Livestock Science 153 (2013) 27–32

Contents lists available at SciVerse ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Genetic parameters of body weight and egg traits in meat-type quail

Luciano P. Silva [a,*], Jeferson C. Ribeiro [a], Aline C. Crispim [a], Felipe G. Silva [a], Cristina M. Bonafé [b], Fabyano F. Silva [c], Robledo A. Torres [a]

[a] Departamento de Zootecnia, Universidade Federal de Viçosa, 36570-000 Viçosa, MG, Brazil
[b] Departamento de Zootecnia, Universidade Federal dos Vales do Jequitinhonha e Mucuri 39100-000, Diamantina, MG, Brazil
[c] Departamento de Estatística, Universidade Federal de Viçosa, 36570-000 Viçosa, MG, Brazil

ARTICLE INFO

Article history:
Received 17 September 2012
Received in revised form
22 January 2013
Accepted 24 January 2013

Keywords:
Body weight
Egg production
Genetic correlation
Heritability
Reduced rank
Specific gravity

ABSTRACT

Data from two quail strains, UFV1 and UFV 2, measured weekly from hatch to sixth week in a total of seven live body weight traits were used aiming to estimate genetic correlations and heritabilities. After females were evaluated they were monitored in their egg-laying phase, in which the total egg number, the average weight of the eggs and the average specific gravity of eggs were measured. Multi-trait analysis was performed with the ten traits measured for estimation of heritabilities, genetic and residual correlations. For body weight traits, heritabilities varying from 0.25 to 0.53 for UFV1 and from 0.27 to 0.53 for UFV2 were estimated; genetic correlations increased as the interval between records was reduced. For egg number, the heritability estimate was of low magnitude (0.05 and 0.04), whereas for average egg weight (0.41 and 0.39) and egg specific gravity (0.31 and 0.18), they were of moderate magnitude for UFV1 and UFV2, respectively. The genetic correlations between body weights and egg number were negative in UFV1 and positive in UFV2; for average egg weight, they were positive, and for specific gravity, they were negative for both strains. It can be concluded, then, that selection based on body weight in the growth phase of meat quail must be done preferably at early ages such as weight at the third or fourth week of life, once they are positively correlated with weight at slaughter age and have few effects on the production and quality of eggs.

1. Introduction

Quail have been raised all over the world for production, especially in countries of Europe, for meat, and Far East, for egg production (Minvielle, 2004). In Brazil, the number of birds and egg production in the last few years have almost doubled (IBGE—Instituto Brasileiro de Geografia e Estatística, 2010). Thereby, it is necessary to meet the production needs and consequently to ensure the future of this activity.

The last few decades have seen a transition in poultry genetics from dual-purpose birds to those specialized in meat or eggs (Siegel et al., 2006). In this way the study of correlations between productive traits is of great importance in the development of poultry breeding programs. Selection is often practiced in one or few traits of interest, which may lead to undesirable responses if its correlations are antagonistic. Several methodologies have been described for the measurement of relations between traits in animal breeding. Phenotypic, genetic and residual correlations obtained by the estimation of variance

* Corresponding author. Tel.: +55 31 3899 2260; fax: +55 31 3899 2275.
E-mail addresses: luciano.pinheiro@ufv.br, lpsanimalscience@gmail.com (L.P. Silva).

1871-1413/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.livsci.2013.01.014

components are very common in animal breeding; however, in studies with quail specialized for meat production, they are limited; most of them only concern body weight measured from the growth phase until slaughter, i.e., from hatch to the sixth week of life, as in a review by Vali (2008).

Although several studies performed multi-trait analyses, these are restricted to two-trait analysis with an anchor trait (El-Fiky et al., 1994; Saatci et al., 2006; Varkoohi et al., 2011) or when using more than two traits simultaneously used only performance and carcass traits (Resende et al., 2005; Vali et al., 2005), but seldom with reproductive traits. The advantage of using a multi-trait model is associated with improving reliability in estimation of genetic parameters (Druet et al., 1999) due to better connections between traits measured and that can be more beneficial for sex-limited traits like egg quality and production.

Multi-trait analyses can be complicated due to large numbers of parameters to be estimated; in this way the use of estimation of genetic principal components of covariance matrix has several advantages over full rank estimation, considering sampling variation and computational requirements and is indicated to facilitate routine analyses involving more than a few traits simultaneously (Meyer and Kirkpatrick, 2005).

The initial growth pattern and the weight at sexual maturity have been pointed out as the main factors which affect the performance of birds in the laying phase (Sezer et al., 2006), and these traits must be regarded with special attention in breeding programs. The selection criterion adopted must not cause decrease in the performance of the breeder birds in the adult phase.

There are numerous differences in the estimates of genetic parameters for body weights in quail, which are caused by several factors; among them are the nutritional plan and the genetic background—some of the studies are performed in populations selected for egg production, or with a lower body weight.

Siegel (1963) showed that some genes which influence the juvenile weight at a certain age have a great impact on other ages due to the pleiotropic effect, and that environmental effects act similarly on the weight gain at several ages, so positive correlations are expected when these traits are considered.

Several studies reported the effects of selection on body weight and egg production in poultry species. Nestor (1971) reported results of selection in two randomly bred control populations that were selected for egg production or increased body weight. In both the selection in the first few generations did not result in great responses in the correlated trait; the further selection results in major reduction on correlated trait but this response ceases in latter generations.

Shebl et al. (1996) reported an increase in the correlated response between weight at 42 days and the total number of eggs in strains selected for high body weight; similar results were obtained by Marks (1979, 1991). However, El-Fiky et al. (1994) and Mielenz et al. (2006) obtained negative estimates of genetic correlations between body weight and the total egg number in quail.

The aim of the present study was to identify and quantify the association between body weight in the growth phase with productive traits of meat-type quail breeders to determine an age for selection for higher body weight which has a lower impact on the production and quality of eggs.

2. Material and methods

2.1. Experimental material and management

Data from 8759 meat quail (*Coturnix coturnix*) of the UFV1 strain and another 9128 from the UFV2 strain from the Poultry Breeding Program of Federal University of Viç osa were used. Of the total, 1824 and 1704 birds from strains UFV1 and UFV2, respectively, were female breeders in the reproductive phase.

The two strains originated from two different farms in Brazil and were selected for high body weight; thus they are possibly no related. The average weight and meat yield indicates that these strains are suitable for meat production.

For each generation, at the starting stage of raising, birds individually identified with numbered tag on the leg for pedigree record were housed in stall of concrete floor with wood shavings bed, with protection circle and heating through heat brooders, by utilizing one hood for approximately 750 quails. Starter diet (from 26% to 28% CP and 2900 kcal of ME/kg) and water were supplied ad libitum. Light regimen from hatch to the fourth week was of 24 h. In the fourth week of life, 102 males and the 204 females with the highest body weight in the whole population were selected and transferred to individual steel cages ($15 \times 20 \times 23\ cm^3$) for monitoring animal productive performance. In the entire period females were kept in individual cages, whereas males were changed between two female breeders in this period. Thus, the sex ratio of breeding population was 2:1 and males were changed among the same two females every three days to maintain the fertility of laid eggs. Mates were chosen randomly. At approximately 5% egg production the diet supplied was changed to a breeder ration (19% CP and 2900 kcal energy/kg) with water and food ad libitum and light regimen of 16 h of light (16:8). The rearing procedures were repeated likewise for 13 generations, with a total of 16 hatches. Despite several generations of individual selection, there is no inbreeding depression in both strains because high population effective size.

2.2. Traits measured

Seven records of body weight, taken weekly from hatch to the sixth week of life and three productive traits of female breeders: total egg number in 365 days from the sixth week of age, average egg weight and egg specific gravity both at 180 days of age, were collected. Specific gravity was determined by the method of water displacement (Hamilton, 1982). This measure is of importance, because it is an indirect indication of egg quality, related with shell thickness and egg breakage resistance, and has