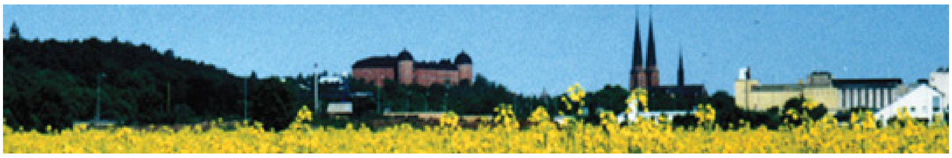

Multiple trait Bayesian analysis of birth, weaning and yearling body weights of Egyptian Zaraibi goat

I. Shaat[1*], *L. Varona*[2] *and W. Mekkawy*[3]

[1]*Animal Production Research Institute, Agriculture Research Centre, Ministry of Agriculture, Cairo, Egypt,* [2]*Area de produccio Animal, Centre UdL-IRTA. 25198, Lleida. Spain,* [3]*Departamento de Ciencia Animal, Universidad Politecnica de Valencia. 46071, Valencia, Spain*

Abstract

Data from 6620 Egyptian Zaraibi kids were collected during 1990 - 2003 to estimate genetic parameters for birth, weaning and yearling weight using a multiple trait Bayesian analysis with animal model. Systematic effects in the model were year-season of birth, sex, type of birth and the age of doe. Gibbs Sampling was used to calculate the marginal posterior distributions of the variance components, heritabilities, genetic and residual correlations. The posterior mean and (95% HPD interval) of the heritability were 0.37 (0.30-0.44), 0.18 (0.14-0.23) and 0.45 (0.36-0.53) for birth, weaning and yearling weight-,s respectively. Genetic correlations were moderate between birth and weaning weight 0.41 (0.27-0.56) and between birth and yearling weight 0.33 (0.20-0.49). A substantially higher genetic correlation was obtained between weaning and yearling weight of 0.79 (0.68-0.88). The residual correlations were 0.21 (0.17-0.26), 0.15 (0.07-0.21) and 0.47 (0.42-0.52) for birth-weaning, birth-yearling and weaning-yearling weights, respectively.

Keywords: Multiple Traits; Bayesian; Genetic Parameters; Zaraibi Goats.

[*]Corresponding author. Tel. +2-02-337-1994; Fax: +2-02-760-0598.
E-mail address: shaat@hotmail.com

1. Introduction

Goats are an important source of meat in Egypt. One of the well-known native Egyptian breeds is Zaraibi goat, also called Egyptian Nubian. Although, the population size is small, this breed has a good reputation in Egypt and the Near East region, because of its high prolificacy and milk production. Some authors reported this breed to be an ancestor of the standard Anglo-Nubian (Devendra and McLeroy, 1982 and Gall, 1981).

Studies available on this breed have focused on the effect of systematic environmental effects on body weight (Mekkawy, 2000)

The aim of this study was to estimate genetic parameters for the birth, weaning and yearling body weights using the multiple trait Bayesian analysis, with the objective of developing a selection plan for the improvement of growth rate in the Zaraibi goats.

2. Materials and methods

2.1 Data and management

Data for this study consist of birth, weaning and yearling weight of a total of 6620 Zaraibi kids, progeny of 114 sires and 1381 dams. The data set was collected at the Egyptian Ministry of Agriculture experimental stations over a 13 year period (1990-2003).

Animals were housed in semi open pens and fed on Egyptian clover (*Trifolum alexandrina*) from December to May. In the rest of the year they fed on rice straw and green fodder if available beside concentrate mixture. The composition of the concentrate mixture was cotton seed cake, maize, wheat barn, rice barn, calcium carbonate and sodium chloride with an average composition of 16% crude protein, and 3% crude fat and 15% crude fiber on average. Does were supplemented with half a kilogram concentrate mixture per day for two weeks before the mating season and from the second to the fourth week of pregnancy. Moreover, milking goats were supplemented with 1 kg of concentrate mixture.

There were two mating seasons per year (June and October). Does were randomly divided into mating groups of 30-35 does and were joined with a fertile buck. If the buck was not able to service the does, he was substituted by another one. Mating period lasted for 45 days. Does were first joined with the buck at the age of approximately 18 month. Goats were allowed to drink two or three times daily. leave out? At kidding, newborn were identified and their type of birth, sex and pedigree recorded. Weight was recorded within twenty-four hours after birth and then at 30-day intervals. Kids were weaned at approximately 90 days of age.

3.3 Statistical analysis

Data were analyzed using a multiple trait Bayesian procedure with animal model (Varona et al., 1994; Van Tassell et al., 1995). The systematic non-genetic effects included in the model were year-season of birth, age of doe at kidding (18-24, 25-36, 37-48, 49-60, 61-72, and >72 months), gender (male and female) and type of birth (single, twin, triplet and more than triplet).

The assumed model was:

$$Y = Xb + Za + e$$

Where,

Y	is the observation vector;
b	the vector of the systematic effects;
a	the vector of the additive genetic effects;
X and Z	the design matrices for the systematic and the genetic effects, respectively; and
e	the vector of residual effects

$$Y \mid b, a, R \sim N(Xb + Za, R \otimes I)$$

$$a \mid A, G \sim N(0, A \otimes G)$$

Where,

A	is the additive genetic relationship matrix;
G	the genetic co-variance matrix; and
R	the residual co-variance matrix

Prior distributions

We assume a fixed prior distribution for the systematic effects, and inverted Wishart distribution for co-variance components.

$b \propto$ constant

$$G \sim IW(S_g, n_g)$$
$$R \sim IW(S_r, n_r)$$

Fully conditional posterior densities

$$b_i \mid y, b_{-i}, a, G, R \sim N(\hat{b}_i, C^{ii})$$
$$a_i \mid y, a_{-i}, b, G, R \sim N(\hat{a}_i, C^{ii})$$
$$G \mid a, b, S_g, n_g \sim IW\ (n_g - 3 - 1)S_g + SS_g, q + n_g)$$
$$R \mid y, a, b, S_r, n_r \sim IW\ (n_r - 3 - 1)S_r + SS_r, n + n_r)$$

Gibbs sampler

A Gibbs sampler procedure (Gelfand and Smith, 1990) was used to calculate the marginal posterior distributions of the variance components, heritabilities and correlations. Gibbs sampler calculated the posterior distribution of the all unknowns of the model using 100000 total iterations, burn-in 200000 and the lag between samples 10 to avoid a high autocorrelation between samples.

3. Results

Table 1. Heritabilities (diagonal), genetic correlations (above) and residual correlations (below)

	Birth Weight	Weaning Weight	Yearling Weight
Birth Weight	0.37(0.30-0.44)	0.41(0.27-0.56)	0.33(0.20-0.49)
Weaning Weight	0.21(0.17-0.26)	0.18(0.14-0.23)	0.79(0.68-0.88)
Yearling Weight	0.15(0.07-0.21)	0.47(0.42-0.52)	0.45(0.36-0.53)

Table 2. Genetic variances and co-variances (kg^2)

	Birth Weight	Weaning Weight	Yearling Weight
Birth Weight	0.070 (0.054-0.085)	0.085 (0.052-0.122)	0.212 (0.113-0.319)
Weaning Weight		0.631 (0.473-0.842)	1.549 (1.051-2.017)
Yearling Weight			6.043 (4.340-7.429)

Table 3. Residual variances and co-variances (kg^2)

	Birth Weight	Weaning Weight	Yearling Weight
Birth Weight	0.117 (0.108-0.127)	0.125 (0.099-0.151)	0.136 (0.071-0.200)
Weaning Weight		2.843 (2.684-2.995)	2.170 (1.847-2.522)
Yearling Weight			7.368 (6.519-8.388)

4. Discussion and conclusions

The use of Bayesian multiple trait analysis increased the accuracy of the estimation in comparison to a single trait analysis for the same data, especially when the difference between the residual correlation and the genetic correlation are high. In addition, estimation of genetic correlation between several traits provides useful information for the indirect selection on a trait which has low heritability, but highly correlated with a trait with high heritability, or it allows selecting animals on an early measured trait.

The high estimate of heritability especially for yearling weight trait indicates that selection on this trait will lead to a good genetic improvement and the high genetic correlation between weaning and yearling weight means that we can improve weaning weight as well as yearling weight at the same time.

Putting the maternal effect in the model may lead to more precise estimate for a pre-weaning trait