



Short Communication

Relationship between early finishing and reduced prevalence of cysticercosis in cattle

Relação da precocidade de terminação e a redução da prevalência de cisticercose em bovinos

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ABSTRACT

This study aimed to group cattle carcasses with similar characteristics to assess the group-specific prevalence of cysticercosis using data from the slaughter of 15,002 cattle. The following variables were recorded: carcass weight, cover fat, individual age, and prevalence of cysticercosis. A k-means clustering method was used to examine the relationship between carcass characteristics and the prevalence of cysticercosis. We did not specify the number of clusters before the analyses but used automatic methods based on a cross-validation to select the best-fitting clusters. One of the three produced clusters included carcass weight, cover fat, and age, as desired by the Brazilian meat industry. This cluster showed a reduced prevalence of cysticercosis ($P = 0.0147$) and earlier finishing compared with the other groups. In conclusion, earlier finishing seems to be associated with a lower prevalence of bovine cysticercosis.

RESUMO

Este estudo objetivou agrupar carcaças de bovinos com características semelhantes para avaliar a prevalência de cisticercose específica do grupo, utilizando dados do abate de 15.002 bovinos. As seguintes variáveis foram registradas: peso de carcaça, gordura de cobertura, idade individual e prevalência de cisticercose. Um método de agrupamento *k-means* foi usado para examinar a relação das características de carcaça e a prevalência de cisticercose. Não se especificou o número de *clusters* antes das análises, utilizaram-se métodos automáticos com base em uma validação cruzada para selecionar os *clusters* mais adequados. Um dos três *clusters* produzidos possuiu peso de carcaça, gordura de cobertura e idade, conforme desejado pela indústria de carnes brasileira. Este *cluster* mostrou uma menor prevalência de cisticercose ($P = 0,0147$) e maior precocidade de terminação em comparação com os outros grupos. Conclui-se que a precocidade de terminação está associada a uma menor prevalência de cisticercose bovina.

INTRODUCTION

The bovine taeniasis-cysticercosis complex can be defined as a set of pathological alterations caused by adult and larval forms of *Taenia saginata*. This zoonosis can show two distinct forms: taeniasis, which affects humans; and cysticercosis, which is caused by the presence of *Cysticercus bovis* (the larval stage of *Taenia*

saginata) in bovine tissues (MAGALHÃES et al., 2017). This disease has an impact on animal production and public health (PADILHA et al., 2018).

Infection of humans with *T. saginata* is common in areas where sanitation is inadequate (USIP et al., 2011; ACEVEDO-NIETO et al., 2012). This parasite is commonly found in South America, North America, and Africa (USIP

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et al., 2011), with high prevalence in several regions of Brazil (PANZIERA et al., 2017) and mainly in economically impoverished areas.

Information on the prevalence of bovine cysticercosis is important for the implementation of control programs (ACEVEDO-NIETO et al., 2012). Anatomopathological diagnosis is the most important instrument in veterinary diagnostics as identification of cysticercosis at the time of slaughter is crucial for the success of programs to prevent the spread of taeniasis to humans (CORTÊS, 2000; LARANJO-GONZÁLEZ et al., 2018).

Age may be one of the factors that increase the prevalence of bovine cysticercosis, and a respective positive correlation has been reported previously (DORNY et al., 2000). However, due to the diversity of environments and the associated phenotypical differences in cattle of the same genotype (LOPES et al., 2008), age at the time of slaughter is variable.

The age at which animals are slaughtered depends on several factors such as carcass weight and composition. Typically, animals that reach a body composition that is appropriate for slaughter at a young age (i.e. early finishing) are desired. In general, cattle are slaughtered when they reach about 50% of the weight of the corresponding adult non-castrated male genotype (LANNA, 1997). The large slaughterhouses in Brazil use a grading manual that targets carcasses weighing 240 to 330 kg, with a fat cover of 3 to 10 mm, and maturity indicated by 0 to 6 permanent incisor teeth; animals meeting these criteria are considered desirable.

Thus, we hypothesized that animals with carcass traits desirable for meat industry also show a lower prevalence of cysticercosis. The aim of this study was to group carcasses with similar characteristics (weight, age, and fat cover) in order to assess the group-specific prevalence of bovine cysticercosis.

MATERIAL AND METHODS

This study is based on data from the slaughter of 15,002 Zebu cattle from the year 2010. Males and females aged between 20 and 60 months were slaughtered in a slaughterhouse under federal inspection, located in Janaúba, State of Minas Gerais.

After fasting for 12 h, cattle were slaughtered after stunning with a bolt gun, as commonly done in the meat industry. Inspection work on the slaughter lines was carried out by a team of inspection agents duly trained to carry out the post-mortem inspection under the supervision and responsibility of an official veterinary doctor of the Federal Inspection Service, as described by Ferreira et al. (2014).

The recorded variables were hot carcass weight, subcutaneous fat cover (using a scoring system), age (according to the number of permanent incisor teeth), and prevalence of cysticercosis.

Animals were selected randomly for this study and originated from 32 municipalities in the Northern State of Minas Gerais, semi-arid region of Brazil. The respective percentages of animals by municipality were as follows: Janaúba (17,77%), Itacarambi (14,38%), Jaíba (10,07%), Montes Claros (9,99%), São João da Ponte (8,55%), Capitão Enéas (7,75%), Jequitaiá (6,00%), Francisco Sá (4,43%), São Francisco (3,95%), Verdelândia (3,90%), Brasília de Minas (1,71%), Matias Cardoso (1,56%), Patis (1,52%), Francisco Dumont (1,36%), Brasilândia de Minas (1,22%), Rubelita (0,69%), Espinosa (0,57%), Engenheiro Navarro (0,50%), Joaquim Felício (0,49%), Manga (0,49%), São João do Pacuí (0,43%), Claro dos Poções (0,42%), Coração de Jesus (0,29%), Salinas (0,29%), São João da Lagoa (0,29%), Mirabela (0,26%), Juramento (0,25%), Pedras de Maria da Cruz (0,25%), Varzelândia (0,22%), Januária (0,14%), Ponto Chique (0,14%) and Pai Pedro (0,13%). The different percentage of the samples of the municipalities was in agreement with the demand of slaughter.

The weight of the hot carcasses was obtained by adding weight of the half-carcasses weighed in the inspection line. The number of incisor teeth of each animal was determined by inspecting the dental arch. Subcutaneous fat from the carcasses was assessed visually during the passage of the carcasses in the inspection line. We followed a previously published scoring system for carcass fat cover with scores from 1 to 5 (FELÍCIO, 2011), where 1 corresponded to the absence of fat (zero to 1 mm); 2 indicated scarce fat (> 1 to < 3 mm); 3 indicated a moderate amount of fat (3 to 6 mm); 4 indicated a considerable amount (> 6 to 10 mm), and 5 indicated an excessive amount of fat (> 10 mm).

Carcasses with lesions that indicated cysticerci were sent to the Department of Final Inspection for parasite detection as described by Ferreira et al. (2014).

A k-means clustering method was applied to examine a potential relationship between animals with cysticercosis and their carcass characteristics. The number of clusters was not specified before the analyses. The software Statistica (version 8.0) was used with automatic methods based on a cross-validation in order to determine the best-fitting clusters. This method serially assigns each object to different clusters in order to minimize the variance within groups and maximize the variance between groups. With this approach a potential correlation of desired carcass traits and the prevalence of bovine cysticercosis can be examined. For the dissimilarity measure, a Euclidean distance was used, which is a coefficient that produces the degree of dissimilarity based on the distance between clusters. A chi-square test was used to test the difference between clusters based on a significance level of $P < 0.050$.

RESULTS AND DISCUSSION

Three clusters were formed according to carcass traits and the prevalence of cysticercosis (Table 1). Cluster 1

showed a significantly higher prevalence of cysticercosis than the other clusters ($P = 0.0147$), and carcasses in this cluster had lower proportions of subcutaneous fat and higher age at slaughter. Cluster 2 showed lower a prevalence of cysticercosis and lower age at slaughter.

Cluster 3 showed a significantly higher prevalence of cysticercosis than the Cluster 1 and carcasses in this cluster had lower proportions of subcutaneous fat. Among the three clusters, cluster 2 contained carcasses of the earliest finishing cattle.

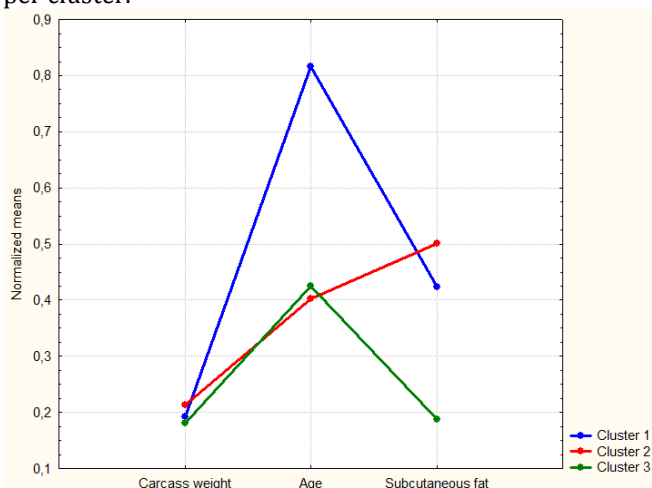
Table 1 – Numbers of animals (Sample N), prevalence of cysticercosis per cluster, and traits of carcasses in each cluster.

	Cluster		
	1	2	3
Sample N	4,956	6,027	4,019
Cysticercosis (%)*	1,41	1,00	1,30
HCW (kg)	257.63±33.93	265.24±28.86	253.55±26.41
Age (PIT)	6.53±0.88	3.22±1.04	3.40±1.19
SF (escore)	2.69±0.50	3.01±0.07	2.57±0.40

HCW = Hot carcass weight; PIT = permanent incisor teeth; SF = subcutaneous fat: 1 (0 to 1 mm subcutaneous fat); 2 (1 to 3 mm); 3 (3 to 6 mm); 4 (6 to 10 mm); 5 (>10 mm). *P-value = 0.0147.

An evaluation of the patterns of normalized means of bovine carcass traits (Figure 1) showed that hot carcass weight produced little variation among the clusters, a

Figure 1 – Patterns of normalized means of bovine carcass traits according to the prevalence of cysticercosis per cluster.



Cluster 1: 1.41% animals with cysticercosis. Cluster 2: 1.00% animals with cysticercosis. Cluster 3: 1.30% animals with cysticercosis.

Carcasses of cluster 2 showed the characteristics desired by the Brazilian meat industry, with a weight of 240 to 330 kg, a fat cover of 3 to 10 mm, and maturity with 0 to 6 permanent incisor teeth. Clusters 1 and 3 also showed the desired carcass weight, but were below the target fat cover. Fat cover, carcass weight, and age are directly related to qualitative characteristics of meat such as texture (PFLANZER; FELÍCIO, 2009). A study by Dorny et al. (2000) found a positive correlation of age with the prevalence of cysticercosis, which is in line with the results of the present study.

Comparing the prevalence of cysticercosis of cluster 2 and the average of clusters 1 and 3, the prevalence was reduced in cluster 2 by 35.71%. Therefore, besides information on risk factors for cysticercosis such as those listed by Laranjo-González et al. (2016),

pattern which was not observed when considering subcutaneous fat and age at slaughter.

investment in improved management schemes may indirectly help to fight this disease.

To ensure early finishing, the diet of cattle should contain high energy levels (SILVA et al., 2008). Thus, to achieve the desirable fat scores in regions of low-energy forage, it is necessary to confine the animals and supplement their diets with concentrates. Moreover, confinement may also result in lower contact of cattle with human feces owing to restricted access to swards and river water.

CONCLUSIONS

Early finishing in cattle may reduce the prevalence of bovine cysticercosis.

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