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INCIDÊNCIA DE SÍNDROME OSTEOCONDRAL JUVENIL EM CAVALOS PURO SANGUE INGLÊS DE CORRIDA ENTRE 14-18 MESES DE IDADE, E SUA INFLUÊNCIA NA CAPACIDADE DESPORTIVA

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Incidence of juvenile osteochondral condition in yearling Thoroughbred racehorses in the South of Brazil

Dissertação apresentada ao Programa de Pós-Graduação em Ciência Animal, área de concentração Saúde, Tecnologia e Produção Animal, da Escola de Ciências da Vida da Pontifícia Universidade Católica do Paraná, para obtenção do título de Mestra em Ciência Animal.

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Lista de abreviações

SOCJ - Síndrome Osteocondral Juvenil

OCD - Osteocondrite dissecante

PSI - Puro Sangue Inglês

CEUA - Comitê de Ética no Uso de Animais

Abbreviations list

FT - Femorotibial

JOCC - Juvenile Osteochondral Condition

MC - Metacarpophalangeal

MT - Metatarsophalangeal

OAS - Osteoarticular status

PIP – Proximal interphalangeal

RF - Radiographic findings

SI – Severity index

TB - Thoroughbred

TC – Tarsocrural

OCD – Osteochondritis dissecans

Dedico este trabalho à minha avó materna (Nilda Paifer Martins), que mesmo não estando mais entre nós, deu-me forças para seguir em frente. Obrigada, vó Dida, por me ensinar o que é o amor pelas pessoas e pelos animais.

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RESUMO GERAL

As afecções ortopédicas são a maior causa de baixo rendimento de equinos desportistas. Dentre as doenças ortopédicas do desenvolvimento (DOD) a Síndrome Osteocondral Juvenil (SOCJ) é frequente no estado do Paraná, e visto o seu impacto econômico, o presente estudo objetivou traçar a incidência de SOCJ em animais sobreano (14 a 18 meses de idade) puro sangue inglês (PSI) de corrida, comparar com a incidência nesse mesmo grupo de animais, quando lactentes (4 - 6 meses de idade), e correlacionar os achados com o desempenho esportivo. Foram avaliadas 22 incidências radiográficas de cada um dos PSI (n=76) dos quatro membros envolvendo as articulações metacarpo falangeana (MCF), metatarso falangeana (MTF), tarso (T) e fêmoro-tíbio-patelar (FTP). A amostragem populacional representa cerca de 13% dos potros nascidos no paraná em 2012. A avaliação consistiu em um sistema de índice de gravidade (IG) que varia entre 0, 1, 2, 4 e 8 conforme a gravidade do achado e o potencial de interferência biomecânico. Em seguida, os escores eram atribuídos por médico veterinário experiente, posteriormente somados, resultando em coeficientes osteoarticulares de cada animal. Foram considerados acometidos os animais que apresentavam coeficiente osteoarticular diferente de 0. Para análise esportiva foi analisada a plataforma Studbook, e compilados dados sobre o número de corridas, vitórias e colocações dos animais. Para análise de relevância dos dados foi realizado o teste de $\chi 2$, para comparação entre as idades foi realizado o teste de Wilcoxon, e para avaliação do desempenho desportivo em relação ao IG foi realizado o teste de correlação de Spearman. No presente estudo, 92% dos animais apresentaram achados compatíveis com SOCJ aos 14-18 meses de idade. A região mais afetada na fase de sobreano foi o tarso (72,9%), seguida da FTP (50%), MTF (25%) e MCF (23%). A análise esportiva não evidenciou correlação entre o IG e o número de corridas, vitórias e colocações, da mesma forma, não houve diferença significativa do IG em lactentes e sobreanos. Conclui-se que SOCJ é frequente na população estudada e não influenciam no rendimento de cavalos de corrida, bem como não se alteram conforme a fase do crescimento, ainda que dados qualitativos demonstrem progressão de alguns casos e remissão de outros. As consequências da SOCJ seguem necessitando de mais estudos.

Palavras-chave: Articulação; Cavalo; Osteocondrite; Osteocondrite dissecante.

ABSTRACT

Orthopedic conditions are the major cause of low yield of racehorses. Among the developmental orthopedic diseases, the Juvenile Osteochondral Syndrome (SOCJ) is prevalent in the state of Paraná (Bastos et al., 2017), and considering its economic impact, the present study aimed to trace the incidence of SOCJ in animals (14 to 18 months old) Thoroughbred English (PSI) race, compare with the incidence of this disease in the same group of animals when infants (4 - 6 months of age), and correlate findings with sports performance. Twenty-two radiographic incidences of each PSI (n = 76) of the four limbs involving phalangeal metacarpal (MCF), phalanx metatarsus (MTF), tarsus (T) and femoro-tibiopatellar (FT) were evaluated. Population sampling represents about 13% of foals born in Paraná in 2012. The evaluation consisted of a system of gravity index (GI) that varies between 0, 1, 2, 4 and 8 according to the severity of the finding and the potential of biomechanical interference. Then the scores were assigned by veterinarian experienced veterinarian, later summed, resulting in osteoarticular coefficients of each animal. Animals with osteoarticular coefficients other than 0 were considered to be affected. For sport analysis, the Studbook platform was analyzed, and data were compiled on the number of races, victories and placements of the animals. For the data relevance analysis, the $\chi 2$ test was performed. The Wilcoxon test was used to compare the ages, and the Spearman correlation test was used to evaluate the sports performance in relation to the GI. In the present study, 92% of yearlings had SOCJ. The most affected region in the Yearling phase was tarsus (72.9%), followed by FT (50%), MTP (25%) and MCP (23%). The sport analysis did not show a correlation between the GI and the number of races, victories and placements, in the same way, there was no significant difference of GI in Weanling and Yearling. It was concluded that radiographic changes are frequent in the study population and did not influence the performance of racehorses, nor did they change according to the growth phase, although qualitative data show progression of some cases and remission of others. The consequences of SOCJ continue to require further study.

Keywords: Horse; Joint; Osteochondritis dissecans; Osteochondritis.

CAPÍTULO 1 – Revisão de Literatura

Síndrome Osteocondral Juvenil

A síndrome osteocondral juvenil (SOCJ) é uma nova terminologia proposta por Denoix e colaboradores (Denoix et al., 2013), que tem como objetivo uma melhor compreensão da etiopatogenia de distúrbios que resultam de influências biomecânicas (compressiva, tensional ou de cisalhamento) no desenvolvimento e crescimento do sistema musculoesquelético.

A forma mais comum de SOCJ são as osteocondroses, onde o insulto biomecânico afeta o processo (e o progresso) de ossificação endocondral (Denoix et al., 2013). Conforme Olstad e colaboradores (Olstad et al., 2015), isso é mediado via danos à microvasculatura e condronecrose subsequente. Fatores predisponentes subjacentes, como o metabolismo alterado do colágeno, podem predispor a injúrias em locais focais. Os insultos biomecânicos podem eventualmente resultar em fragmentação osteocondral da superfície articular ou em locais periarticulares, ou na formação dos cistos de ossos subcondrais juvenis, sendo que, em casos graves, colapso total da superfície articular ou mesmo de um osso pequeno inteiro pode ocorrer (Denoix, 2013).

. São vários os fatores que culminam na osteocondrose, osteocondrite dissecante, fisites, tendinites e desmites, mas o fator que caracteriza esses achados como Síndrome Osteocondral Juvenil, é o fato desta (ou destas, quando em comorbidade) decorrem da alteração primária do processo de ossificação da endocondral, o que altera a distribuição de forças na superfície articular, e sobrecarrega uma ou outra estrutura. A SOCJ, está intimamente ligada à morfologia da área de pastejo, exercícios irregulares, mudanças em lote (Lepeule et al., 2009), e pode estar relacionada com a nutrição da mãe na fase quando gestante do potro (durante a fase embrionária desse), bem como a alimentação do potro durante seu desenvolvimento (Robles et al., 2017), além dos fatores genéticos associados (Wypchło et al., 2018).

Informações sobre SOCJ no Brasil e no mundo

No Brasil, alguns estudos trazem informações sobre a osteocondrite em cavalos de outras raças, como o índice de OCD (osteocondrite dissecante) em garanhões Brasileiro de Hipismo (BH), que avaliou a articulação tíbio-társica e apresentou incidência de 7,7%, com sêmen “OCD-Free” (Gallo et al., 2010). Em potros Lusitanos, os achados radiográficos compatíveis com osteocondrose no tarso e articulação femorotibiopatelar regrediram ao após o 5° e 8° mês de idade, respectivamente, sendo que aos 18 meses de idade o índice de acometimento passou de 76,08% para 16,2% (Baccarin et al., 2012).

Recentemente, no Programa de Pós-Graduação em Ciência Animal da PUCPR, realizou-se um trabalho acerca dos achados radiográficos, e um grupo de cavalos PSI foi investigada através de avaliação clínica e radiográfica digital aos 4-5 meses de idade e, posteriormente aos 14-18 meses, em quatro criatórios na região metropolitana de Curitiba, representando em torno de 13% dos animais nascidos no Estado do Paraná no ano de 2012. Esse estudo resultou em um artigo publicado no Journal of Equine Veterinary Science (Bastos et al., 2017) apresentando a prevalência da SOCJ na população avaliada aos 4-5 meses de idade. Assim, o grupo apresentou informações inéditas, em uma população sem pré-seleção (ou seja, a totalidade dos animais nascidos em cada um dos haras naquele ano), e em idade não estudada, apresentando formas de avaliação consideradas novas, o que contribuiu sobremaneira no entendimento desta alteração.

Neste contexto, a avaliação das imagens desses mesmos animais aos 14-18 meses de idade foi realizada no presente estudo, e será uma informação inédita no Brasil, importante para a comparação com os estudos em outros países, assim como para os médicos veterinários envolvidos na criação do cavalo PSI em território nacional. Mesmo que as informações supracitadas sejam todas de grande importância, a investigação mais interessante foi sobre o desenvolvimento das alterações articulares ao longo do tempo de crescimento do cavalo PSI, o que ainda não havia sido demonstrado pela literatura, até onde se tem conhecimento. Não tínhamos conhecimento se

alterações observadas em idade precoce poderiam desaparecer, manter-se ou progredir.

No mundo a SOCJ é descrita em diversos países. A prevalência de osteocodrose em equinos de raça Puro Sangue Inglês (PSI) foi encontrada em 64,5% dos equinos na Nova Zelândia em um estudo com 1004 animais (Axling et al., 2016), enquanto em outra investigação australiana foi de 23% (Russell et al., 2017). Nos animais da raça PSI da África do Sul, a prevalência de osteocondrose foi relatada como 14% (Furniss et al., 2011). Segundo outro estudo neozelandês, osteófitos e entesófitos no tarso distal foram observados em 31% dos equinos. Na articulação tibiotársica a osteocondrose apareceu em 4% dos equinos, enquanto no femorotibial atingiu 3% dos animais (Oliver et al., 2008). Em outro estudo do mesmo país, 0,63% dos desmamados apresentaram fragmentação do dorso distal do tálus, e 5,01% dos animais avaliados apresentaram osteocondrose na crista intermediária distal da tíbia, e os achados não influenciaram a relação número de raças, colocações e vitórias (Steel et al., 2019). Nos EUA, de acordo com um estudo, um dos achados mais comuns em membros anteriores são entesófitos e osteófitos na articulação intertarsal (27%); além disso, a prevalência de osteocondrite na articulação femorotibial foi de 8%, embora 30% dos animais tivessem artroscopia (Preston et al., 2010). O fato é que os estudos que trazem a prevalência dessa condição, são feitos a partir de exames pré-compra, que podem de certa forma selecionar o grupo avaliado, o que não acontece no presente estudo, além disso, não há informações relativas a SOCJ em cavalos PSI no Brasil.

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Objetivos

Objetivo Geral

Determinar a incidência de Síndrome Osteocondral Juvenil (SOCJ) em cavalos da raça Puro Sangue Inglês de corrida, na idade entre 14 e 18 meses de idade, no estado do Paraná, e avaliar a influência na capacidade desportiva.

Objetivos Específicos

1. Avaliar a incidência da SOCJ nos cavalos PSI de corrida de 14 – 18 meses de idade e as articulações mais afetadas.
2. Avaliar a influência de SOCJ na capacidade esportiva.
4. Comparar a ocorrência da SOCJ nos cavalos PSI de corrida de 14 – 18 meses de idade com o trabalho prévio já realizado no grupo demonstrando a ocorrência nos mesmos animais na idade de 4 – 5 meses (Bastos et al., 2017).

Hipóteses

H0: Não há achados radiográficos compatíveis com Síndrome Osteocondral Juvenil em cavalos Puro Sangue Inglês de corrida entre 14-18 meses de idade no estado do Paraná

H1: A Síndrome Osteocondral Juvenil tem incidência importante nos cavalos Puro Sangue Inglês de corrida entre 14-18 meses de idade no estado do Paraná, mas não influencia no rendimento para corrida.

H2: A Síndrome Osteocondral Juvenil apresenta diminui o desempenho esportivo dos cavalos Puro Sangue Inglês de corrida.

CAPÍTULO 2 – Artigo científico a ser submetido no periódico Journal of the American Veterinary Medical Association

Original Article

Incidence of juvenile osteochondral condition in yearling Thoroughbred racehorses in the South of Brazil

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Abstract

OBJECTIVE: To investigate the incidence of Juvenile Osteochondral Condition (JOCC) in yearling Thoroughbred (TB) racehorses in the south region of Brazil, same animals studied as weanlings by Bastos et al. (2017), comparing radiographic findings in both ages and studying the relevance to race performance. **DESIGN**: Descriptive, observational study. **SAMPLE**: 76 males and females yearling TBs from the Paraná state, south of Brazil. **PROCEDURES**: Twenty-two radiographic positions were obtained to investigate the proximal interphalangeal (PIP), metacarpo/metatarso phalangeal (MC/MT), tarsocrural (TC) and femorotibial (FT) joints. The evaluation consisted of a severity index (SI) which varied as 0, 1, 2, 4 and 8, and the sum of the SI resulted in an osteoarticular status (OAS) of good, intermediate or poor, for each animal. The number of races entered, victories and placing race were obtained from the Brazilian Studbook. **RESULTS**: 92% of the investigated animals presented any radiographic finding (RF) compatible to JOCC. The most affected region was the tarsal (72.9%), followed by FT (50%), MT (25%) and MC (23%). There was no significant difference between radiographic observations on the weanling and yearling ages of the same animals, as well as RF did not influence on race performance. **CONCLUSIONS AND CLINICAL RELEVANCE**: Radiographic findings related to JOCC are frequent in TB yearling population, however, even findings with high SI and OAS considered poor could race and win. Radiographic studies are used in TB yearling sales, but the meaning of the RF and relevance continue to require further studies.

Keywords: Equine; Horses; Joint; Osteochondritis dissecans.

Introduction

In Brazil, the equestrian industry moves around US$ 4.0 billion and employs around 610 thousand people directly and indirectly, an economy generated by about 5 million horses. In the country, the state of Paraná (South of Brazil) is the second largest breeding center of the Thoroughbred (TB) race horses[1].

The TB race horse has, in the musculoskeletal system, the greatest number of situations requiring veterinary medical attention, affecting the performance and also limiting the sports career. Among these are joint diseases, which may occur during skeletal development (osteochondrosis and bone cysts), or due to excessive acute impact or repetitive strain resulting from training and running competitions[2]. Juvenile Osteochondral Condition (JOCC) is a terminology previously proposed which designates the occurrence of osteochondrosis in the young horses, assessing the size of the defect, its position in the joint relative to the support center, its influence on joint mobility and possible complications associated[3].

The pathophysiology of the disease is due to a failure in the endochondral ossification through ischemia and chondronecrosis[1], it is also possible that the rapid development of the animals and even the feeding of the mother in the embryonic stage contribute to the non-vascular development[4]. However, it is known that this is a multifactorial disease, and besides the age we must take into account other factors such as feeding, the age of the mother at birth and paddock size, amongst others[5].

The prevalence of osteochondrosis is described for the population of yearlings TBs in different countries. The prevalence of JOCC in yearlings TB race horses was demonstrated to be 64.5% in Australian and New Zealand population in one study comprising 1004 horses[6], while it was 23% in an investigation also in Australian[5]. In a study which investigated pre-purchase radiographic changes in South African TB

yearlings the prevalence of tarsal osteochondrosis lesions was 4.40 % and stifle osteochondrosis lesions 0.4 %[7]. Tarsal joint seems to be a major affected site for osteochondral defects. Osteophytes and enthesophytes in the distal tarsus were observed in 31% of horses in New Zealand (8) and 27% in USA[9]. In addition, the prevalence of osteochondritis in the femorotibial joint was reported as reaching 8% of the yearlings[9]. Bone modifications related to fore and hind fetlocks are also reported in the radiographic investigations in similar populations of young racehorses[10]. The fact is that these studies bring the prevalence of the joint radiographic findings resulted from pre-purchase exams, which may, in a certain way, select the evaluated group.

The first report on the prevalence of JOCC in Brazil was reported by Bastos et al.[11], studying a population of weanling TBs in the state of Paraná, southern Brazil. This study described the occurrence of radiographic findings compatible with JOCC in 76.5% of the investigated horses at 4-5 months of age, however, it not yet described for the yearlings. Then, the present study aimed to describe the prevalence of radiographic findings compatible with JOCC in the yearling horses studied by Bastos et al.[11] as weanlings, and making a comparison between the findings of JOCC observed in the same animals while weanlings and yearlings; finally, a possible influence of the radiographic findings in the yearling age on the race performance was investigated.

Materials and methods

Ethical aspects and animals

The present study was approved by Ethics Committee on the Animal Use of the Pontifícia Universidade Católica do Paraná, under the protocol number 776.

Initially, it was performed the clinical and radiographic examination of 76 TB race horses, male and female, yearlings (14-18 months old), from four breeding farms

from the region of Curitiba, South of Brazil. The animals embraced in this study were born in 2012 and did not enter any kind of selection, representing the whole population of the four breeding farms.

Previously, the same animals were investigated as weanlings, and the data concerning to the prevalence of JOCC was reported by Bastos et al. (2017); this information will be used in the present study only in terms of comparison of the radiographic findings in relation to the two different ages (weanlings vs yearlings). The methodology to obtain and analyze the radiographs were the same for both researches.

The feeding management of the animals consisted by supplementing them twice a day with concentrate and mineral salt, and water *ad libitum*. They were kept with their dams until completing 6 months of age; after this, they were organized by groups according to their size, gender and behavior. All the four establishments had a similar management and organization.

Clinical and radiographic analysis

The clinical exam consisted on estimating the body mass by using a commercial tape, evaluating the possible presence of articular effusion, and evaluation of lameness according to the American Association of Equine Practitioners (0–5).

The investigated joints were the front proximal interpahalangeal joint (PIP), metacarpophalangeal (MC), metatarsophalangeal (MT), tarsocrural (TC), and femorotibial (FT) joints. The radiographic analysis was made using a digital x-ray apparatus model Mark III (Eklin®, Carlsbad, CA, USA) associated with an x-ray emitter model TR 90 (Minxray®, Northbrook, IL). The same apparatus was used, as the same person conduced both evaluations.

Radiographic positions used for joints evaluation were lateromedial, dorso 30◦ medial-palmaro/plantarolateral oblique and dorso 30◦ lateral-palmaro/plantaromedial oblique for the MCP and MTP; lateromedial, dorsoplantar, dorso 10◦ lateral-plantaromedial oblique and dorso 65◦ medial-plantarolateral oblique for the TC; and caudocranial and caudo 20◦lateral-craniomedial oblique for FT [7-11], totaling 21 positions.

The radiographs were analyzed by two experienced evaluators, using, in common sense, the severity index (SI) 0, 1, 2, 4, and 8, proposed by Lepeule et al.[12] and adapted by Bastos et al. [11], considering the radiographic finding size relative to the joint, proximity to other structures, presence of associated complications, commitment of other structures, presence of bone remodeling and intraarticular bone fragment, degree of the articular space, cystic alterations, and finally, the compromising of the articular movement. The sum of SI of each animal resulted in an osteoarticular status (OAS), based on three categories established as follows: good (no injury or a slight injury, sum of SI = 1 or 0), intermediate (sum of SI < 5), or poor (sum of SI > 5).

The specific sites investigated in each joint were the sagittal ridge of the third metacarpal and metatarsal bones, and dorsal and palmar/plantar joint margin of the proximal phalanx for MC and MT; dorsal and palmar/plantar joint margin of the proximal and middle phalanges; the intermediate ridge of the tibia and trochlear ridges of the talus for the proximal tarsus; distal intertarsal and tarsometatarsal joints; and femoral condyles and trochlear ridges for the FT.

Race performance

To evaluate the race performance, it was consulted the data base of the Brazilian TB Studbook (http://studbook.agence.com.br/consultar-animal), and it was considered the

information of the number of races entered, as well as victories and placing (2^{nd} to 5^{th} places), the data were collected up to October 2018.

Statistical analysis

Initially, data normality was analyzed using D'Agostino and Pearson test. Non-parametric data (OAS and SI) were analyzed using Wilcoxon's test to compare the sides right and left from a joint or a specific site, and to compare the SI when weanling and yearling. To compare the number of races, victories and placements in males and females it was used the Mann-Whitney test. To analyze the correlation between SI and number of races, victories and placements was used Spearman's correlation test. Finally, 76 yearlings embraced in the present study had been previously investigated as weanlings[11] and the modifications concerning to the radiographic findings are demonstrated descriptively. The program used was GraphPad Prism 7.0 English version for Windows, considering $p < 0.05$ significative.

Results

Animals and clinical examination

The present study investigated 76 horses, 36 (47.0%) male and 40 (53.0%) female, representing almost 13,0% of the TB births in the Paraná State in the year of 2012. At the moment of the clinical examination none of the investigated horses presented abnormal signs of lameness or joint effusion.

Radiographic findings

Radiographic findings (RF) compatible with JOCC were observed in 70 (92.1%) of the studied animals, 40 females and 30 males.

There was no difference in the involvement between left and right sides when analyzed for front PIP ($P > 0.999$), MC ($P = 0.184$), hind PIP ($P > 0.999$), MT ($P = 0.963$), FT ($P = 0.844$) and TC ($P = 0.784$).

From the total number of animals that presented RF, 51 (72.9%) were affected in the TC joint. In the proximal tarsus, there were eight animals with RF, five of which were in the right pelvic limb, affected in the medial trochlea of the talus; and three on the left hindlimb, one in the intermediate tibial ridge, one in the lateral trochlea, and one in the medial trochlea of the talus. From the 51 animals with RF related to the tarsus, 48 (94.1%) were affected in the distal tarsus, 54.2% of them presented bilateral radiographic findings.

The FT was the second most affected joint, with 35 animals presenting a RF, and 19 (54%) of them presenting bilateral findings.

In 18 of the investigated yearlings there were RF in the MT, and 33% of them had bilateral RF; MC was committed in 16 animals while 25% of them presented bilateral RF. The PIP was affected in the hindlimb of one of the investigated animals

(Table 1). It is important to evidence that the animals could have more than one joint with RF.

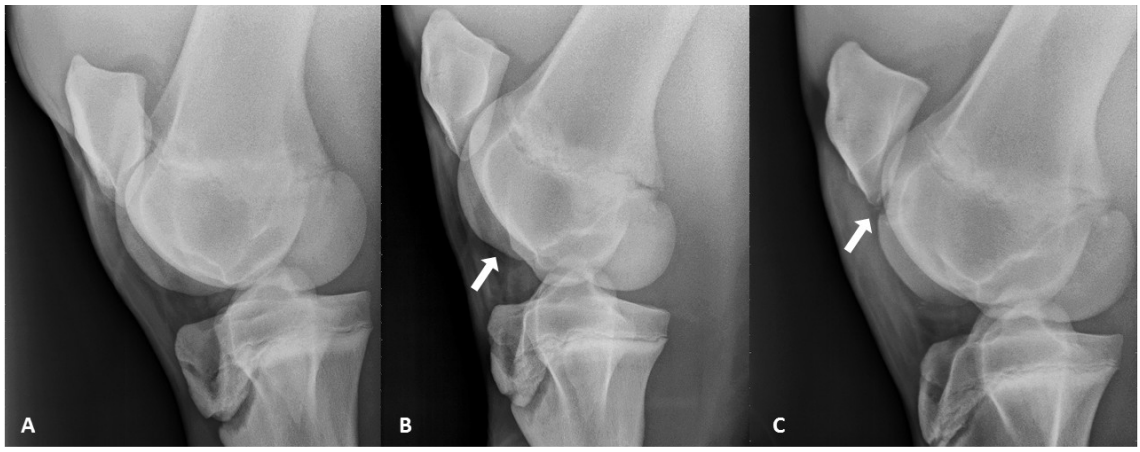
Table 1: Number of animals with juvenile osteochondral conditions according to the joint committed and the percentage of bilateral radiographic findings.

Joint	Number of animals	Right	Left	Bilateral (%)
Metacarpophalangeal	16	11	9	25%
Forelimb Proximal Interphalangeal	0	0	0	0%
Metatarsophalangeal	18	11	13	33%
Hindlimb Proximal Interphalangeal	1	1	0	0%
Tarsocrural	51	36	42	53%
Femorotibial	35	27	27	54%

The median for SI was 2, the 25% percentile was 1, while the 75% percentile was 5, and the maximum value was 13.

In this study, 21 animals (27.6%) had OAS considered good; 38 (50.0%) were classified as OAS intermediate, and 17 (22.4%) of them had OAS poor. The OAS ranged from 0 to 13, with the 25% percentile of 0 in the group good, 2 in the group intermediate, and 6 in the group poor, while the 75% percentile was 1 in the group good; 2.5 in the group intermediate and 8 in the group poor, the exemple is described in figure 1.

Figure 1 - Radiographic findings in femortibioal jont of Thoroughbred Racehorses (TB) between 14 and 18 months of age, in the southern of Brazil. Score according to Lepeule et al., 2013. 1A- Femortibiopatellar joint without radiographic findings (OAS good). 1B- Femortibial joint with shunting of medial femoral trochlear crest - corresponding to score 2 (OAS intermetiade). 1C - Femortibial joint with osteochondrosis at medial femoral trochlea crest - corresponding to score 8 (OAS poor).



Race Performance

From the studied population, 60 horses (79.0%) presented race information registered in the Brazilian Studbook platform, while racing information was not found for 16 (21%) of them.

The sport analysis showed that males and females ran equally in all aspects evaluated, number of races ($P = 0.416$), number of victories ($P = 0.325$) and placings ($P = 0.593$).

The RF also did not interfere in the race results of the evaluated animals, in the number of races ($P = 0.932$), number of victories ($P = 0.800$) and placements ($P =$

0.482). Animals with OAS good, intermediate and poor had similar number of races (P = 0.489), number of victories (P = 0.721) and number of placings (P = 0.393).

JOCC radiographic findings (weanlings vs. yearlings)

The comparison of the OAS between the yearlings and weanlings did not demonstrate statistical difference (P = 0.162) (table 2).

Table 2: Total Severity Index and Osteoarticular Status of Thoroughbred horses when weanlings and yearlings in the Southern Brazil.

	Weanling		Yearling	
Animal	**SI**	**OAS**	**SI**	**OAS**
1	4	I	5	I
2	7	P	0	G
3	13	P	6	P
4	8	P	0	G
5	3	I	2	I
6	4	I	2	I
7	8	P	0	G
8	3	I	0	G
9	4	I	1	G
10	1	G	1	G
11	4	I	10	P
12	0	G	2	I
13	3	I	1	G
14	3	I	4	I
15	5	I	7	P
16	9	P	7	P
17	3	I	1	G
18	2	I	2	I
19	4	I	1	G
20	5	I	7	P
21	3	I	4	I
22	2	I	1	G
23	0	G	2	I
24	5	I	1	G
25	6	P	2	I
26	12	P	6	P
27	0	G	3	I
28	2	I	2	I
29	3	I	3	I
30	3	I	2	I
31	2	I	5	I
32	4	I	2	I
33	2	I	7	P
34	0	G	2	I
35	3	I	3	I
36	0	G	9	P
37	0	G	7	P
38	2	I	5	I

	Weanling		Yearling	
Animal	**SI**	**OAS**	**SI**	**OAS**
39	2	I	6	P
40	0	G	2	I
41	0	G	3	I
42	5	I	6	P
43	5	I	3	I
44	2	I	1	G
45	9	P	11	P
46	0	G	7	P
47	1	G	3	I
48	0	G	1	G
49	1	G	5	I
50	2	I	3	I
51	0	G	0	G
52	4	I	13	P
53	2	I	4	I
54	2	I	1	G
55	0	G	4	I
56	1	G	2	I
57	0	G	7	P
58	2	I	2	I
59	11	P	1	G
60	1	G	1	G
61	0	G	2	I
62	1	G	0	G
63	4	I	5	I
64	1	G	2	I
65	1	G	1	G
66	2	I	7	P
67	1	G	2	I
68	1	G	4	I
69	2	I	2	I
70	11	P	5	I
71	5	I	6	P
72	1	G	4	I
73	1	G	1	G
74	2	I	3	I
75	0	G	2	I
76	0	G	1	G

In weanlings, the 25% percentile was 1, and 75% percentile was 4, while in the yearlings the 25% percentile was 1 and the 75% percentile was 5. The minimum value of SI was 0 and maximum 13 in both ages. The median of SI was 2 for both ages.

Seventy-six animals were investigated in both ages. Fifty-five (72.4%) of them had SI > 0 on both moments, while 15 (19.7%) animals had SI = 0 when weanling and SI > 0 when yearling, 5 (6.6%) presented SI > 0 when weanling and SI = 0 when yearling. One animal had SI = 0 on both ages (table 2).

Discussion

The present study is the first to report the prevalence of RF related to JOCC in a population of TB yearlings in Brazil. Our study involved a significant population of TBs born in the South region of Brazil in 2012, and completes the study initiated by Bastos et al.[11] who demonstrated the prevalence of 76.5% of RF related JOCC when the animals were at the weanling age. This same population, as yearlings, presented a prevalence of RF of JOCC in 92.1% of the investigated animals. However, there were no strong associations among a horse's SI while weanling and yearling, but some lesions present in weanlings regressed, when the second radiographic analysis was made as yearling. It is necessary to emphasize that none of the animals underwent surgical procedures that could interfere in the observations of the RF.

A previous study similarly investigated the presence of skeletal lesions in weanlings and yearlings, in TBs in Australia and New Zealand[6]. The study analyzed radiographic sets containing a minimum of 34 radiographic positions and evidenced the presence of skeletal conditions in 69.9% of the weanlings and 64.5% of the yearlings. They used a higher number of radiographic positions than our study, however, our results of higher prevalence could be related to the investigation of absolute

populations, and the cited study investigated radiographic sets of animals presented for sales, then went through a selection. Moreover, another important difference between both researches is that, our study investigated in the two different ages the same animals, while Axling et al.[6] did not.

The most affected joint in the present study was the tarsus, mostly in the distal tarsal joints. Osteochondrosis frequently manifests in the tarsus and this may suggest that this region undergoes changes because of joint pressure during horse growth, so that they are required at different intensities throughout development[8]. However, it was not the most affected joint in another study[13]. Moreover, when the same animals were investigated as weanlings the most affected joint was the FT joint[11].

In the present study, there was no correlation between the SI or OAS with the athletic performance, and both male and female animals ran equally. The analysis of the radiographs according to JOCC criteria takes into account the RF proximity to the point of joint support and the osteoarticular involvement[12]. Even though, the present study observed RF of high SI score and joints considered as poor OAS, there was no repercussion on sport performance regardless of the joint affected. Previously, in a study which compared the RF between siblings, taking into account in their methodology the probability of running at 2 and 3 years, and there was no difference in the number of starts between the siblings, but horses with fragments in the pastern joint tended to be less likely to start a race at 2 years of ag[14], and also disagree to other that take into account the athlete's financial performance of 328 TB horses and had a correlation between the gravity of findings and the poor athletic financial performance[13], which relate the findings to a deficit in these questions. Probably, the number of animals investigated in the present study was not sufficient enough to study race career, as well as methods differ in such analysis as we studied the number of races entered, victories

and placements, but chances to start a race at 2 years of age[14] and money earnt[13] are also used.

Interestingly, most of the investigate animals on both ages presented a RF, and this maintained from weanling to yearling age. This could indicate that an investigation as weanling would enable an appropriate correction when needed, however, 20% of the investigated population developed a joint modification after the first radiographic investigation. Moreover, further studies must be conducted in order to understand the RF as pathological or adapting modifications, as the repercussions on the athletic career still needs clarification. As probably, they might be being overemphasized, though some RF can be weakly associated with poorer racing outcomes, according to the conclusions of Santschi et al.[14].

Conclusions and clinical relevance

The present study demonstrates the prevalence of radiographic findings related to JOCC in Brazilian TB yearlings, and that this observation increased in respect to the same population while weanlings. Moreover, these observations did not interfere with their race performance. Further studies with higher number of horses investigated must be performed in order to certify the present conclusions.

Acknowledgements

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CAPÍTULO 3

Considerações finais

Os dados colhidos no presente estudo, relativos à ocorrência de SOCJ em cavalos PSI de 14-18 meses, são dados (inéditos) no Brasil e contribui para comparar com dados de outros locais do mundo, além de atentar para o profissional clínico que a SOCJ pode ser frequente. Para análise da prevalência da SOCJ, deve-se levar em conta que a população estudada não apresentava sinais de alteração no exame clínico, o que não descarta a hipótese de que as alterações podem ser parte de um mecanismo de adaptação do indivíduo no processo de crescimento. Entretanto, é preciso investigar de forma mais profunda a interferência desses achados radiográficos na carreira e qualidade de vida dos animais.

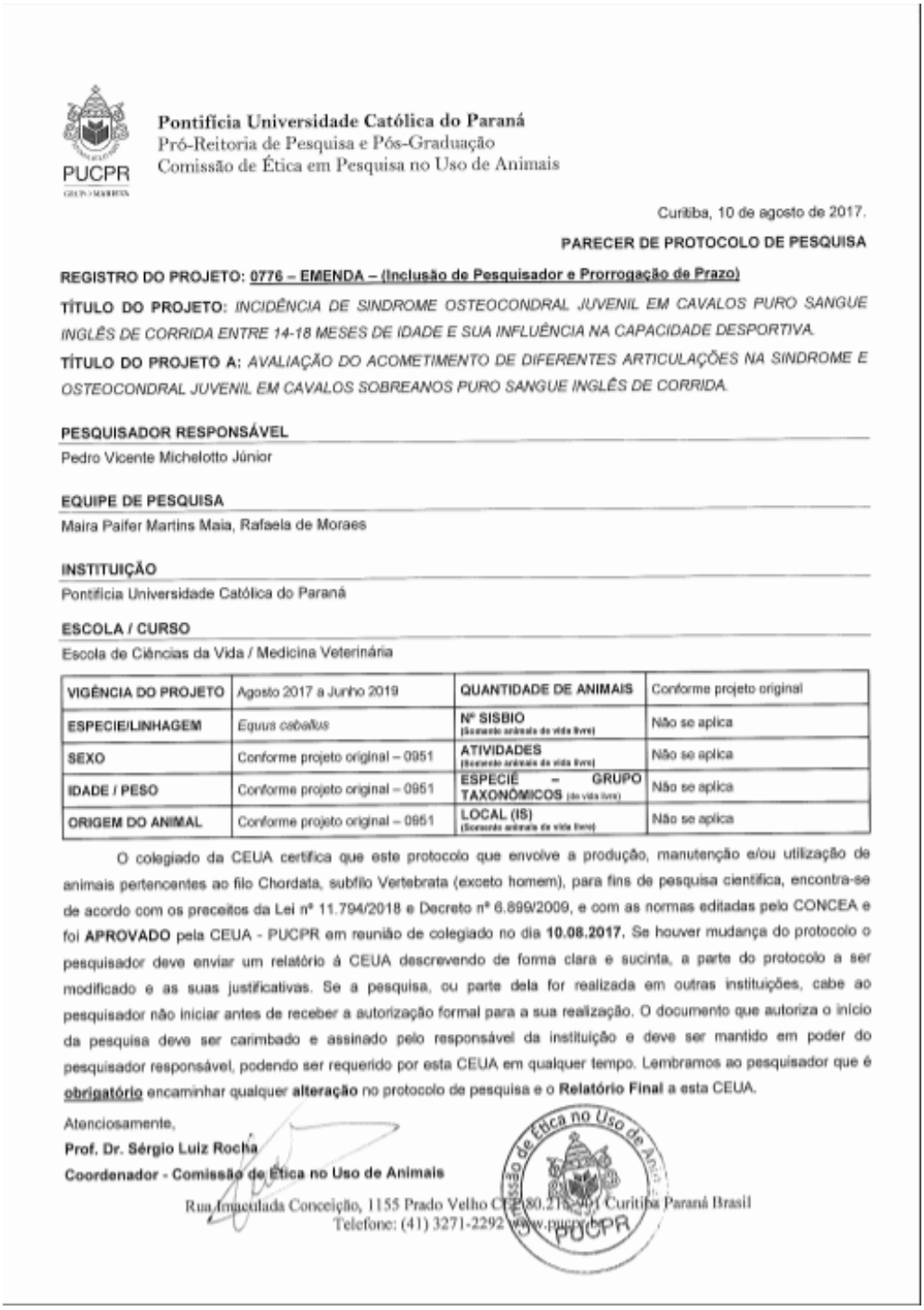
Como proposto pela H1 do presente trabalho, a SOCJ de fato tem prevalência bastante importante na população estudada (92%), sendo esta a hipótese aceita, anulando, portanto, a H0 ou hipótese de nulidade. Esta informação foi precedida pelo estudo anterior, de Bastos (2017) que já indicava uma incidência de 67,9% de achados radiográficos compatíveis com SOCJ nos mesmos animais estudados, quando tinham 4-6 meses de idade.

A H2 do estudo, era que os achados compatíveis com SOCJ possuem interferência negativa no desempenho esportivo dos cavalos PSI de corrida. Esta hipótese foi negada, visto que não houve correlação de achados entre a SOCJ e o número de corridas, vitórias e colocações dos cavalos, entretanto, a prevalência de SOCJ foi bastante frequente, de forma que a população sem nenhum achado radiográfico foi pequena quando comparada com a população acometida. Essa assimetria pode ter sido a causa da ausência de relação entre os achados radiográficos e a carreira esportiva dos animais.

Sugestões para estudos futuros

A sugestão para estudos futuros é que seja utilizado um maior número de animais e que sejam avaliados fatores com menos variáveis, como o tempo de corrida, se possível. Sugere-se também que sejam avaliadas variáveis como tamanho do piquete, data do parto, idade da mãe para correlacionar com os achados radiográficos.

Anexos



Pontifícia Universidade Católica do Paraná
Pró-Reitoria de Pesquisa e Pós-Graduação
Comissão de Ética em Pesquisa no Uso de Animais

PUCPR

Curitiba, 10 de agosto de 2017.

PARECER DE PROTOCOLO DE PESQUISA

REGISTRO DO PROJETO: 0776 – EMENDA – (Inclusão de Pesquisador e Prorrogação de Prazo)

TÍTULO DO PROJETO: *INCIDÊNCIA DE SINDROME OSTEOCONDRAL JUVENIL EM CAVALOS PURO SANGUE INGLÊS DE CORRIDA ENTRE 14-18 MESES DE IDADE E SUA INFLUÊNCIA NA CAPACIDADE DESPORTIVA.*

TÍTULO DO PROJETO A: *AVALIAÇÃO DO ACOMETIMENTO DE DIFERENTES ARTICULAÇÕES NA SINDROME E OSTEOCONDRAL JUVENIL EM CAVALOS SOBREANOS PURO SANGUE INGLÊS DE CORRIDA.*

PESQUISADOR RESPONSÁVEL
Pedro Vicente Michelotto Júnior

EQUIPE DE PESQUISA
Maira Paifer Martins Maia, Rafaela de Moraes

INSTITUIÇÃO
Pontifícia Universidade Católica do Paraná

ESCOLA / CURSO
Escola de Ciências da Vida / Medicina Veterinária

VIGÊNCIA DO PROJETO	Agosto 2017 a Junho 2019	**QUANTIDADE DE ANIMAIS**	Conforme projeto original
ESPECIE/LINHAGEM	*Equus caballus*	**Nº SISBIO** (Somente animais de vida livre)	Não se aplica
SEXO	Conforme projeto original – 0951	**ATIVIDADES** (Somente animais de vida livre)	Não se aplica
IDADE / PESO	Conforme projeto original – 0951	**ESPECIE – GRUPO TAXONÔMICOS** (de vida livre)	Não se aplica
ORIGEM DO ANIMAL	Conforme projeto original – 0951	**LOCAL (IS)** (Somente animais de vida livre)	Não se aplica

O colegiado da CEUA certifica que este protocolo que envolve a produção, manutenção e/ou utilização de animais pertencentes ao filo Chordata, subfilo Vertebrata (exceto homem), para fins de pesquisa científica, encontra-se de acordo com os preceitos da Lei nº 11.794/2018 e Decreto nº 6.899/2009, e com as normas editadas pelo CONCEA e foi **APROVADO** pela CEUA - PUCPR em reunião de colegiado no dia **10.08.2017.** Se houver mudança do protocolo o pesquisador deve enviar um relatório à CEUA descrevendo de forma clara e sucinta, a parte do protocolo a ser modificado e as suas justificativas. Se a pesquisa, ou parte dela for realizada em outras instituições, cabe ao pesquisador não iniciar antes de receber a autorização formal para a sua realização. O documento que autoriza o início da pesquisa deve ser carimbado e assinado pelo responsável da instituição e deve ser mantido em poder do pesquisador responsável, podendo ser requerido por esta CEUA em qualquer tempo. Lembramos ao pesquisador que é **obrigatório** encaminhar qualquer **alteração** no protocolo de pesquisa e o **Relatório Final** a esta CEUA.

Atenciosamente,
Prof. Dr. Sérgio Luiz Rocha
Coordenador - Comissão de Ética no Uso de Animais

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Anexo A: Parecer de protocolo de pesquisa emitido pelo CEUA para inclusão das pesquisadoras de mestrado e iniciação científica em projeto já aprovado anteriormente pelo CEUA sob protocolo 0776