

Reproductive rates and performance traits in beef cattle infected by Bovine Herpesvirus

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Received: 28/03/2005
 Accepted: 13/02/2006

Abstract

Reproductive rates and performance traits in beef cattle females infected by Herpesvirus Bovine-1 (BoHV-1) were evaluated in a farm at São Paulo state, Brazil. Gir, Guzerá, Nelore and Caracu purebred animals were examined to BoHV-1 (ELISA) at the beginning of the breeding season and the occurrence of reactors was 54.2% (386/712). BoHV-1 did not interfere in the pregnancy rates of both reagent - 80.3% (310/386) and non-reagent - 74.5% (243/326) females. It did not reduce the parturition rate of both reagent - 97.7% (300/307) and non-reagent - 93.8% (225/240) females. Total rate of stillbirths in BoHV-1 reagent females - 1.3% (4/300) did not differ from non-reagent females - 2.2% (5/225). BoHV-1 did not affect performance traits for reagent and non-reagent females, respectively, to daily weight gain during the breeding season (459.90 ± 2.82 g and 466.63 ± 2.87 g), body condition score at the beginning of the breeding season (6.89 ± 0.08 and 6.99 ± 0.08), body condition score at the end of the breeding season (7.73 ± 0.06 and 7.71 ± 0.06), weight at parturition (419.17 ± 3.34 kg and 425.97 ± 3.22 kg). It was concluded that non-vaccinated beef cattle females infected by BoHV-1 and bred under adequate extensive management, with body condition score over 5 and gain of weight during the breeding season presented good pregnancy, parturition and birth rates, no matter the breed, genetic group, age and seroconversion.

Key-words:

Bovine Herpesvirus 1.
 Beef Cattle.
 Zebu breeds.
 Reproductive performance.
 Performance traits.

Introduction

Bovine infectious rhinotracheitis / infectious pustular vulvovaginitis (IBR/IPV), caused by Bovine Herpesvirus type 1 (BoHV-1)¹ is a virosis that affects the respiratory and reproductive systems. Its economic impact can be not only observed in the losses it causes in infected animals, but also in the restrictions to the international trade of animals and animal products².

Infected bovines are carriers of

BoHV-1 for their entire life and the virus remains in neurons of the trigeminal and sacral ganglions, in a non-infectious or latent form. It may be reactivated when animals are exposed to predisposing stressful events that decrease their immunological resistance, such as transportation, treatment with glucocorticoids and calving³. Carriers may reactivate and eliminate viral particles, most of the times without presenting clinical signs^{4,5,6}.

In pregnant cows, viremia may lead

to abortion, even if the female does not present rhinotracheitis symptoms³. BoHV-1 infection may lead to losses due to respiratory and reproductive symptoms as infertility, stillbirths or birth of weak calves. This virus interferes in reproductive rates of infected herds, affecting both embryonic and fetal development; abortion is more frequently observed between 3 and 9 months of pregnancy^{8,9,10}. Infection of the reproductive tract may lead to endometritis and infertility^{11,12,13,14}.

BoHV-1 is disseminated in Brazilian beef cattle herds^{15,16,17}. However, the effects of the infection on reproductive and productive rates and on productive performance traits of beef cattle breeds endemically infected should be evaluated in field conditions. The profitability of beef cattle production is directly related to the number of animals born per year, which is dependent on the reproductive performance and performance traits, such as age at first calving, calving interval, weight at calving and at weaning. Therefore, performance traits should be analyzed together with sanitary evaluations in order to exclude the negative effects of sanitary problems on fertility of animals bred in extensive conditions.

Body condition score is an indirect evaluation of the effect of nutrition on reproduction. A body condition score equal to five or six at calving is necessary for females to present ovarian activity at the beginning of the breeding season, besides a quicker return to heat^{19,20,21,22}.

The absence of data demonstrating the reproductive and productive effects of BoHV-1 in non-vaccinated beef cattle bred under extensive management and adapted to tropical conditions lead to the design of the present study. The objective of this trial was to evaluate performance traits and reproductive performance in females bred under the management conditions stated above.

Materials and methods

This trial was performed in a rural property located in the northern region of the

state of São Paulo, Brazil, average altitude 548 meters above sea level, tropical humid climate, AW subtype, according to Köppen's classification. Meteorological indices observed during the period of study were average precipitation equal to 148.3 mm, mean minimum temperature equal to 15.3°C and mean maximum temperature equal to 32.5°C.

The herd was composed of purebred Gir, Guzerá, and Nelore *Bos indicus* and Caracu *Bos taurus*. Nelore animals are classified into three different genetic groups: control (selected for average postweaning weights), selection (both selected for high post weaning weights) and traditional, while Gir, Guzerá and Caracu animals come only from the selected lines.

Breeding season lasted 3 months, starting in November 1998 and ended in February 1999. Cows from the Selection and Traditional herds were mated: a group of 15 and 25 cows were, respectively, designed to bulls with two and three years old. In the control herd, cows were also mated with bulls two and three years old and each bull, no matter the age, was mated with 15 cows. A similar age distribution was followed within mating groups.

Pregnancy diagnosis was performed 60 days after the end of the breeding season and females were separated in groups of pregnant and non-pregnant cows²⁴. The clinical evaluation of the reproductive tract of bulls and spermogram were performed and males not approved in these examinations were not included in this trial²⁵.

Pregnant cows were regrouped and sent to pastures that could stand a higher load, while non-pregnant cows were culled. Heifers that were not pregnant were kept in the herd in order to have a second chance during the next breeding season. All pregnant cows were supplemented before and after calving with silage or chopped pasture, corn and cotton meal.

Weight, height and body condition score of the cows were evaluated in the beginning and end of the breeding season, at calving and at weaning. Evaluation of body condition score ranged from 1 to 9, for *Bos indicus* breeds²⁶ and

Bos taurus breeds²⁰.

Blood collection to identify the occurrence of BoHV-1 reagent and non-reagents²⁷ was performed in all animals in the mating groups, at the beginning of the breeding season, in November 1999. A second collection was performed in November 2000, in order to identify the animals that seroconverted until the end of the calving season²⁷. BoHV-1 serodiagnosis was performed by indirect ELISA, as recommended by the Office International des Epizooties²⁸. Commercial ELISA kits were used (Idexx; *HerdCheK*) according to the manufacturer's instructions.

Reproductive performance of BoHV-1 reagent and non-reagent females was evaluated by pregnancy rates, calving and stillbirth coefficient. Two-proportion tests comparing reagent and non-reagent animals were used, such as chi-square, exact Fisher's test; a was established at 5% for two-tailed test^{29,30}. Pregnancy and calving rates, and stillbirth coefficient were analyzed, considering the different animal categories of the cows, such as breed (Gir, Guzerá, Nelore and Caracu), genetic group of the Nelore breed (Control, Selection and Traditional), age (2 to 3 years old, 3 to 4 years old, 4 to 5 years old and²⁹ 5 years old) and body conditions scores (from 2 to 5, from 5 to 6, from 6 to 7, from 7 to 8 and from 8 to 9).

BoHV-1 effect on performance traits of the cows, such as mean weight gain during breeding season, body condition scores at the beginning and the end of the breeding season were evaluated by the F test, through a variance analysis of random trials³⁰. The *Statistical Analyses System* (SAS) was used, establishing a at 5%.

BoHV-1 effect on weight gain traits during breeding season and body condition score of the cows at the beginning and end of the breeding season took into account the following sources of variation: breed (Gir, Guzerá, Nelore and Caracu); age of the cow (2, 3, 4, 5, 6 and ²⁹ 7 years old); age and breed interaction; calving in the previous

breeding season (1998-1999); calving in the 1999-2000 breeding season; BoHV-1 reagent or non-reagent; interaction between 1998-1999 calving and 1999-2000 calving; interaction between calving (1999-2000) and being BoHV-1 reagent or non-reagent.

BoHV-1 effect on weight of the cows at calving took into account the following sources of variation: breed (Gir, Guzerá, Nelore and Caracu); age of the cow (2, 3, 4, 5, 6 and ²⁹ 7 years old); calving in the 1999-2000 breeding season; being BoHV-1 reagent or non-reagent; interaction between calving (1999-2000) and being BoHV-1 reagent or non-reagent.

Results

Total pregnancy rate among reagent – 80.3% (310/386) and non-reagent females – 74.5% (243/326) did not differ statistically by the chi-square test ($p > 0.05$) (Table 1). Pregnancy rates of reagent and non-reagent females did not vary according to age and breed ($p > 0.05$). However, when each Nelore genetic group was considered, those in the Selection herd presented greater pregnancy rates in reagent females – 92.7% (51/55) than in non-reagent ones – 79.1% (53/67) ($p < 0.05$), that is, the virus did not reduce fertility in the Nelore herd.

Considering the total number of females, the calving rate of reagent females – 97.7% (300/307) was greater than that observed for non-reagent ones – 93.8% (225/240). Difference was significant in the chi-square test ($p < 0.05$). That is, BoHV-1 did not decrease calving (Table 1). No effect was observed in the calving rate of reagent and non-reagent females in each breed, age and Nelore genetic groups, either ($p > 0.05$).

Condition of the calf at birth (live or stillborn), according to the conditions of the mother (reagent / non-reagent) showed that the stillbirth coefficient of the BoHV-1 females – 1.3% (4/300) did not differ from that of the females BoHV-1 non-reagent – 2.2% (5/225) (Table 1), even when breed, genetic group and age were considered

($p > 0.05$); that is, BoHV-1 did not interfere with the stillbirth coefficient.

Body condition score of the females at the beginning and end of the breeding season was analyzed together with the reproductive and sanitary evaluation of the herd. Females that presented a body condition score below 5 at the beginning of the breeding season were also the ones that presented lower pregnancy rates – 65.1% (28/43) – than those with body condition scores above 5 – 82.2% (282/343) (Table 2) ($p < 0.05$). At the end of the breeding season, pregnancy rates of reagent females with body condition score below 6 – 36.4%

(8/22) was lower than those with body condition score above 6 – 82.9% (301/363) ($p < 0.05$), according to the chi-square test (Table 3).

Although seroconversion occurred in 10.3% (58/561) of the herd from the beginning to the end of the breeding season, there was no effect of BoHV-1 on the stillbirth coefficient, and pregnancy and calving rates, when compared that seroconverted with those that remained non-reagent and reagent during the same period (Table 4).

No statistical significant effects of BoHV-1 were observed ($p > 0.05$) on the performance traits evaluated (Table 5).

Table 1 – Comparison between pregnancy and calving rates and stillbirth coefficients between cows reagent and non-reagent to BoHV-1, and level of statistical significance. São Paulo - SP, 2001

Variable	BoHV-1 reagent	BoHV-1 non-reagent	statistical significance
Total pregnancy rate	80.3 % a (310/386)	74.5 % a (243/326)	$\chi^2 = 3.07$ $P > 0.05$
Total calving rate	97.7 % a (300/307)	93.8 % b (225/240)	$\chi^2 = 4.52$ $P < 0.05$
Total stillbirth coefficient	1.3 % a (04/300)	2.2 % a (05/225)	Exact Fisher's test = 0.51 $P > 0.05$

Different letters show statistical significance between columns.

Table 2 – Chi-square test between the proportion of pregnant and non-pregnant BoHV-1 reagent cows, according to the body condition score at the beginning of the breeding season. São Paulo - SP, 2001

Body condition scores	BoHV-1 reagents		Statistical significance
	Pregnant	Non-pregnant	
2 – 5	5.1 % (28/43)	34,9% (15/43)	$\chi^2 = 6.03 *$ $p < 0.05$
5 – 9	82,2% (282/343)	17,8% (61/343)	

Table 3 – Chi-square test between the proportion of pregnant and no-pregnant BoHV-1-reagent cows, according to the body condition score at the end of the breeding season. São Paulo - SP, 2001

Body condition scores	BoHV-1 reagents		Statistical significance
	Pregnant	Non-pregnant	
2 – 6	36.4% (08/22)	63,6% (14/22)	$\chi^2 = 25.5 *$ $p < 0.0001$
6 – 9	82,9% (301/363)	17,1% (62/363)	

Table 4 – Two-proportion test between the groups Seroconversion, Non-reagents and Reagents by ELISA BoHV-1, for pregnancy and calving rates, and stillbirth coefficients. São Paulo - SP, 2001

Rates	BoHV-1 Seroconversion			BoHV-1 Non-reagents			BoHV-1 Reagents		
	No.	%	Total	No.	%	Total	No.	%	Total
Pregnancy	49	84.5 ^a	58	172	82.7 ^a	208	261	88.5 ^a	295
Calving	46	79.3 ^a	58	167	80.3 ^{a b}	208	258	87.5 ^{a c}	295
Stillbirth	0	0.0 ^a	46	04	2.4 ^a	167	05	2.0 ^a	257

z critical = 1.96 á = 5% Different letters show statistical significance between columns.

Table 5 – Summary of the variance analysis for some performance traits of the cows in the breeding season. São Paulo - SP, 2001

Performance traits	BoHV-1 reagents mean ± SD	BoHV-1 non-reagents mean ± SD	F	Pr > F
Mean daily weight gain (kg)	459.90 ± 2.82 _a	466.63 ± 2.87 _a	0.05	0.82
Body condition score at the beginning of the breeding season	6.89 ± 0.08 _a	6.99 ± 0.08 _a	0.52	0.47
Body condition score at the end of the breeding season	7.73 ± 0.06 _a	7.71 ± 0.06 _a	0.02	0.89
Weight at calving (Kg)	419.17 ± 3.34 _a	425.97 ± 3.22 _a	2.48	0.12

Different letters show statistical significance between columns.

Discussion

BoHV-1 impact was studied in clinical, reproductive and nutritional evaluations in a herd naturally infected and non-vaccinated of beef cattle, made up of genetically improved Gir, Guzerá, Nelore and Caracu animals, adapted to tropical climate. Reproductive and productive effects were based on the comparison of BoHV-1 reagent and non-reagent animals bred under the same environmental and animal husbandry conditions, what validated the results obtained. In the Brazilian specialized literature there is a lack of information on reproductive and productive rates in herds of beef cattle breeds adapted to this kind of climate and to extensive animal husbandry, which is the main process of beef cattle breeding in Brazil.

The occurrence of 54.2% (386/712) BoHV-1 reagent females in the herd studied

was similar to the rate described in several Brazilian states^{15,16,17}. A high rate of natural infection may characterize a condition of naturally acquired immunity⁷. This observation justifies the study of epidemiological, clinical and animal husbandry characteristics in the interpretation of BoHV-1 impact in endemically infected herds. Seroreagent animals in the present trial did not present genital or respiratory symptoms, condition that was also described by other authors^{7,31}.

Although BoHV-1 infection has been described as causing abortion^{8,9,10}, endometritis and infertility^{11,12,13,14}, the herd studied did not present significant reproductive disorders, when BoHV-1 reagent females were compared to non-reagent ones in the control groups. In spite of the fact that literature reports that pregnant females infected by BoHV-1 may abort more frequently in the second or third

trimesters of pregnancy^{8,9,15}, BoHV-1 infection did not cause a decrease in calving rates in the herd studied. The virus is also reported to lead to the birth of weak calves or stillbirths^{7,32}. This effect, however, was not observed in the herd evaluated, when infected and non-infected females were compared. Besides the effect of BoHV-1 on stillbirth coefficient, other factors, such as age and breed of the mother were also evaluated, for they may be associated with the death of neonates³³. There was no interference in relation to breed, Nelore genetic groups and age, though.

Females that seroconverted did not present any effects on stillbirth coefficient, and pregnancy and calving rates, what is in accordance with the results of other trials^{34, 13}. However, it has been reported that primo infections may lead to losses due to reproductive and respiratory problems³⁵.

Nutritional status of beef cattle is considered to be a limiting factor in the reproduction of females bred under extensive husbandry. Because of this, evaluations of body condition score were performed together with the sanitary and reproductive evaluation of the herd, in order to exclude possible nutritional effects that may interfere with fertility. Pregnancy rates in reagent females showed that body condition score below 5, both in the beginning and end of the breeding season, was the factor that reduced animal fertility, and not virus infection. Body condition score above 5 is technically recommended when good reproductive rates are aimed, for it favors ovarian activity at the beginning and end of the breeding season, besides a quicker return to heat²⁰.

BoHV-1 reagent or non-reagent pregnant animals gained weight and

improved body condition during the breeding season, even with most of the cows in lactation, as seen by the mean weight gain obtained. Although lactation has a suppressive effect on ovulation, this is less evident in animals that present moderate body condition scores at calving, or animals that did not present a drastic weight loss after calving^{19,22}. Lactation is very demanding on the organism and together with the inhibition of GnRH release during milking, it makes difficult for cows presenting body condition scores below four to return to heat²⁷. Therefore, the good nutritional status of the herd is favorable for reproduction. However, there are no published data to draw a possible comparison with BoHV-1 effects observed here.

Conclusions

Beef cattle females infected and non-vaccinated against BoHV-1, submitted to extensive management, presenting body condition scores above five at the beginning and end of the breeding season and presenting weight gain during the breeding season showed good fertility and calving rates, as well as low stillbirth coefficients, no matter the breed, genetic group, age and seroconversion.

Acknowledgements

The authors would like to thank Mr. Lúcio Aparecido Furtado for animal husbandry; to Mrs. Rosângela Maria Furtado and Mr. Sebastião Aparecido Teixeira for organizing the data files; to Mr. Antônio José de Lima, for providing all the breeding book information. The authors would like to thank FAPESP (process no. 99/05068-3) for the financial support.

Índices reprodutivos e características de desempenho em bovinos de corte infectados pelo Herpesvírus Bovino 1

Resumo

Avaliou-se índices reprodutivos e características de desempenho em fêmeas bovinas de corte, infectadas pelo Herpesvírus Bovino-1

Palavras-chave:

Herpesvirus Bovino 1.
Bovinos de Corte.
Zebuínos.

(BoHV-1), em um rebanho no Estado de São Paulo, Brasil. Animais das raças Gir, Guzerá, Nelore e Caracu foram monitorados no início da estação de monta e a sororeatividade ao BoHV-1 pelo teste ELISA foi 54,2% (386/712). O BoHV-1 não interferiu no índice de prenhez de matrizes reagentes - 80,3% (310/386) e não reagentes - 74,5% (243/326) e nem reduziu a taxa de parição de matrizes reagentes - 97,7% (300/307) e não reagentes - 93,8% (225/240). O coeficiente de natimortalidade de matrizes reagentes ao BoHV-1 - 1,3% (4/300) não diferiu da encontrada para as não reagentes - 2,2% (5/225). O BoHV-1 não afetou a média de algumas características de desempenho de fêmeas reagentes e não reagentes, respectivamente, como ganho de peso médio diário durante a estação de monta ($459,90 \pm 2,82$ g e $466,63 \pm 2,87$ g), condição corporal na entrada da estação de monta ($6,89 \pm 0,08$ e $6,99 \pm 0,08$), condição corporal na saída da estação de monta ($7,73 \pm 0,06$ e $7,71 \pm 0,06$) e peso à parição ($419,17 \pm 3,34$ kg e $425,97 \pm 3,22$ kg). Concluiu-se que matrizes de corte infectadas pelo BoHV-1 e não vacinadas, criadas sob condições adequadas de manejo zootécnico extensivo e nutricional, como escore corporal acima de 5 e ganho de peso durante a estação de monta, apresentaram bons índices de prenhez, parição e natalidade, independente da raça, grupo genético, faixa etária e soroconversão.

Performance reprodutiva.
Características de desempenho.

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