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PERFORMANCE OF OFFSPRING FROM BOVINE MATRICES CLASSIFIED ACCORDING TO THE DEGREE OF HEMINTOSIS

(DESEMPENHO DE FILHOTES DE MATRIZES BOVINAS CLASSIFICADAS DE ACORDO COM O GRAU DE HEMINTOSE)

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RESUMO

Considerando a importância do controle parasitário em bovinos, investigações por meio de alternativas tornam-se essenciais, como o uso de animais resistentes e a diversidade do genoma do hospedeiro devido à dificuldade de profilaxia de helmintíases em ruminantes. O objetivo foi avaliar o grau de helmintíase, ganho de peso e parâmetros hematológicos em descendentes de meio-irmãos machos e fêmeas de matrizes Nelore previamente classificadas por diferentes níveis de infecção parasitária por helmintos. Os animais foram divididos de acordo com a classificação de suas mães, sendo entre resistentes (G1), resilientes (G2) e suscetíveis (G3). A coleta para contagem de ovos por grama de fezes (OPG), coproculturas e identificação de larvas foram realizadas a cada 28 dias, sendo a mesma para a pesagem iniciada após o desmame. A coleta de sangue foi realizada no início e no final do experimento para determinação do volume globular, proteína plasmática total (PPT) e contagem de eosinófilos. O resultado obtido para OPG demonstrou que não houve diferença significativa entre os grupos, mas os bezerros descendentes de vacas previamente classificadas como suscetíveis (G3) apresentaram OPG superior aos resistentes e resilientes (G1 e G2). Em relação ao peso, houve diferença significativa no ganho de peso diário total (GPD) (machos e fêmeas), quando os animais do G3 apresentaram um GPD menor em relação aos demais grupos. Não houve diferença nos parâmetros hematológicos avaliados. Nas coproculturas, em todos os grupos foram encontradas larvas de Cooperia spp., Haemonchus spp. e Oesophagostomum spp. Conclui-se que novilhas nascidas de vacas suscetíveis podem sofrer a influência de suas mães em relação à carga parasitária e assim, uma redução no desempenho produtivo. Por

outro lado, os bezerros machos não sofreram a influência de suas mães no grau de helmintoses e desempenho.

Palavras-chave: ganho de peso, helmintos, resistência, EPG.

ABSTRACT

Considering the importance of the parasite control in bovine, investigations through alternatives become essential, such as the use of resistant animals and the diversity of the host genome due to the difficulty of prophylaxis of helminthiasis in ruminants. The objective was to evaluate the degree of helminthiasis, weight gain and hematological parameters in male and female half-sibling offspring from Nelore matrices previously classified by different levels of parasitic helminth infection. The animals were divided according to the classification of their mothers, being browse of resistant (G1), resilient (G2) and susceptible (G3). The collection to count eggs per gram of feces (EPG), coprocultures and larvae identification were realized every 28 days, being the same for the weighing that started after the weaning. Blood collection was performed at the beginning and at the end of the experiment to determine the globular volume, total plasmatic protein (TPP) and eosinophil count. The result obtained for EPG demonstrated that there was no significative difference among the groups, but the calves offspring of cows previously classified such as susceptible (G3) showed a higher EPG than the resistant and the resilient (G1 and G2). Relatively to the weight, there was a significative difference in the overall daily weight gain (DWG) (males and females), when the animals fromG3 showed a smaller DWG compared to the other groups. There was no difference in the hematologic parameters evaluated. In coprocultures, in all the groups were found larvae of *Cooperia spp., Haemonchus spp. and Oesophagostomum spp.* It is concluded that heifers born to susceptible cows may suffer the influence of their mothers in relation to the parasitic load and thus, a reduction in the productive performance. On the other hand, male calves did not suffer the influence from their mothers in the degree of helminthosis and performance.

Keywords: weight gain, helminths, resistance, EPG.

INTRODUCTION

In a herd of animals not selected for parasitic resistance, being them of any breed, there are approximately 10 to 20% of individuals considered naturally resistant, that is, animals that would not need an anthelmintic or would need very low amounts of treatment to control the gastrointestinal nematodes. In the same proportion, there are individuals considered susceptible that will always show high numbers of helminths in their gastrointestinal tract, being considered disseminators of parasites in the environment. There are also resilient individuals, that are non-resistant animals, but they are able to attenuate the effect of parasitism on their productive performance (AMARANTE et al.,

2004; ROCHA et al., 2004).

Among them and among the species it is common for the animal skill to acquire autoimmunity and express resistance to be variable from one individual to another, proving to be a genetic control seen in several researches that use EPG as an examining parameter (GABARRE et al., 2001). The great evidence of this genetic control is in the inheritance values for parasitic resistance, that is, how much of this characteristic is hereditary for the offspring (GABARRE et al., 2001). Thus, the selection of animals through the resistance to the gastrointestinal helminths appears as a new form to increase the capacity of the animal to control the level of parasitic infection, resulting in a decrease in the cost of using anthelmintics and an improvement in the production of these animals (AMARANTE et al.,2004; ROCHA et al.,2004).

As it was suggested by Basseto et al., (2009), it is possible to perform a selection by analyzing the number of EPGs from hosts resistant to gastrointestinal nematodes. In a herd of parasitized animals, there is a possibility that resistant animals will demonstrate a superior performance. From hematological, coproparasitological and serological tests, it is possible to identify these animals that better withstand parasitism and possibly present better performance than their conspecifics, transmitting these characteristics to their offspring. As it was explained above, the objective was to evaluate the degree of helminthiasis, weight gain and hematological parameters in half-sib offspring, male and female from Nelore matrices previously classified by different levels of parasitic infection by helminths.

MATERIAL AND METHODS

The experiment was conducted in a property located in Castilho-SP (20°52’18.5” S 51° 29’25.3”w) with an area of 1210 hectares of surface with pastures of *Urochloa decumbens and Maximussyn Panicummaximum,* destined to breeding, rebreeding and fattening of Nelore cattle. Nelore heifers, previously classified for helminthiasis, to count eggs per gram of feces (EPGs) were grouped in relation to the level of susceptibility to parasites found in literature describing a proportionality of resistant, resilient and susceptible animals, taking as an example the one suggested by Gasbarre, Leighton and Sonstergard (2001), according to the degree of infection by gastrointestinal helminths

(25% resistant, 50% resilient and 25% susceptible (approximately). After entering the reproductive period, they were submitted to the protocol for fixed-time artificial insemination (FTAI), using semen from the same bull.

The pregnant rate obtained from the female considered resistant, resilient and susceptible was of 60%, 41% and 37%, respectively. When the three groups were considered, the general rate of pregnancy was 45,4%, a similar index in relation to other lots of the same property and also in other stations of crossing. Forty-five half-sibling offsprings from Nelore breed (15 from resistant proles, 20 from resilient and 10 from the susceptible), from selected matrices, were grouped according with the classification of the mothers: G1-offspring of resistant matrices; G2-offspring of resilient matrices; G3-offspring of susceptible matrices were evaluated.

The animals were kept in the same pasture, under the same housing conditions without any antiparasitic treatment, where they remained throughout the experimental period, which started at three months after the birth, through the weaning process at eight months and culminating at fifteen months of age, when they are the most severely affected by helmintoses.

The degree of parasitism of the animals was available through collections of feces, performed every 28 days. Feces were collected directly from the rectum of the animals for coprological examinations, by counting eggs per gram of feces (EPG), using the chamber of McMaster (Gordon and Whitlock, 1939). Cultivation of feces and extraction of larvae was also performed, by the method of Roberts and O'Sullivan (1950), for a later identification of the genres present by the key of Keith (1953). The animals were weighed (Kg) in an electronic balance, performed every 28 days after weaning, to evaluate the performance and to determine the hematological parameters. Blood samples were collected individually, by venipuncture, at the beginning and at the end of the experiment, for the measurement of total plasma protein (PPT), globular volume (GV), and eosinophil count.

The PPT was observed in the manual ocular refractometer, according to the method of Silveira (1988). The GV values, given in percentage, were determined by centrifuging the blood in capillary tubes for five minutes using Strumia method, performed by means of blood smears stained by rapid panoptic, according to the technique of Schalm and Carrol (1988). The data obtained were submitted to variance

analysis, and the means were compared by the test of Tukey at 5% probability. Statistical analysis was performed with the help of a Minitab Software-Version 17 (Minitab Inc. 2006).

RESULTS AND DISCUSSION

The EPG averages of males and female calves, offspring from matrices previously classified as resistant, resilient and susceptible can be observed in table 1.

Table 1. Mean variables, coefficient of variation (CV) of egg count per gram of feces (EPG) of group 1 (offspring from resistant matrices), group 2 (offspring of resilient) and group 3 (offspring of susceptible) obtained from male and female calves at 3 months of age, before weaning, after weaning and throughout the experiment in Castilho, São Paulo-Brazil.

		GROUPS			CV
		1	2	3	
3 months of age	general EPG	65.0 a	180.0 a	307.0 a	194.04
	females EPG	58.3 a	371.0 a	363.0 a	187.50
	male EPG	75.0 a	76.9 a	233.0 a	130.59
Before weaning (3 to 8 months)	general EPG	71.7 b	151.3 b	312.1 a	77.61
	females EPG	50.0 b	156.0 b	421.0 a	44.80
	male EPG	104.2 a	148.7 a	166.7 a	76.72
After weaning	general EPG	67.1 b	79.3 b	206.1 a	62.73
	females EPG	40.5 b	75.5 b	271.4 a	53.21
	male EPG	107.1 a	81.3 a	119.0 a	61.77
Entire period	general EPG	69.2 b	112.5 b	255.1 a	59.98
	females EPG	44.9 b	112.6 b	340.6 a	47.13
	male EPG	105.8 a	112.4 a	141.0 a	62.91

The result obtained for the EPG count at 3 months of age (at the beginning of the experiment) shows that the animals were already parasitized and that they did not show differences among the groups, both males and females.

At the age of 3 to 8 months, the EPG of males showed no difference among the groups, whereas the EPG of female daughters of cows previously classified as cosusceptible was higher than that of daughters of resistant and resilient cows, which present similar EPG values for the two groups. It was observed that the general average of EPG counts (males and females) was also higher in the group of offspring of susceptible cows.

After weaning, compared to the offspring group of susceptible animals, the general

EPG mean and the EPG mean of the females continued to show differences in the offspring of resistant animals and resistant to diseases. The group of offspring of resistant animals and resistant to diseases was maintained and the EPG was reduced to the previous classification, which is the group of offspring of susceptible cows. Therefore, in Australia, New Zealand and Uruguay, the progressive elimination of susceptible animals and the choice of animals resistant to gastrointestinal parasites has become an active alternative to improve the ability to limit the degree of infection in sheep (CASTELLS et al., 2002). It is believed that the same method can be applied in cattle (SOUTELLO et al., 2001). Estimates of heritability of resistance to parasitism determined by EPG ranged from 0.14 to 0.44 (SAYERS et al., 2005). These values of heritability estimates allow to classify the genetic progress from low to moderate, that is, it has a reasonable potential for the selection of resistant animals.

Therefore when comparing the EPG of all males and females of the three groups during the entire period of experience, it was observed that there was no significant difference and the mean of EPG of the males was 115.38 and of the females it was 142.35.

The result obtained for the mean variable EPG during the entire period of females and males shows that the average of helminths in groups 1, 2 and 3 were 69.2, 112.5 and 255.1, respectively. For the groups 1 and 2, the general average of EPG of the females were lower, when compared with the group of offspring of half-sibs of susceptible matrices. In resistant animals there is a lower parasite load, eliminating less nematodes eggs to the environment, resulting in lower pasture contamination (ONYIAH et al., 2005), thus reducing the exposition of animals to parasites.

When observing the variation of the EPG average of the male calves during one year of study, it was verified that groups 1 and 2 kept the averages always stable. However, group 3 demonstrated an increase of EPG during the weaning period.

For the group of offspring of half-siblings from resistant matrices (group 1), the order of prevalence for the results obtained from the coprology was of : *Cooperia* spp. (48.65%), *Haemonchus* spp. (45.95%) and *Oesophagostomum* spp. (5.41%); for the group of offspring of half-siblings from resilient matrices (group 2) it was of: *Cooperia* spp. (70.00%), *Haemonchus* spp. (20.00%) and *Oesophagostomum* spp. (10.00%); and finally, for the group of half-sisters offspring from susceptible matrices (group 3), it was of: *Cooperia* spp. (59.32%), *Haemonchus* spp. (32.20%), *Trichostrongylusspp.* (5.08%)

and *Oesophagostomum* spp. (3.39%).

In the analysis by Fiel (2001), it was observed that the mothers of these calves had results similar to those found in the present study for groups 1 and 2, with a higher prevalence of the genus *Cooperia spp.* (48.80%) and *Haemonchus spp.* (46.03%), followed by *Oesophagostomum spp* (5.17%). For the group of resilient animals, results were of: *Cooperia spp.* (67.96%) and *Haemonchus spp.* (25.2%), followed by Oesophagostomum spp. (6.80%). However, when observing the result for sensitive animals in the study of Fiel (2001), it can be observed that the genus of nematodes found were not similar, with a greater predominance of larvae of the genus *Haemonchus spp.* (47.6%) and *Oesophagostomum spp.* (36.05%), followed by *Cooperia spp.* (15.12%) and *Trichostrongylus spp.* (1.16 %). Meanwhile, in this study, it is the only group in which *Triachostrongylus spp* (5.08%) also appears in offspring of susceptible mothers.

Table 2 shows the weight gain values of male and female calves in the offspring groups of resistant, resilient and susceptible matrices, during the experiment.

Table 2. Average daily weight gain (DWG), coefficient of variation (CV) and probability of male and female calves in group 1 (half-sisters offspring from resistant matrices), group 2 (calves born from resilient) and group 3 (calves born from susceptible), during the experiment, in Castilho, São Paulo- Brazil.

	GROUPS			
Variable	1	2	3	**CV**
General DWG	0.789a	0.783 a	0.598 b	4.57
DWG (kg/day) females	0.763 a	0.649ab	0.550 b	7.66
DWG (kg/day) male	0.828 a	0.855 a	0.661 a	30.2

All groups presented values of total plasma protein lower than those considered normal, which is 67.4 - 74.6 g/L (KANEKO; HARVEY; BRUSS, 1997). Values below what is considered normal are one of the consequences caused by haemonchosis, due to blood loss (AMARANTE, 2005), because of spoliation (AMARANTE et al., 2004; BRICARELLO et al., 2004).

In relation to the general average daily weight gain (DWG), the animals in group 3 (0.598kg) showed less weight gain compared to groups 1 and 2. These data are consistent with the study of Melo (2003), in which the effect of the parasites affect the medium weight gain and reduces the performance of susceptible sheep in relation to the resistant group. The research performed by Basseto et al. (2009) showed that the weight of the

resistant to diseases was always higher compared to the weight of the susceptible sheep. Groups 1 and 2 did not show significant differences, earning daily 0.789 and 0.783 kg, respectively. In the case of resistance, the immunological response limits the establishment of the parasite, while in the case of resilience, the animals are able to live with the parasites with minimal reduction in productivity. The (DWG) medium weight gain of female offspring of resistant cows (group 1) showed a significant difference, when compared to the animals of group 3, however, it did not differ from group 2. Meanwhile, Amarante (2004) reported that sheep are more productive. Female offspring from susceptible mothers had lower DWG, when compared to animals from resistant mothers. For male calves there was no significant difference for DWG in any of the groups.

However, in the present study, male calves showed greater daily weight gain when compared to female calves, weighing 0.821kg and 0.666 kg, respectively. In the same way, Macedo et al. (2001) observed that male bovines present a bigger weight gain and a better feeding efficiency in relation to the females.

For eosinophils, there were no significant differences among the groups, when the circulating eosinophils were analyzed, in which the average of females at the beginning of the experiment was of 2.57% (G1), 1.38% (G2) and 2.25% (G3), and at the end of the experiment was of 7.71% (G1), 9.50% (G2) and 6.50% (G3). The average for the males at the beginning of the experiment was of 0.40% (G1), 2.25% (G2) and 2.00% (G3), and at the end of the experiment was of 3.80% (G1), 8.75% (G2) and 4.67% (G3). It can be seen that there was an increase in the percentage of eosinophils from the beginning to the end of the experiment, but all the values are within the normal range for these animals, in which the variation goes from 0 to 20% (LACVET,2016). But, this increase in the number of eosinophils is explained by the fact that after an infection caused by helminths, the number of eosinophils can increase in blood and in tissues, which helps in the elimination of the parasites (BALIC; BOWLES; MEEUSEN 2000; TIZARD 2008).

There was no significant difference in any of the parameters evaluated among the three groups for males and females. The globular volume (GV) values were within the normal ranges, that vary from 26-49% (COLES, 1984). Whitlock et al., (1958) classified sheep as susceptible and resistant to gastrointestinal nematodes, based on the values of globular volume of these animals. Those that presented GV less than 20%, when submitted to contaminated pasture, were susceptible. However, in the present experiment,

the animals of the half-sisters offspring group of susceptible matrices did not present values below 20%.

All the groups showed total plasma protein values considered normal, since values of normal animals range from 67.4–74.6 g/L (KANEKO;HARVEY;BRUSS;1997). Values below of what is considered normal is one of the consequences caused by hemonchosis due to loss of blood (AMARANTE, 2005), due to spoliation (AMARANTE et al., 2004; BRICAARELL et al., 2004).

CONCLUSION

Offspring of susceptible matrices may be influenced by their mothers in relation to the parasitic load and consequent reduction in their reproductive performance. However, calves from resistant, resilient and susceptible cows were not influenced by their mothers in the degree of helminthosis and performance.

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