

The effect of age on the racing speed of Thoroughbred racehorses

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The running performance of Thoroughbred racehorses has been reported to peak when they are between 4 and 5 years old. However, changes in their racing speed by month or season have not been reported. The purposes of this study were to reveal the average racing speed of Thoroughbreds, and observe changes in their average speed with age. The surveyed races were flat races on turf and dirt tracks with firm or standard track conditions held by the Japan Racing Association from January 1st, 2002 to December 31st, 2010. The racing speed of each horse was calculated by dividing the race distance (m) by the horse's final time (sec). Average speeds per month for each age and distance condition were calculated for each gender group when there were 30 or more starters per month for each age and distance condition for each gender group. The common characteristic change for all conditions was an average speed increase up until the first half of the age of 4 years old. The effect of increased carry weight on average speed was small, and average speed increased with the growth of the horse. After the latter half of the age of 4 years old, the horses' average speed remained almost constant, with little variation. It is speculated that decreases in the weight carried; and the retirement of less well performing horses; are responsible for the maintenance of average speed.

Key words: Thoroughbred, race, speed, growth, age

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In the Northern hemisphere, the physiological development of Thoroughbred racehorses is thought to be completed during the latter part of the age of 4 years old. With respect to their skeletal development, the latest epiphysis closure occurs at the age of 4–5 years old in a cervical vertebra [2]. The running performance of Thoroughbred racehorses also reaches a peak at the same time. The weight carried by a horse in a race is basically determined by the gender and age of the horse. In the flat races held by the Japan Racing Association (JRA), there is no weight allowance after April of the age of 4 years old. After this age, racehorses run with the same carrying weight as those over the age of 5 years old. A previous report comparing the age-specific running performance of Thoroughbred racehorses in the United States showed that their running performance peaked at age of 4 years old [3]. Furthermore, previous reports in Brazil

and Japan have shown that Thoroughbred running performance was fastest at 4 and 5 years old, respectively [5, 6]. However, in those studies, only the age-specific average racing speed was reported—the change in racing speed by month or season was not. In the report from the United States [3], performance was evaluated by the Beyer index, which takes into account differences in the racecourses and the track conditions; however, changes in racing speed by month were not reported. To address these absences in the literature, we therefore calculated the average racing speed of Thoroughbreds per month, and at each race distance for flat races on turf or dirt tracks. We also analyzed changes in the horses' average speed with growth and aging.

Materials and Methods

The surveyed races were flat races on turf and dirt tracks held by the JRA from January 1st, 2002, to December 31st, 2010. The race lengths were 1,200, 1,400, 1,600, 1,800 and 2,000 m on turf and 1,000, 1,200, 1,400, 1,700 and 1,800 m on dirt. These were the respective “top 5” races in terms of their number of starters. JRA's dirt courses are different from those used in the United States. The base of a dirt track is a

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Table 1. Distribution of gender and distance for starters on flat turf races

Gender	Distance (m)				
	1,200	1,400	1,600	1,800	2,000
Males & geldings	22,024	8,761	16,006	21,514	22,013
Females	24,227	8,310	11,009	13,100	8,962
Total	46,251	17,071	27,015	34,614	30,975

Table 2. Distribution of gender and distance for starters on flat dirt races

Gender	Distance (m)				
	1,000	1,200	1,400	1,700	1,800
Males & geldings	6,217	18,017	13,560	20,912	23,431
Females	6,264	13,835	7,036	9,848	8,245
Total	12,481	31,852	20,596	30,760	31,676

layer of mountain sand packed firmly and then covered with loose sand (9 cm) to absorb the touchdown impact. Only the final time data from firm or standard condition tracks were used in this study because track condition affects the final time and the firm and standard conditions had the most data. The final time is that officially recorded by the JRA, which is measured on video in time increments of one-tenth of a second. The horses were divided by gender, with one group being “females” and the other being “males & geldings”; male horses and geldings were grouped together because of the relatively low number of geldings belonging to the JRA. The racing speed of each horse was calculated by dividing the race distance (m) by the horse’s final time (sec). Average speeds per month for each age and distance condition were calculated for each gender group when there were 30 or more starters per month for each age and distance condition in each gender group. The average weight carried per month by each age group was calculated for each gender group when there were 30 or more starters per month for each age group in each gender group.

Results

In descending order, the greatest number of turf race starters were found in the 1,200 m, 1,800 m, 2,000 m, 1,600 m and 1,400 m races (Table 1). The greatest number of starters for dirt races, in descending order, were found in the 1,200 m, 1,800 m, 1,700 m, 1,400 m and 1,000 m events (Table 2). The ratio of males & geldings to females was equal across shorter distances in both turf and dirt races but increased with distance; the ratio was almost 2:1 for 2,000 m races on turf (Table 1) and 1,800 m races on dirt (Table 2). Geldings constituted only 2.7 and 2.8% of starters on turf and dirt, respectively. Therefore, the effect of geldings on

the data of the males & geldings is believed to be very small.

The common characteristic change observed across all distances on both turf and dirt was that the average speed increased slowly up until February of the age of 3 years old (Figs. 1A, 1B, 2A and 2B). Subsequently, from March to September of the age of 3 years old, speed showed a continual increase and then increased rapidly in October and November. Thereafter, their average speed increased continuously until the first half of the age of 4 years old, after which it remained almost constant, with little variation.

The average weight carried increased in males & geldings at approximately 3.5 years of age (Figs. 1C and 2 C). The average weight carried decreased in both males & geldings and females in June of the age of 3 years old. From December of the same year, the weight carried increased and then peaked in June to August of the following year (at the age of 4 years old).

The number of starters in each gender group, and each type of race, increased at 2 years old. In October of the age of 3 years old, this number decreased rapidly (Figs. 1C and 2C).

Discussion

The average speed of Thoroughbreds surveyed on turf and dirt races increased slowly up until February of the age of 3 years old (Figs. 1A, 1B, 2A and 2B). One of the reasons why the average speed increase during this period was slower than in subsequent periods might be that increases in carried weight inhibited the average speed increases associated with growth [4]. In the JRA races, the weight carried increased with growth in the males & geldings group (Table 3). As a result, the average weight carried increased in almost the same period as the relatively slow speed increases (Figs. 1C

Turf

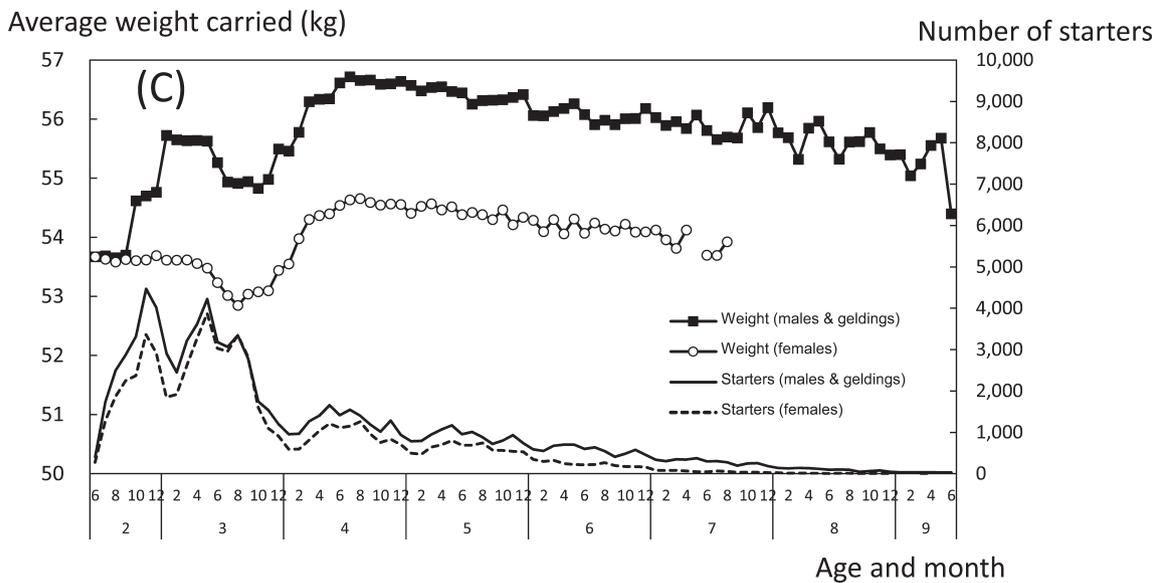
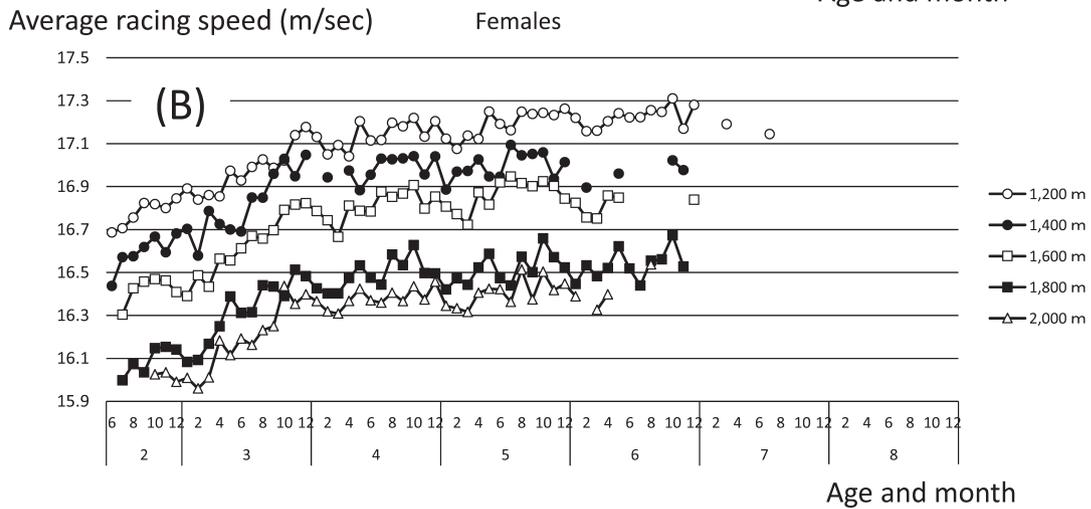
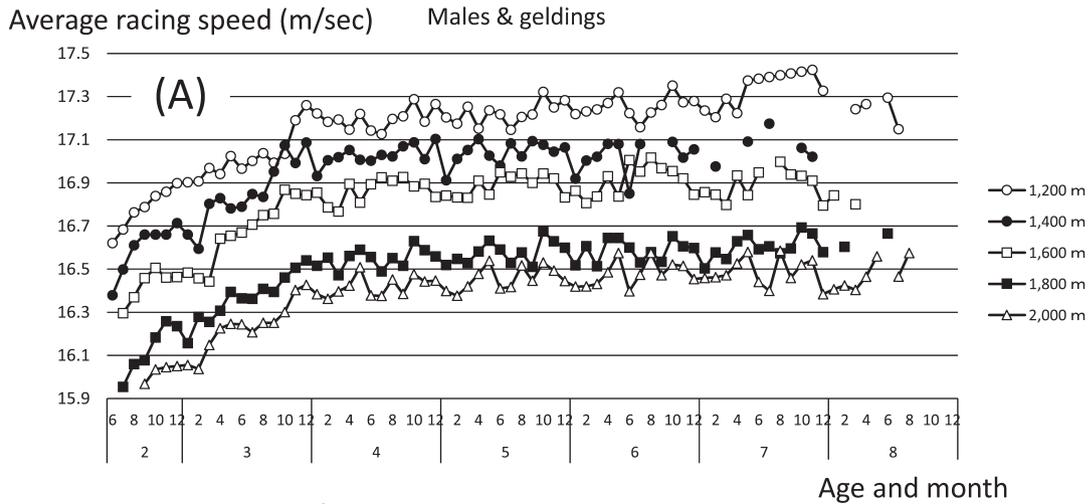


Fig. 1. Average speed for each race distance in males & geldings (A) and females (B), the average weight carried (C) and the number of starters (C) on turf races.

Dirt

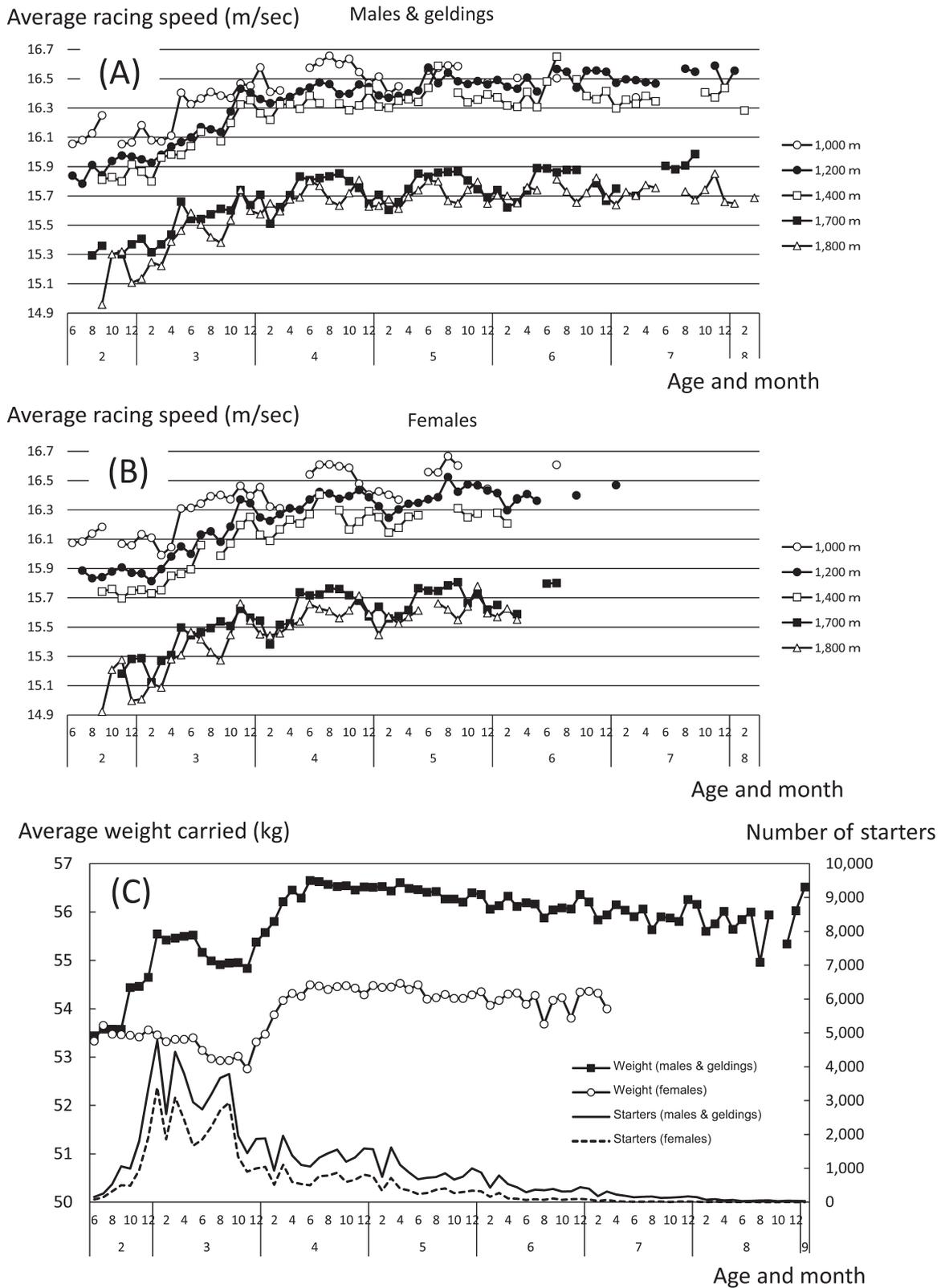


Fig. 2. Average speed for each race distance in males & geldings (A) and females (B), the average weight carried (C) and the number of starters (C) on dirt races.

Table 3. Weight carried and age of horse

Gender/Age	2 years old		3 years old	
	Until September	October to December	Until September	October to December
Males & geldings	54 kg	55 kg	56 kg	57 kg
Females		54 kg		55 kg

and 2C). However, this explanation is unlikely because the increase in average speed was also slow in females of the same age, whose carried weight had not increased (Table 3, Figs. 1C and 2C). Another possible cause was the change in the group composition of starters during the study period because of many horses debuting in a newcomer or maiden race. The total number of 2-year-old starters increased rapidly over time (Figs. 1C and 2C). Because the starters that debuted during this period included more horses that were novices and therefore less trained than horses that had already debuted, which were well trained and faster, the average speed could be expected to increase slowly. Subsequently, from March to September of the age of 3 years old, the average speed for all race lengths showed a continued increase (Figs. 1A, 1B, 2A and 2B). Average weight carried decreased in both males & geldings and females from June of the same year because races between 3-year-old horses and those over 4 years old had started; there was a weight allowance for 3-year-old horses in these races. However, the average speed for each track and length increased gradually, not rapidly. Therefore, it appears that running performance increases related to growth have a more significant impact than decreases in weight carried. The average speed for most race lengths and track surfaces increased rapidly in October and November of the age of 3 years old (Figs. 1A, 1B, 2A and 2B). Maiden races also ended at this time, at the age of 3 years old; therefore, almost all maiden horses that showed less impressive running performance retired from racing in the JRA. As a result, the total number of starters decreased significantly for both turf and dirt track races after October of the age of 3 years old (Figs. 1C and 2C). Therefore, as only horses with higher running performance than maiden horses were left, the average speed seemed to increase rapidly. With regard to subsequent increases, the average speed thereafter increased continuously to the first half of the age of 4 years old. During this period, the weight carried increased, as the weight allowance for 3-year-old horses in races with those over 4 years old decreased in incremental steps (Figs. 1C and 2C). However, no inhibition of the increase in average speed by weight carried was observed; it appears that growth is a stronger factor for average speed than inhibition by such weight. After this period, average speed remained at an almost constant level,

with little variation (Figs. 1A, 1B, 2A and 2B). In a previous study on geldings, performance peaked at a real age of 4.25 to 4.75 years evaluated by the Beyer Speed Figures in the United States [3]. Because a horse generally gives birth between March and April in the northern hemisphere, a real age of 4.25 to 4.75 years would occur between June and December, which is consistent with this result. The fastest average speed was recorded at age 4 in Thoroughbreds in Brazil [5], at 4 to 6 years old in Trotters in Germany [1] and at 5 years old in Thoroughbreds in Japan [6]. These results also agree with the result of the present study. Under the rules of the JRA, the weight allowance in a special weight race is removed between January and March of the age of 4 years old, as a function of race length. This time point is almost the same as that when the average speed peaked.

The average speed did not decrease with aging after the peak at the first half of the age of 4 years old (Figs. 1A, 1B, 2A and 2B). However, it has previously been reported that performance evaluated by Beyer Speed Figures decreased gradually after the peak [3]. In that study, only horses that had records spanning several years were selected. However, the present study targeted all horses that started in the intended period and races. The average speed might not have decreased in this study because horses whose performance decreased with aging were retired from racing and the remaining horses retained their performance. Furthermore, the average weight carried by the horses in our study decreased gradually in both males & geldings and females from the latter half of the age of 4 years old, at which time their performance peaked. The weight carried decreased in the low performance horses in handicap races. Weight adjustments like this might inhibit the decrease in average speed with aging.

The average speed after the latter half of the age of 4 years old for each race length on turf tracks was fastest in the shortest (1,200 m) race and slowest in the longest (2,000 m) race for both genders in most months. On the other hand, on dirt tracks, although the average speed after the latter half of the age of 4 years old in the 1,000 m race was fastest in most months, the average speeds in the 1,200 and 1,400 m races were sometime close to those in the 1,000 m race. The average speed in the 1,800 m race was also close to that in the 1,700 m race for most months. The difference in

average speed was not remarkable on dirt tracks. Therefore, while the average speed decreased on turf tracks as the race length was extended, the influence of this extension of race length was low on dirt tracks. The reason for this seems to be that the top speed on dirt tracks is limited by the nature of the race. The top speed for turf track races of 1,200 m was about 17.2 m/sec, while that for dirt track races of 1,000 m was about 16.5 m/sec. Another reason might be that the dirt tracks used for the 1,200 and 1,400 m races included a short turf zone (about 100 m) just after the starting gate on a few racecourses, and horses can run faster on turf than dirt tracks, as demonstrated in this study. However, although both the 1,200 and 1,400 m tracks of a few racecourses have a short turf zone, the difference in average speed between these two types of dirt track was not remarkable. Therefore, extending the length of a dirt track had little effect on average speed.

Although the 5 race lengths surveyed for the turf tracks were different, with equal intervals of 200 m, the difference in average speed between the 1,600 and 1,800 m distances was larger than the differences for the other tracks. The 1,600 m racetracks used at most JRA racecourses include a single turn, while most of the 1,800 and 2,000 m racetracks include two turns. Because racing speed decreases at a turn compared with straights [8], the difference in average speed between the 1,600 and 1,800 m races might be larger than the difference between other races without different numbers of turns.

On the dirt tracks, races up to 1,400 m also include a single turn, while 1,700 and 1,800 m races include two turns at most JRA racecourses. Although the difference between 1,400 and 1,700 m races is 300 m, the decrease in average speed between these two races was larger than that between 1,000 and 1,400 m races, in which the difference was 400 m. Therefore, turns induce a decrease in average speed regardless of the composition of the track.

It was possible that the influence of track turns was greater on dirt tracks than on turf tracks. The average speeds on turf tracks after the age of 4.5 years old were about 17.1 m/sec and 16.6 m/sec in 1,400 and 1,800 m races, respectively, a difference of about 0.5 m/sec. On the other hand, the difference was about 0.7 m/sec on dirt tracks of the same length (average speeds of about 16.4 m/s and 15.7 m/s, respectively). Furthermore, the decrease in average speed with extension of the race length was less on dirt tracks than on turf tracks. Therefore, larger decreases in average speed between the 1,400 and 1,800 m races on the dirt tracks seem likely to have been caused by the greater influence of turning on racing speed on the dirt tracks *per se*. One other potential reason is that the dirt tracks are generally located on the inside of turf tracks at all JRA racecourses, and the turning radius of dirt tracks is smaller than that of turf tracks

[8]. Another reason may be that under standard conditions, dirt tracks might have less grip than turf track; as a result, horses might reduce their speed on dirt tracks during turning [8]. The propulsive force on turf tracks was shown to be larger than on either synthetic or dirt tracks [7].

In conclusion, the average speeds for all race distances surveyed on turf and dirt increased up until the first half of the age of 4 years old. The effect of the increase in weight carried on the increase in average speed with growth was only small. After the latter half of the age of 4 years old, the average speed remained at an almost constant level, with little variation. I speculate that the decrease in weight carried and retirement of less well performing horses kept the average speed high.

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