









Participation frequency and performance of horses in national shows of Campolina and Mangalarga Marchador breeds

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ABSTRACT - This study aimed to determine the participation frequency and competitive performance of Campolina and Mangalarga Marchador horses in national shows concerning marcha type, sex, and age. To that end, the trial results of national horse shows between 2007 and 2017, comprising 1,781 Campolina and 5,239 Mangalarga Marchador animals, were extracted from the databases of the breeders' associations of each breed. The results regarding participation frequency in these events and the performance achieved by horses were grouped by breed, marcha type, sex, and age group and then subjected to frequency distribution tests. In both breeds, most animals attended only one national show. However, when the specimens were separated by marcha type, sex, and age, it was observed that 54.39% of marcha batida Campolina males competed twice, with greater participation of adult horses (41.41%) than of young ones (22.22%). For Mangalarga Marchador, irrespective of gait type, the proportion of adult horses (67.22%) that competed was higher than that of young ones (25.63%). For marcha picada competitors, the proportion between young (13.97%) and adult (81.91%) was even higher. It was concluded that, over their competitive careers, most horses of either breed attended only one national show, that marcha picada animals usually compete only when adults, and that marcha batida females compete more often when young. In addition, the age group in which competitors achieve their best performances varies according to the specimen.

Keywords: equine, morphometry, phenotypic selection

Introduction

Annually, associations of Campolina and Mangalarga Marchador breeders promote national horse shows. According to Costa et al. (2006), besides the economic importance for horse breeding, these events enable the selection of the most adequate breeding animals to produce the next generations by gathering the best specimens of each breed. In conventional competitions in national horse shows, the animals are split according to the marcha modality (batida and picada), sex, and age, being subjected to two evaluation categories, morphology and marcha, each with 50% weight for the final classification (ABCCCampolina, 2018; ABCCMM, 2018).

When assessing the correlation between classifications in morphologic and marcha trials in national shows achieved by foals and adult horses, Santos et al. (2018) observed that only 35% of Mangalarga Marchador foals had a correlation between both evaluation categories, whereas such correlation was found in only 11% of adult animals. For Campolina, those authors found similar results, with 24% of foals and 6% of adult horses showing a correlation between the two categories.

Santos et al. (2018) attributed the higher percentage of foals with a correlation between morphology and marcha to the way the animals are presented. In marcha trials, foals (under 36 months) are presented being led by the halter, whereas adults (over 36 months) are ridden by the presenter. Although the marcha trial of animals led by the halter is based on the same parameters assessed in ridden horses, except for ride comfort and rideability, it is possible that, during the presentation of animals led by the halter, presenter skill has a bigger impact on the final result. Such results raised new questions. Among the foals that attended national shows, how many continued competing when adults? Were the classifications achieved by the animals that competed in both age groups similar? What is the participation frequency of Campolina and Mangalarga Marchador horses in national horse shows?

This study aimed to determine the participation frequency and competitive performance of Campolina and Mangalarga Marchador horses in national shows concerning marcha type, sex, and age, besides comparing the performance of the horses at different phases of life.

Material and Methods

Data from national horse shows of Campolina and Mangalarga Marchador breeds between 2007 and 2017, extracted from the databases of the Brazilian Association of Campolina Horse Breeders (ABCCCampolina) and Brazilian Association of Mangalarga Marchador Horse Breeders (ABCCMM), respectively, were used.

To determine the participation frequency of horses in national Campolina shows, the data concerning each of the ten national shows (2007 to 2017) were collected in a single file, which allowed tallying up the number of times horses of each name were repeated. The same process was carried out for Mangalarga Marchador horses. To compare the proportion of Campolina and Mangalarga Marchador horses that attended between one and eight national shows, the results were subjected to a frequency distribution test (chi-squared) using the statistical software GraphPad InStat (version 3.06). The proposed index was the chi-square (χ^2):

$$\chi^2 = \sum_{i=1}^k \frac{(fo_i - fe_i)^2}{fe_i} \quad (1)$$

in which fo_i and fe_i represented the observed and expected frequencies for breed i , respectively, and k was the total of breeds (Campolina and Mangalarga Marchador).

To determine the participation frequency concerning marcha type and sex in Campolina horse shows, the data from ten national shows were divided into four groups: marcha batida males, marcha batida females, marcha picada males, and marcha picada females. Next, the number of times the name of each animal from each group appeared in the lists was counted. The same process was carried out for Mangalarga Marchador horses. After that, the results were subjected to a frequency distribution test using the statistical software GraphPad InStat (version 3.06). The proposed index, for each breed, was the chi-squared (equation 1), in which k represented the total of groups (marcha batida males, marcha batida females, marcha picada males, and marcha picada females).

To compare the age groups (young and adults), in which male and female marcha batida and picada horses attended national Campolina horse shows, the data from ten national shows were divided into three groups: horses that competed only when young, animals that competed only when adults, and those that competed in both age groups. The number of marcha batida males, marcha batida females, marcha picada males, and marcha picada females was then counted. The same process was carried out for Mangalarga Marchador horses. After that, the results were subjected to a frequency distribution test using the statistical software GraphPad InStat (version 3.06). The proposed index, for each of the four

groups (marcha batida males, marcha batida females, marcha picada males, and marcha picada females) of each breed, was the chi-squared (equation 1), in which k was the total of groups (horses that competed only when young, animals that competed only when adults, and those that competed in both age groups).

To compare the final classifications achieved by each horse that attended conventional contests in national Campolina horse shows when both young and adult, only the results from horses that competed in both age groups were considered. Next, these horses were divided into three groups: animals that achieved their best performance when young, animals that achieved better results when adults, and those that had similar results in either age group. The same process was carried out for Mangalarga Marchador horses. After that, the results were subjected to a frequency distribution test using the statistical software GraphPad InStat (version 3.06). The proposed index, for each breed, was the chi-squared (equation 1), in which k represented the total groups (animals that achieved better results when young, animals that achieved better results when adults, and those that had similar results in either age group).

Based on reports from professionals of the area, the prevalence of horses that competed in marcha batida in one year and then migrated to marcha picada was also investigated for both breeds.

Results

Over ten years (2007 to 2017), the study tallied up the results of 1,781 Campolina horses, 1,437 of which competing in marcha batida and 344 in marcha picada. For Mangalarga Marchador, 5,239 animals were counted, 3,869 of which in marcha batida and 1,370 in marcha picada.

In both breeds, most horses (59%) competed in only one national show. An analysis of the proportion of animals that attended between one and nine shows revealed a gradual decrease in the number of competitors (Table 1).

The proportion of Mangalarga Marchador horses that competed in a single event (62.24%) was higher than that of Campolina animals (56.04%). However, a higher percentage of Campolina horses competed two or three times. The proportion of horses that attended four to eight shows was similar between the breeds and only one Campolina horse (0.06%) competed in nine national horse shows.

A separate analysis of participation frequency of Campolina marcha batida and marcha picada males and females shows that marcha batida males differed from other categories, with most of them (54.39%) competing twice. Moreover, percentages of marcha batida males attending three or four times were also significantly greater than other categories, being more numerous than marcha batida males attending one show (6.08%) (Table 2).

On the other hand, most (62.84%) marcha batida females competed only once, as did marcha picada males (79.27%) and females (73.89%), demonstrating that the proportions of marcha picada horses that attended a single national horse show were even higher than marcha batida animals.

For the Mangalarga Marchador breed, regardless of sex or marcha type, the percentage of animals that competed only once was always numerically higher than the other participation frequencies.

It was found that owners of Campolina marcha batida males prioritized the participation of adult horses (41.41%) in detriment of foals (22.22%) (Table 3). The opposite was observed for marcha batida females, with a higher participation of foals (48.66%) than adult mares (35.39%). Furthermore,

Table 1 - Percentage of participation of Campolina and Mangalarga Marchador horses in one or more national horse shows

Breed	Number of national shows								
	01	02	03	04	05	06	07	08	09
Campolina	56.04B	24.71A	10.84A	5.22A	1.68A	1.07A	0.34A	0.06A	0.06
Mangalarga Marchador	62.24A	21.11B	8.86B	3.72A	2.08A	1.53A	0.44A	0.02A	-

Different letters in the columns indicate difference between breeds according to chi-squared test ($P < 0.05$).

marcha batida males had a higher percentage of representatives that competed in both age groups (36.36%) compared with females (15.98%).

For marcha picada, the participation of only three Campolina male foals (1.91%) and nine female foals (5.23%) was much lower than that of adult males (98.09%) and mares (94.77%). In addition, no marcha picada horses competed in both age groups.

For Mangalarga Marchador, the proportion of adult male (55.39%) and female (49.67%) marcha batida competitors was higher than those of male (34.54%) and female (40.02%) foals. Furthermore, the percentage of males and females that competed in both age groups was similar, 10.07% and 10.31%, respectively.

As in marcha batida, the number of adult marcha picada Mangalarga Marchador competitors was also higher than that of young animals, and few horses competed in both age groups. However, in marcha picada, the difference between the average proportions of young (13.97%) and adult (81.91%) competitors were even higher.

When comparing the classifications obtained by Campolina horses that attended national shows in both age groups, it was observed that the proportion of marcha batida males that achieved better results when young (41.25%) did not differ from that of adult horses (38.75%) (Table 4). However,

Table 2 - Percentage of Campolina and Mangalarga Marchador horses, grouped by marcha modality and sex, that attended one or more national horse shows

Marcha breed	Sex	Number of national shows				
		01	02	03	04	05
Campolina						
Batida	Male	6.08C	54.39A	23.31A	10.47A	3.72A
	Female	62.84B	19.54B	9.55B	4.82B	1.40A
Picada	Male	79.27A	12.20C	6.10B	1.22B	1.22A
	Female	73.89A	20.00B	2.78B	2.78B	0.56A
Mangalarga Marchador						
Batida	Male	63.13AB	21.08A	9.13A	3.71A	2.00A
	Female	60.11B	21.79A	8.52A	3.78A	2.16A
Picada	Male	65.42A	18.54A	9.19A	3.27A	2.65A
	Female	63.74AB	21.43A	8.93A	3.98A	1.51A

Different letters in the columns indicate difference between marcha modalities and sex, in each breed, according to chi-squared test ($P < 0.05$).

Table 3 - Percentage of Campolina and Mangalarga Marchador horses, grouped by marcha modality and sex, that attended national horse shows only as foals, only as adults, or in both age groups

Marcha	Sex	Foal	Adult	Foal and adult
Campolina				
Batida	Male	22.22Bb	41.41Ba	36.36Aa
	Female	48.63Aa	35.39Bb	15.98Bc
Picada	Male	1.91Cb	98.09Aa	-
	Female	5.23Cb	94.77Aa	-
Mangalarga Marchador				
Batida	Male	34.54Bb	55.39Ba	10.07Ac
	Female	40.02Ab	49.67Ca	10.31Ac
Picada	Male	13.92Cb	82.91Aa	3.16Bc
	Female	14.01Cb	80.91Aa	5.08Bc

Different uppercase letters in the columns indicate difference between marcha modalities and sex, in each breed, according to chi-squared test ($P < 0.05$).

Different lowercase letters in the rows indicate differences among foal, adult, and foal and adult according to chi-squared test ($P < 0.05$).

Table 4 - Percentage of Campolina and Mangalarga Marchador horses, grouped by marcha modality and sex, that achieved better results in national horse shows as foals, as adults, or with similar results in both age groups

Marcha	Sex	Foal	Adult	Foal and adult
Campolina				
Batida	Male	41.25Aa	38.75Aa	20.00Ab
	Female	38.41Aa	32.45Aa	29.14Aa
Picada	Male	-	-	-
	Female	-	-	-
Mangalarga Marchador				
Batida	Male	44.8ABa	24.8Bb	27.2Ab
	Female	37.14Ba	38.57Aa	24.29Ab
Picada	Male	46.67ABa	33.33ABa	20.00Aa
	Female	64.71Aa	17.65Bb	17.65Ab

Different uppercase letters in the columns indicate difference between marcha modalities and sex, in each breed, according to chi-squared test ($P < 0.05$).

Different lowercase letters in the rows indicate differences among foal, adult, and foal and adult according to chi-squared test ($P < 0.05$).

these two proportions were higher than those of competitors that achieved similar classifications in either age group (20%).

No difference was found in the proportion of Campolina marcha batida females that achieved better classifications when young (38.41%), when adults (32.45%), or that achieved similar results in either age group (29.14%). In addition, no marcha picada horses competed in both age groups.

Mangalarga Marchador marcha batida males and marcha picada females had better classifications when foals than when adults or when competing in both age groups. However, these differences were greater among marcha picada females, with 64.71% of competitors achieving better results when young, 17.65% when adults, and 17.65% with similar results in either age group.

No difference was found in the proportion of Mangalarga Marchador marcha batida females that achieved better classifications when young (37.14%) and when adults (38.57%). However, these two proportions were higher than that observed among female horses that achieved similar results in either age group (24.29%). For marcha picada males, the proportions were the same when foals, adults, and when comparing both age groups.

It was also observed that 20 Campolina horses migrated between marcha modalities between 2007 and 2017. Of those, nine males and 11 females competed in marcha batida trials when foals and switched to marcha picada modalities when adults.

Discussion

The more expressive participation of Mangalarga Marchador horses in national shows between 2007 and 2017 compared with Campolina animals is directly related to the size of herds of each breed.

Mangalarga Marchador has the largest horse herd in Brazil, with around 540 thousand registered animals. Added to that is the existence of 8,650 breeders and 15 thousand affiliates of ABCCMM with 70 centers and breeder associations in the main states of the country, besides official representations in Germany, Italy, United States, and Argentina. Annually, around 240 events of the breed are held around the country, and the national horse shows alone bring together approximately 1,500 animals each.

Meanwhile, Campolina has the fifth largest national herd, with approximately 100 thousand registered animals (MAPA, 2016). Nonetheless, Campolina animals are present in 22 states of Brazil, with Minas Gerais leading the numbers, followed by Rio de Janeiro and Bahia (Procópio et al., 2003; Vieira et al.,

2015). According to Bussiman et al. (2018), Campolina horses have been exported to Mexico, Venezuela, United States, and Germany.

The marcha is a natural, symmetric, four-beat gait with alternate support of the lateral and diagonal feet interspersed with moments of triple support. The reactions are smooth, with little vertical shift of the center of mass and constant contact with the ground (Nascimento, 1999). This complex gait has some variations, i.e., marcha picada, in which the proportions of diagonal and lateral two-feet support are very close, and marcha batida, in which diagonal support prevails over lateral support (Procópio et al., 2007; Santiago et al., 2014a).

Brazilian marcha horse breeds (Campolina, Mangalarga Marchador, Pampa, and Piquira) require both marcha types, batida and picada, to maintain the genetic variability of the herd. According to Vitral (2018), over recent years, marcha picada has exhibited exponential growth in the Mangalarga Marchador breed, becoming a reality not only in the trials in the Brazilian Northeast region but also in the Southeast. This marcha modality, which never ceased existing in the breed, has been again valued and judged in horse shows. Thus, the demand for marcha picada animals has increased, along with the selection process and pressure. Ever since, the numbers of marcha picada animals have rapidly grown due to the large genetic variability of the herd and to the significant number of lineages and animals.

The participation of adult marcha picada Mangalarga Marchador horses in national shows began only in 2006, while marcha picada foals started attending in 2010. Prior to that, only marcha batida animals were judged (ABCCMM, 2019). In Campolina national horse shows, adult marcha picada categories were incorporated in 2010, while foals started competing in 2016. That justifies the larger representativeness of marcha batida animals, for either breed, than marcha picada ones.

The larger participation of Mangalarga Marchador horses in a single national horse show could be related to two factors: the requirements of the regulations of these events and the high financial cost to prepare and bring animals to the events.

According to the regulations of national horse shows, each Mangalarga Marchador must qualify in regional shows officialized by the ABCCMM around the country in the same equestrian year so that they can be enrolled in national events. Thus, by gathering only horses that achieved good classifications in previous trials, each category of national shows comprises specimens with high morphological and functional level, making the contests very close.

The high level of national trials requires large investments from breeders in genetics, nutrition, health, training, and participation in regional shows so that they can be eligible to attend national events. Hence, owners of animals that failed to achieve good results in the first national show they attended lack the incentive to attend with the same horses in the following years. These breeders choose to continue investing only in the competitive career of the horses with higher chances of winning, i.e., the ones that have achieved the first places in previous years. This strategy is likely also used by many Campolina breeders, since most horses of this breed also competed only once.

On the other hand, a larger number of Campolina horses attended two or three national horse shows, which suggests their breeders are more persistent. Unlike Mangalarga Marchador horses, Campolina animals do not need to qualify in regional shows to be enrolled in national events of the breed. Therefore, breeders prioritize the participation of their animals in those events, sometimes for several years in a row. Moreover, ABCCCampolina officializes a smaller number of regional shows over the year. In agreement with this idea, only 6.08% of marcha batida Campolina males competed just once, with most animals of this modality competing in two national horse shows. The proportion of males in this modality that competed three or four times was also numerically higher than the number of horses that competed only once.

However, persisting with the same specimens in several national shows must be seen with caution. Horses are among the species of animal performance interest that have the longest genetic progress due to both natural factors (11 months of gestation, a single animal per birth, and 15% of embryos lost)

and to the conditions imposed by the selection methods of progenitors (Zamborlini and Pereira, 2012). Thus, the constant presence of the same horses in national shows of the Campolina breed requires special attention by the breeders' association, since repeating the same specimens may hamper herd renewal and further slow down genetic progress. As an example of intervention of a breeders' association in face of this risk, the Brazilian Association of Zebu Breeders, aiming at constant renewal of the herd, has enforced a maximum age limit of three years for Nelore, Guzerat, and Tabapuan bovines to attend contests (ABCZ, 2019).

According to Valera et al. (2000), stallions usually begin reproducing after showing their value as athletes and, for this reason, their reproductive activity begins later than that of females. Dias et al. (2000) found that the age of Brazilian Sports Horse stallions when they have their first offspring is 10.2 years, similar to that found in other breeds used for the same sports purpose. However, in breeds for which sports performance is not part of the characteristics considered in the selection of progenitors, such as draft horses, stallions begin reproduction earlier. Parés (1995), for instance, observed mean age of 4.5 years for Breton stallions when they first reproduced.

Since Campolina and Mangalarga Marchador breeds have no quantitative animal performance trials for approval of stallions, breeders and judges try to estimate the genotypes of animals from phenotypic manifestations, assessed in morphological and functional trials, aiming to choose the future progenitors among those of higher "genetic merit" with the characteristics that most interest the breeder. Hence, horses of either breed are subjected to years of training and competitions since good results in national shows revert into valuation of the specimen, of their progenitors, and of their offspring. That has resulted in the age of Campolina stallions at the first offspring being 8.3 years and a gap of 8.7 years between generations (Procópio et al., 2003), while the age of Mangalarga Marchador stallions at the first offspring is 8.9 years with the gap of 8.4 years between generations (Costa et al., 2004).

The larger participation of marcha batida Campolina males in two, three, or four national shows may also justify why these animals compete more in national contests only as adults or in both age groups. In the present study, during data processing, it was observed that the few animals that competed more than once did so only when young. Therefore, horses that competed in consecutive years did so only as adults or once as foals and the remainder when adults.

The opposite was observed for marcha batida Campolina females, i.e., higher attendance in national shows as foals, likely due to the different ages at which males and females begin reproduction. Therefore, when many young female Campolina competitors reach 36 months of age, they terminate their competitive careers and are destined to reproduction, with only the most promising mares remaining in contests.

According to Vitral (2018), soon after the inclusion of marcha picada categories in horse shows, a lack of standardization was observed concerning the quality of animals both in marcha and conformation. That is due to the time marcha picada horses were left out of the trials and, consequently, the little attention they have received in breeding farms.

Since Campolina horses in adult marcha picada categories began attending national horse shows only in 2010 and foals only in 2016, it is expected that judges will need some time to define and/or adjust the evaluation of this gait. At the same time, breeders must identify the characteristics valued in marcha picada trials to select horses with such attributes and/or potential to produce offspring that fit the desired gait standard. It is likely that, during this period of adjustment and learning, many breeders will bring their horses to trials more to seek guidance, with little purpose in persisting with the same specimens in consecutive national shows. That would justify why most marcha picada Campolina males and females attend only once in national shows.

The recent inclusion of marcha picada foal categories in national Campolina horse shows in 2016 also justifies the fact that 96% of males and females of this modality compete only as adults. On the other hand, for Mangalarga Marchador, the difference between the dates of inclusion of adult (2008)

and young (2010) marcha picada horses was only two years and, nevertheless, the presence of adult marcha picada horses prevailed in national shows (82%).

The low frequency of Mangalarga Marchador horses that competed as foals and also as adults, besides signaling that the judgment methodology of young animals may not be adequate to guide breeders in foal selection, also corroborates the results by Santos et al. (2018), who found that the same morphology and functional evaluation method used to assess both young and adult animals has led to different effects.

The large variation observed regarding the phase of life at which horses achieved their best competitive performance may be associated with the influence of uncontrolled factors that even prevent deeper analyses. The judges that evaluated young horses were likely not the same that evaluated the same animals when adults, just like the competitors against which a specimen competed as a foal not always were the same against which it competed as adults. In addition, there are different management and care each horse has received over their competitive careers, taming methods, training protocols adopted, and possible injuries and diseases, which may impact the final result of contests.

The change in marcha modality observed for 20 Campolina horses may be associated with the skill and/or genetic predisposition some specimens have to change the frequency of bipedal support between diagonal and lateral. Thus, these animals are enrolled in marcha batida categories when young because, through training with specific rhythm and commands, they are able to execute the marcha with a prevalence of diagonal bipedal support. However, when these horses reach adulthood, if the breeders foresee higher chances of victory in marcha picada categories, the animals are conditioned to compete with marcha featuring proportions of closer diagonal and lateral bipedal support (Santiago et al., 2014b).

Conclusions

Over their competitive careers, most Campolina and Mangalarga Marchador horses attend only one national horse show. Usually and in both breeds, the animals of the marcha picada modality compete in these events only as adults, while marcha batida Campolina females attend more as foals. In addition, the age group in which competitors obtain their best performances varies according to the specimen.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization: J.M. Santiago. Data curation: J.M. Santiago and J.E.C. Lucena. Formal analysis: J.M. Santiago. Funding acquisition: J.M. Santiago and J.E.C. Lucena. Investigation: J.M. Santiago and J.E.C. Lucena. Methodology: J.M. Santiago, J.E.C. Lucena, C.A.M.S. Nascimento, I.V.F. Gonzaga, A.C. Silva, D.A.S. Melo and D.L.S. Lima. Project administration: J.M. Santiago. Resources: J.M. Santiago and J.E.C. Lucena. Writing-original draft: C.A.M.S. Nascimento, I.V.F. Gonzaga, J.M. Santiago, A.C. Silva, D.A.S. Melo, D.L.S. Lima, A.P.G. Pinto and J.E.C. Lucena. Writing-review & editing: J.M. Santiago, J.E.C. Lucena, C.A.M.S. Nascimento and I.V.F. Gonzaga.

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