HEALTH AND BODY CONDITION OF RABBIT DOES ON COMMERCIAL FARMS

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ABSTRACT

The sanitary status (presence or absence of rhinitis, mastitis, sore hocks and mange) and body condition (BC) of 3751 lactating does was evaluated on an individual basis to: a) analyse the influence of the "sanitary status" factor in lactating does on their body condition, and b) estimate the influence of BC on the sanitary status of does. The body condition scoring (BCS) was evaluated by palpating and estimating the fullness of muscle and fat of the lumbar, sacral, coxal tuberosity and gluteal regions, in relation to the size of the animal, on a lineal scale of 1 to 9. Prevalence of the diseases was 19.48% coryza, 4.34% mastitis, 5.46% sore hocks and 4.13% mange. An ANOVA was used to evaluate the effect of sanitary status on the BCS, the following factors being significant: rhinitis, mastitis, sore hocks, number of kindling, partum-AI interval, lactation stage and farm. The presence of rhinitis, mastitis and sore hocks caused the BCS to decrease by 6%, 7% and 7%, respectively ($P<0.001$). Therefore, all possible measures must be taken to reduce the prevalence of these diseases in farms. The method of maximum likelihood (CATMOD procedure) was used to estimate the analysis of the factors of variation affecting each disease. The factors that were significant for some of the diseases were: farm, BC, reproductive rhythm, number of kindling, phase of lactation, season and use of foot-rests. The use of foot-rests reduces the prevalence of sore hocks by over 50%. The BCS is a good indicator of health in does, and is thus a criterion in farm management.

Key words: Rabbit Doe, Welfare, Body condition, Health.

INTRODUCTION

In this paper, the body condition (BC) of a breeding doe refers to the amount of muscle and fat surrounding the body. In rabbit farming, the BC of doe is taken into account in practice, for example, before the start of a new cycle, as a reason for culling and also in the field of research (De Blas and Nicodemus, 2001; Cardinali *et al.*, 2007). Different variables influence the BC: housing (habitat and environment), feeding (water and food), age (or number of kindling), reproductive rhythm, health, management (age at weaning) and is, in short, an indicator of animal welfare, according to Broom (1986). As far as the relationship between BC and rabbit health is concerned, this indicator is used in clinical medicine as a tool for diagnosing, together with the health evaluation, amongst other bases for judgement (Rosell, 2003). The association between BC and sanitary status is evident and probably acts in both directions. They depend on each other. The aims of this study were: a) to analyse the effect of rabbit doe "sanitary status" during lactation on their BC and b) to estimate the relation between BC and the health of rabbit does.

MATERIALS AND METHODS

Animals and experimental design

During the period between 21st March 2006 and 18th April 2007, 43 visits were made to 39 different farms, where the sanitary status and body condition of the breeding does (n = 3751) were individually

checked and recorded. Four types of information were recorded for each doe: a) production factors related to the farm: the theoretical reproductive rhythm (Postpartum-AI interval), the presence/absence of foot-rests and the genetic origin; b) physiological status at the time of examination: date and number of kindling; c) sanitary status: that is, presence/absence of coryza (1/0), mastitis (1/0), sore hocks (1/0) and mange (1/0); d) another categorical variable was added, called "sick", where the doe was quantified as suffering (1/0) or not from one of the listed diseases.

The body condition of the does was assessed by palpating and estimating the fullness of muscle and fat of the lumbar, sacral, coxal tuberosity and gluteal regions, in relation to the size of the animal. This was a subjective estimation, as in the case of Bonanno *et al.* (2005), though on a lineal larger scale as body condition scoring from 1 to 9 was also carried out; with 5 being the intermediate score (optimum body condition), 1 the lowest score (cachexia) and 9 the highest (obesity). The body condition of each doe was assessed prior to the sanitary examination.

Statistical analysis

Two complementary models were used for the statistical analysis:
a) An ANOVA was used to analyse the effect of sanitary status on the BCS, where the BCS is the dependant variable and the 4 diseases considered the independent variables. The effect of sanitary status on the BCS was estimated by the GLM procedure of SAS (SAS, 1999) with the following model:

$$Y_{ijklmno} = \mu + R_i + M_j + S_k + M_l + NP_m + WLA_n + FAR_o + e_{ijklmnop}$$

where: Y_{ijkl} = BCS (1-9); R_i = effect of rhinitis, i= (1/0 levels); M_j = effect of mastitis, j= (1/0 levels); S_k = effect of sore hocks, k= (1/0 levels); M_l = effect of mange, l= (1/0 levels); NP_m= effect of number of kindling, m= (1, 2, 3-5, 6-10, 11-15,15-30); WLA_n= effect of week of lactation, n= (1,2,3,4,5+); FAR_o: effect of farm, o= (1, 2, ..,39) and $e_{ijklmnop}$ = residual error.

b) An analysis of the factors of variation affecting sanitary status. Since the variable "disease" follows a binomial distribution (1/0), we carried out an analysis of variance for categorical data, estimated by the method of maximum likelihood (CATMOD procedure, SAS™), using the following model:

$$Y_{ijklmno} = \mu + BCS_i + REP_j + NP_k + PAI_l + WLA_m + FAR_n + e_{ijklmno}$$

where $Y_{ijklmno}$ = success of the disease (yes/no); μ = global prevalence; BCS_i = effect of body condition score, i = (3-7); REP_j = effect of presence or absence of foot-rests, j= (1-0); NP_k= effect of number of kindling, k= (1, 2, 3-5, 6-10, 11-15, 15-30). PAI_l: effect of Partum-AI interval, l=(11, 15, 18, 25, 30, 56); WLA_m= effect of week of lactation, m= (1,2,3,4,5+); FAR_n = effect of farm n= (1, 2, ..,39) and e_{ijklmn}= residual error.

A χ^2 test (FREQ procedure) was used to compare different classes for those factors that showed a significant effect.

RESULTS AND DISCUSSION

Characteristics of the population

Table 1 showed the description of the studied population. The results for the characteristics described were the expected in commercial rabbit farming. Another aspect to be highlighted was that 84% of the does had foot-rests in their cages. With regard to the sanitary status, the prevalence of the examined diseases was 19.48% coryza, 4.34% mastitis, 5.46% sore hocks and 4.13% mange, corresponding to 29.21% for the "sickness" factor due to one of these four causes. The mean prevalence of sore hocks was lower than previously observed, which was reckoned as 9% (Rosell and de la Fuente, 2004). The generalized use of foot-rests favoured this improvement.

Figure 1 showed the distribution of the BCS in the 3751 assessed does. The high concentration of intermediate values, which produced a very low typical deviation of 0.80 has to be emphasised.

Table 1: Phenotypic means, standard deviations (SD), minimums (Min.), maximums (Max.) and coefficients of variation (CV%) for total lifetime performance traits[1]

Traits[2]	Mean	SD	Min.	Max.	CV%
Body condition score	4.91	0.80	2	9	16
Number of kindling	6.45	5.11	1	38	79
Partum-AI. Interval (days)	13.70	7.03	11	56	51
Phase of lactation (days)	18.48	11.79	1	60	63

[1]Number of analysed records = 3751
[2]BCS, body condition score, PAI, Postpartum-A.I. interval

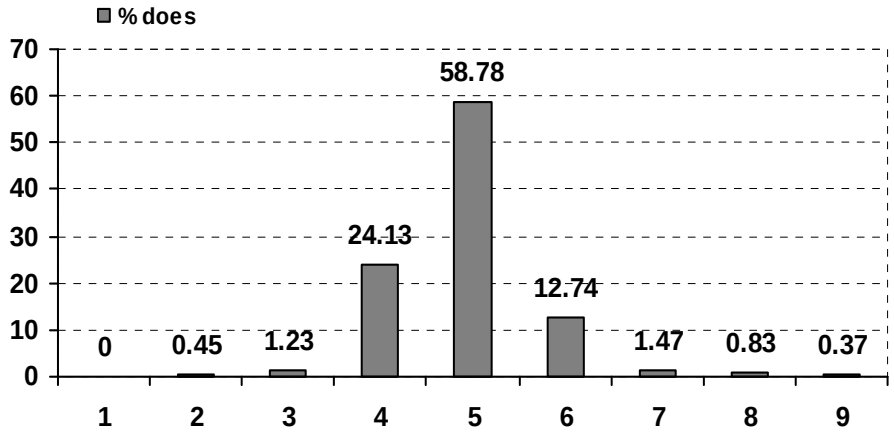

Figure 1: Distribution of the BCS of the 3751 does

Effect of each disease on the BCS

Table 2 showed the factors affecting the BCS, including the percentage of variance explained for each studied factor. Obviously, "farm" is the factor explaining the largest part of BCS variability. Factors determining sanitary status, presence/absence of rhinitis, mastitis and sore hocks showed a very significant effect. On the opposite, mange did not influence BCS. The presence of rhinitis, mastitis or sore hocks decreased the BCS by 6-7%.

Table 2: Factors affecting BCS

Source of variation	DF	F value and significance[1]	% of variance [2]
Rhinitis	1	88.03 ***	4.52
Mastitis	1	35.79 ***	6.35
Sore hocks	1	50.30 ***	6.86
Mange	1	1.46 NS	0.08
Number of kindling	5	2.67 *	0.22
Partum-AI. Interval (week)	2	20.30 ***	0.13
Phase of lactation (week)	4	4.39 **	0.70
Farm	29	53.51 ***	36.71
Model	49	64.87 ***	55.58

[1]***= significant at P<0.001, **= significant at P<0.01
[2]% of variance explained by the effect

Apart from the sanitary status, several extrinsic factors, such as feeding and management, influenced the BCS. In the present experiment they were included in the "farm" effect (Table 2). The intrinsic factors (inherent to the animal), as the number of kindling and lactation stage, influenced significantly, but slightly, the BCS. Table 3 showed that the four diseases studied decreased the BCS. The most statistically significant effects correspond to rhinitis, mastitis and sore hocks, which decreased the body condition by 6 and 7%. The low prevalence of some diseases, like mastitis, sore hocks and mange, means that a large-scale sample is required to demonstrate the effects of these diseases. So,

more accurate effects of rhinitis on BCS, and vice versa, are obtained than those of the other diseases. To correct this drawback, a new sampling has been started for an ongoing study. In addition, other variables should be included, such as weaning age, due to its effect on breeding state, and reproductive rhythm (Feugier and Fortun Lamothe, 2006). The effect of health on the body condition has three consequences: a) it corroborates that the use of the BCS as a criterion for culling, together with others (infertility, age), is a good practice; b) a BCS decrease in does must warn rabbit farmer and c) good body condition is a sign of good health.

Table 3: Effect of sanitary status on the BCS (LS Means± error)

Disease	BCS		Difference	Significance[1]	
	Yes	No		T value	P value
Rhinitis	4.36±0.05	4.62±0.04	0.26 (6%)	9.69	***
Mastitis	4.32±0.06	4.65±0.04	0.33 (7%)	6.71	***
Sore hocks	4.32±0.05	4.66±0.04	0.34 (7%)	7.90	***
Mange	4.45±0.06	4.51±0.04	0.06 (1%)	1.10	NS

[1]***= significant at P<0.001, NS = non significant

c) Risk factors of disease

The complementary approach is to analyse the disease risk factors, amongst which is BCS. Table 4 showed the influence of several factors on the prevalence of the diseases studied.

Table 4: Variation factors of sanitary status. Significance of χ^2 test (CATMOD procedure)

Source of variation	Sanitary status				
	One Disease	Rhinitis	Mastitis	Sore hocks	Mange
BCS	**	**	**	***	**
REP	NS	NS	NS	***	*
NP	NS	**	NS	*	NS
PAI	**	***	NS	***	NS
WLA	NS	Ns	*	NS	**
Season	*	**	NS	**	**
Doe origin	***	***	NS	**	**
FAR	***	***	***	***	***

REP: foot-rests; NP: number of kindling; PAI: Partum-AI interval; WLA: week of lactation; FAR: farm. N.S.: non significant (P≥0.05); *: significant effect (P<0.05); **: very significant effect (P<0.01);***: highly significant effect (P<0.001)

The significant factors for the some of the 5 characteristics were: BCS, reproductive rhythm (PAI) and season of the year, with BCS and farm being most significant. The presence/absence of foot-rests had a very significant effect on the prevalence of sore hocks, which also coincides with previous observations (Rosell and de la Fuente, 2004). The farm factor was obviously the most important as it included all the effects common to all the does on the same farm, like: housing, animals, feed, hygiene, handling, replacement rate, amongst others. Table 5 showed the mean disease prevalence according to BCS.

Table 5: Sanitary status according to BCS

BCS (n)	Prevalence (%)			
	Rhinitis	Mastitis	Sore hocks	Mange
1-3 (63)	17.46	20.63	25.40	19.05
4 (905)	27.62	8.08	10.61	6.75
5 (2,205)	19.32	3.22	3.63	3.36
6 (478)	8.58	1.26	2.09	1.26
7-9 (100)	3.00	0.00	3.00	2.00
Global	19.49	4.35	5.47	4.13
χ^2	91.98 ***	92.69 ***	120.87 ***	65.46 ***

*** (χ^2, P<0.001)

As was to be expected the animals with a better body condition presented lower prevalence for the four diseases. This relationship or association does not necessarily determine that they are cause-effect; however, the association is very evident, since disease prevalence gradually decreased as the

body condition improved. BCS and disease are two characteristics having a reciprocal influence; that is, thin does are more susceptible to suffering a disease and vice versa, sick does shows a worse BCS. In addition, a thin, sick doe is more likely to be culled. The relationship between both characteristics is quantified using the sickness-BCS joint frequency; if the sick does with a low BCS have been culled, the relationship is underestimated. This indicates that the relation or effect between both characteristics is greater than that estimated in this study. In our opinion, it can therefore be concluded that the effect of the presence or absence of disease is what determines this.

CONCLUSIONS

The sanitary status of the does measured via the 4 diseases: rhinitis, mastitis, sore hocks and mange, is one of the most important factors affecting body condition. This influence is highly significant for rhinitis, mastitis and sore hocks. The consequence is that all the measures to reduce their prevalence in farms must be taken. BCS is a good indicator of the health of females so it could be used as a criterion in farm management. The presence of foot-rests reduces the prevalence of sore hocks by over 50%.

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