random effects. The mean and standard deviation for MY was 145±64 gd^{-1}. The additive genetic variance, the error variances and the heritability of MY were 247.86 $\mathbf{g^2}$, 1869.0 $\mathbf{g^2}$ and 0.12±0.02, respectively. In conclusion, the heritability of milk production was low, but within the range of values notified in the literature; which suggest that genetic selection must be done considering a higher number of related animals and more accurate statistical methods of selection for improving milk yield in rabbits.

Keys words: Heritability; does rabbit; Mexico.

RESUMEN

Los componentes de varianza y la heredabilidad de la producción de leche fue estimada en una población de 114 conejas (Nueva Zelanda Blanco (NZW), 24 California (CAL), 37 NZW x CAL, y 37 CAL x NZW) en el valle de México. Las conejas fueron hijas de 21 sementales y 53 madres las cuales produjeron 300 camadas y 2375 registros de producción de leche. La producción de leche (MY) fue calculada pesando a la camada en 8 ocasiones, antes de después del amamantamiento. El análisis estadístico fue realizado utilizando un modelo animal individual, el cual incluyó los efectos fijos de raza, número de parto (1,2,3), número de pezones (8,9,10), mes de parto (enero-febrero, marzo-abril, mayo-junio, julio-agosto), estado de preñez (gestante y no gestante), las covariables días de lactancia, días de gestación y tamaño de camada, y los efectos directos y aleatorios. El promedio y la desviación estándar para la MY fue 145±64 gd^{-1}. La varianza genética aditiva, la varianza del error y la heredabilidad de la MY fueron 247.86 g^2, 1869.0 g^2 y 0.12±0.02, respectivamente. En conclusión, la heredabilidad de la producción de leche fue baja, pero dentro del rango de los valores señalados en la literatura; lo cual sugiere que la selección genética debe hacerse considerando un alto número de relaciones de parentesco y métodos estadísticos de selección más precisos para mejorar la producción de leche en conejas.

Palabras claves: Heredabilidad; conejas; México

INTRODUCTION

Doe´s milk yield (MY) is associated with preweaning growth rate and survival of young rabbits during the first three weeks of life (Khalil, 1994; Rommers *et al*., 1999; Sorensen *et al*., 2001). Therefore, some authors consider that increasing MY, through the selection of females, could increase preweaning growth rate of young rabbits and decrease preweaning mortality (Ayyat *et al*., 1995; El-Maghawry *et al*., 1993; Khalil and Khalil, 1991; Lukefarhr and Hamilton, 1997). However, response to selection is determined by the heritability of the trait of interest and the proportion of selected animals. Few reports on the heritability of rabbit milk yield have been reported in the literature (El-Maghawry *et al*., 1993; Ayyat *et al*., 1995; Lukefahr *et al*., 1996; Iraqi, 2008). In addition, heritability estimates may vary according to the population, environmental conditions and statistical estimation methods. The objective of this study was to estimate the components of variance and heritability of MY in a purebred and crossbred does rabbit population, in the Mexican Valley, using an individual animal model.

MATERIAL AND METHODS

The study was carried out with the information from 300 litters from 114 does, daughters of 21 sires, and 53 dams. The does belonged to the New Zealand White (NZW, n=42), Californian (CAL, n=24), NZW x CAL (n=37) and CAL x NZW (n=37) breed groups. Males and females of NZB y CAL purebred were used to obtain purebred and crossbred females in a farm, located in the Valley of México, at 19°27`N and 98°53` W, at the altitude of 2240 above sea level, with a mean annual temperature of 15°C and mean rain fall of 645 mm (García, 1981).

The animals were located in a 10.7 x 20 m rabbitery, with concrete floor, drainage system, brick walls, and roof. Females and males were maintained in individual cages (90 x 60 x 40 cm) with a wire floor and walls of galvanized sheet metal distributed in modules of 12 spaces, provided with an automatic water distribution system. A commercial granulated feed which contained 15.5% crude protein, 2% fat, 15% crude fiber, 9% ash and 0.55% phosphorus was used.

MY was measured weighing each litter 8 times, before and after suckling (Lukefahr, 1983) for a total of 2375 records. A previous study (Gómez-Ramos *et al*., 2008) showed not differences in MY between purebred and crossbred does here studied, therefore, they were considered a single population. The MY variance components were estimate using an individual animal model:

$$y = Xb + ZaUa + e$$

Where: y = vector of milk yield observations, b = vector of fixed effects of breed group, kidding number (1, 2, 3), number of nipples (8, 9,10), kidding month (January-February, March-April, May-June, July-August), pregnant state (pregnant does and empty does), and the covariates, days of lactation (DL), days of pregnancy (DP) and litter size (LZ); Ua = vector of direct additives random effects of animals; X and Za incidence matrices associated with the records for the fixed, and direct additive effects, respectively; e = vector of residual random effects.

Heritability of MY and their standard errors was computed using the DFREML procedure (Meyer, 1988).

RESULTS AND DISCUSSION

The mean MY was 145±64 gd^{-1}, which is 26 gd^{-1} higher than that estimated by Ayyat *et al.* (1995). However, Lukefahr *et al.* (1996) obtained a value 43 gd^{-1} higher. McNitt and Lukefahr (1990) and McNitt and Moody (1990) in California does obtained means of 152 y 158 gd^{-1}, respectively. Lukefahr *et al.* (1983), Sabater *et al.* (1993) and Fernández *et al*. (2004) obtained estimates of 174, 157 y 207 gd^{-1} in NZW x CAL rabbits. Lukefahr *et al.* (1983) reported a MY of 178 gd^{-1} in CAL x NZW females.

The additive genetic variance, the error variance and the heritability of MY were 247.86 g^2, 1869.0 g^2 and 0.12$\pm$0.02, respectively. The heritability, estimated in this study, suggest a poor response to selection based on own performance of does. Lukefahr *et al.* (1996) using an animal model, estimated h^2, in nuliparous and multiparous NZW, CAL, CAL x NZW and NZW x CAL does, of 0.14 and 0.11, respectively (without adjusting for litter size (LZ) at 21 days). Their h^2 estimates increased to 0.23 and 0.27, respectively, when adjusted for litter size. Khalil *et al.* (2004), also adjusting by LZ obtained h^2 estimates ranging from 0.18 to 0.21 in a Spanish doe line V, Gabali breed and their crosses, measuring MY at 7, 14 y 21 days of nursing. Ayyat *et al.* (1995), adjusting for LZ at birth, estimated h^2 for MY measure at 7, 14, 21 and 28 days of lactation, in the range of 0.04 to 0.22. More recently, Iraqi (2008) reported h^2 for MY in the range of 0 to 0.11. Khalil *et al.* (1986) and Ayyat *et al.* (1995) mentioned that maternal and environmental effects are the main variation sources and the cause of low estimates of h^2 estimates for MY in rabbits. Differences between heritability estimates might also be due the type of breed, environmental conditions, management and statistical methods used.

CONCLUSIONS

The heritability of milk production was low, but within the range of values notified in the literature; which suggest that genetic selection must be done considering a higher number of related animals and more accurate statistical methods of selection for improving milk yield in rabbits.

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