Age at Peak Performance of Successful Track & Field Athletes

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ABSTRACT

Knowledge of age at peak performance in competitive sport could inform decisions about selection and preparation of athletes for specific events. The purpose of the study was to estimate age at peak performance of elite track-and-field athletes. 168,576 performance times and distances by 2017 athletes in 19 men's and 19 women's track-and-field events from 1979 to 2009 were downloaded from tilastopaja.org. Each athlete had finished in the top 16 (track events and combined events) or top 12 (field events) of their event at an Olympic Games or a World Athletics Championships between 2000 and 2009. After adjustment for year of competition, and venue-related factors such as altitude, wind-speed, indoor or outdoor and level of competition, a mixed linear model provided quadratic age-related performance trajectories to estimate each athlete's age at peak performance and age window for negligible contiguous improvement and decline. Age at peak performance for men ranged from 23.9 ± 2.4 y (10000 m; mean ±SD) to 28.5 ± 2.2 y (discus throw) and for women from 24.7 ± 2.5 y (pole vault) to 28.1 ± 3.9 y (discus throw). There were clear differences in mean age at peak performance between male and female throwers (mean;±CL) (28.0;±0.4 vs. 26.7;±0.6 y), between male and female runners (25.1;±0.3 vs. 26.2;±0.4 y), and between throwers and runners or jumpers (27.3;±0.5 vs. 25.6;±0.3 or 25.7;±0.3 y). In conclusion, the current generation of track-and-field athletes should prepare for an age window of ~2.5 y each side of a peaking age of ~23-28 y depending on event. Differences and trends in participation, ethnic representation, professionalization and specialization could account for differences between events and for apparent changes from age at peak performance of previous generations.

Key words: Age, Gender, Gerontology, Performance Progression, Track & Field Athletics

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INTRODUCTION

Athletes planning a career in competitive sport would benefit from knowing the age at which their peak performance is likely to occur and the period over which they can maintain that peak performance. Coaches and athletes could then focus their planning with realistic expectations about the athlete's future performance at international level. While it is reasonably obvious that the average man and woman reach their peak of physical maturity sometime in their 20's, there has been surprisingly little research on the question of the age of peak performance of elite athletes in specific sports.

In track-and-field, Schulz and Curnow [1] believed that the age of career-best performance differed between events. For example, the age of the best performance for events requiring explosive power and speed occurred at a younger age than for events requiring endurance. Several authors [1-3] have used world records and Olympic performances as an athlete's best performance and calculated their age on the date to determine the age of best performance. In a study of the age at which men and women Olympic gold medalists (1948 – 1980) achieved their Olympic performance, Schultz and Curnow [1] reported ages for the men of 23.4 ± 2.4 y (mean ± SD) in sprint events; 24.2 ± 1.9 y for middle distance; 27.6 ± 2.1 y to 30.1 ± 3.7 y for long distances; 23.1 ± 2.8 y for horizontal jumps and 24.4 ± 3.5 y for shot put. For the women the ages were 22.1 ± 3.5 y for the sprint events; 23.8 ± 2.6 y for the 800m (the event was not introduced until 1960); 23.6 ± 4.2 y; 23.7 ± 4.2 y for the long jump and high jump, respectively (the only two jumping events held for women before1996) and 26.1 ± 3.9 for the shot put. A very early study [4] based on the age of the world record holder revealed that for all men's running events, the age of maximum performance increases with distance. Schultz and Curnow [1] also concluded that the mean age for best running performance in men increases with the length of the race. For women, they surmised that that the pattern was similar, although the number of observations available for the long distances was limited because distances over 400m had only recently been added to the Olympic competitions. Schultz and Curnow further concluded that for women the age of best performance was consistently younger than that of men. With the exception of the 800m race and the high jump, the mean age of the women gold medal winners was approximately one year younger than the mean age of winning men. Horwill [2] on the other hand found that women middle- and long-distance runners achieved their best performances later than that of the men. Horwill used performances of past and present middle- and long-distance world record holders to conclude that male 800m and 1500m runners were most likely to run their fastest at around the age of 25 y, while for females their best was at the later age of 27 y. The age at which a runner was most likely to run a lifetime best for the 3000m and 5000m was 27 y for males and 29 y for females, while for the 10000 m, it was 29 and 31 y, respectively. Smith [5] believed that the chronological age of best performance varied between sports and depended on factors such as developed power, endurance capacity and experience; he speculated that distance runners would realize top-level performance in their late twenties or early thirties.

The first study to determine the age of peak performance over an athlete's career was attempted by Hollings et al. [6], who plotted the performance progression of 390 retired former elite athletes across 36 track-and-field events. They estimated that most athletes achieved their career personal best between 25 and 27 y in all events. Their study identified a number of limitations, including the arbitrary selection of athletes used in the analysis as well as the small cohort of athletes in each event. Later, Berthelot et al. [7] used a four parameter (double exponential) model to calculate performance peaks at 25.99 ± 2.13 y on average across male and female runners (100m to marathon) with a range from 23.29 y (men's 10,000m) to 31.61 y (men's marathon). Their data was limited to using the single best annual performance for men's and women's running events only. The availability of a comprehensive track-and-field database (tilastopaja.org) now provides the opportunity to address limitations of earlier studies. This database features athletes' biographical data and competition results throughout their careers. Conventional repeated-measures analysis of variance cannot cope with the irregular complex structure of these data, but mixed modeling can. Using this technique, we have estimated the age at peak performance of elite track-and-field athletes and the width of the age window within which peak performance was likely to occur.

METHOD

All competition performances published at tilastopaja.org for 2017 track-and-field athletes (1026 male and 991 female) who finished in the top 16 in a track or combined event, or in the top 12 in a field event at an Olympic Games or a World Athletics Championships between 2000 and 2009 were downloaded. A total of 168,576 performances across 19 men's and 19 women's track-and-field events was used for the analysis. Table 1 shows the number of athletes and number of performances in each event. The following variables were captured from the tilastopaja site: athlete's date of birth; name of and date of the competition;

Table 1. The Number of Athletes and Performances for Each Event Used in the Construction of the Performance Trends (Trajectories)

Event	Men			Women		
	Athletes	Performances	Average no. of performances for each athlete	Athletes	Performances	Average no. of performances for each athlete
100-m	57	7199	126	58	5892	102
100-m Hurdles	-	-		55	6553	119
110-m Hurdles	60	7574	126	-	-	
200-m	62	6051	98	68	5069	75
400-m	72	6538	91	58	5207	90
400-m Hurdles	60	5415	90	62	4325	70
800-m	58	5392	93	54	4355	81
1500-m	66	4098	62	66	3691	56
3000-m Steeplechase	55	2716	49	44	1042	24
5000-m	75	1914	26	61	1690	28
10000-m	68	960	14	68	793	12
High Jump	45	5897	131	40	5468	137
Pole Vault	50	7369	147	45	6740	150
Long Jump	49	5536	113	51	5397	106
Triple Jump	45	4592	102	40	4572	114
Shot Put	36	4829	134	34	3730	110
Discus Throw	36	4794	133	38	4037	106
Hammer Throw	26	3567	137	42	4601	110
Javelin Throw	43	4552	106	42	3563	85
Heptathlon	-	-		65	1489	23
Decathlon	63	1371	22	-	-	
Totals	**1026**	**90362**	**88**	**991**	**78214**	**79**

competition performance (time, distance or points); competition finishing position; environmental and venue-specific data associated with the competition performance (venue above or below 1000m; outdoor or indoor track, fully automated or hand timing, and wind-speed in $m.s^{-1}$). Where athletes were subsequently disqualified from the competition (for whatever reason), the performance was discarded. All data for athletes suspended for a doping violation were also discarded.

Individual performance trends for each athlete were generated using the mixed linear model procedure (Proc Mixed) in the Statistical Analysis System (Version 9.2, SAS Institute Inc., Cary, NC). The model included fixed effects to estimate a mean quadratic trend for age and to adjust for a mean quadratic trend for year, and for the effects of environmental and venue-specific factors.[8] Random effects were included to allow for a unique quadratic trend for the effect of age on performance of each athlete. The residual random effect in the model represented within-athlete competition-to-competition variability; a different residual variance was specified for the following levels of competition: World Championships and Olympic Games, World Junior Championships, and other competitions.

Figure 1 illustrates for one athlete how the quadratic was used to determine the age of peak performance and how it was used to estimate the duration of the peak performance window. Each athlete's age of peak performance was derived from their individual quadratic trajectory using the formula x=-b/(2a), where the quadratic was Performance = $a.Age^2$ + b.Age + c. Any ages of peak performance falling outside the athletes' age ranges were excluded from further analysis. An approximate estimate of the uncertainty in each individual age of peak performance was obtained using bootstrapping applied to a selection of typical athletes. The bootstrapping was realized with a spreadsheet. [9]

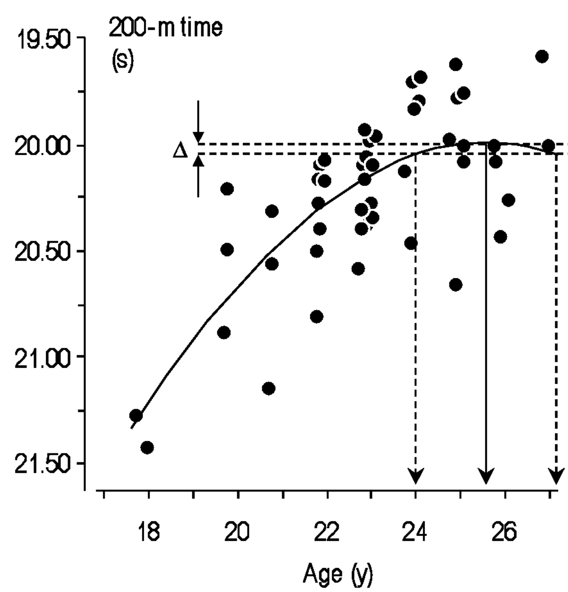

Figure 1. The Performance Progression Trajectory, Age of Peak Performance and the Duration of the Window of Peak Performance for a Former World Champion in the 200m
Solid vertical line shows the age of peak performance (25.6 y).
The distance between the two vertical dotted lines shows the duration of the peak performance window (3.2 y).
Δ is the smallest worthwhile effect.

A window of peak performance was defined as the period of time around the age of peak performance when performance predicted by each quadratic trend was within the smallest worthwhile change in performance from the peak. The smallest worthwhile effects were calculated as 0.3 of the within-athlete variation between competitive events at international level.[10] Values for within-athlete variation between international competitions were 0.8% sprints and hurdles; 1.1% middle and long distance running; 1.9% high jump and triple jump; 2.1% long jump and pole vault and 3.3% throws.[11] The corresponding smallest important effects were therefore: 0.24%; 0.33%; 0.57%; 0.63% and 1.0%, respectively. The mean width of this window was $2(\sqrt{\Delta}/a)$ where Δ= the smallest important change in performance and a= the coefficient for the fixed effect representing the quadratic term of the mean performance trajectory. (The formula was derived by simple algebra).The width of the window of peak performance for each athlete was calculated from their performance trajectory. The mean and standard deviation for the window for each event was derived by averaging the width of the window of all athletes in the same event.

To investigate the possibility that athletes reach a window of peak performances that extends beyond that defined by a quadratic, we analysed the residuals from the mixed model. Any tendency towards a plateau in performance would result in overall positive residuals for ages beyond their age of peak performance and compensatory negative residuals at earlier ages (because the mean value of the residuals in a mixed model is always zero). For each event we therefore modeled the residuals as a linear function of age, rescaled to zero at each athlete's age of peak performance, and then predicted the mean value of the residuals at 5 y post the age of peak performance and at the age of peak performance. In all events the predicted means were less than the smallest worthwhile effect for each event.

Standardization was the approach used to define smallest differences for age of peak performance and for the width of the window around the age of peak performance: that is 0.2 of the between-subject standard deviation for these variables was the smallest important value.[11] This value was then used to make inferences about differences between the events and event groups for both these variables and a spreadsheet [12] was used to make these inferences. Uncertainty in effects was expressed as 90% confidence limits. Outcomes were interpreted using magnitude-based inferences.[13] Briefly, an outcome was deemed unclear if its confidence interval overlapped thresholds for smallest substantial positive and negative effects. A clear effect was reported as the magnitude of its observed value in relation to thresholds for small, moderate, large and very large effects; 0.20, 0.60, 1.2, 2.0, respectively.[14]

RESULTS

The age at which men and women track-and-field athletes achieve their peak performance was similar (see Table 2). Men and women runners and jumpers reached their performance peak at the same age, while throwers were somewhat older. Generally, men runners reached their peak performance at a younger age that men jumpers and throwers, while women jumpers reached their age of peak performance at a younger age than women runners and throwers. Women runners reached their peak at an older age than their male counterparts, while women and men throwers, with the exception of the women's hammer throw, tended to reach their peak performance around the same age. Men 10000m runners and women pole vaulters were the first athletes to reach their age-performance peak, while men and women discus throwers were the oldest when they reached their peak.

Table 2 shows the mean and standard deviation of the duration that athletes spend in the window of peak performance in individual events for men and women. Part of that standard

Table 2. Age (y) at Peak Performance and Number of Years in the Peak Performance Window in Individual Events for Men and Women

	Age at peak performance[a]		Window of peak performance[b]	
Event	**Men**	**Women**	**Men**	**Women**
Sprints & Hurdles				
100m	24.5 ± 2.4 (n=41)	25.4 ± 2.9 (n=47)	4.3 ± 1.2	4.2 ± 1.6
100m Hurdles	-	27.2 ± 2.1 (n=42)	-	3.8 ± 1.1
110m Hurdles	26.3 ± 2.5 (n=44)	-	3.5 ± 1.1	-
200m	25.0 ± 2.0 (n=45)	24.9 ± 2.4 (n=52)	4.6 ± 1.4	4.1 ± 1.3
400m	24.5 ± 2.0 (n=59)	24.8 ± 2.2 (n=46)	3.7 ± 1.4	3.1 ± 1.0
400m Hurdles	25.9 ± 2.7 (n=44)	26.2 ± 2.2 (n=42)	3.6 ± 1.0	4.1 ± 1.0
Mean; ±90%CL	*25.2;±0.3*	*25.7;±0.3*	*3.9;±0.1*	*3.9;±0.1*
Middle-distance				
800m	24.9 ± 2.0 (n=43)	27.0 ± 2.6 (n=37)	5.2 ± 1.4	4.8 ± 1.2
1500m	25.3 ± 2.3 (n=48)	27.4 ± 3.1 (n=42)	6.0 ± 1.3	6.1 ± 2.3
3000m Steeple	25.5 ± 2.2 (n=38)	25.2 ± 2.5 (n=12)	4.9 ± 0.7	4.6 ± 1.8
5000m	24.7 ± 3.0 (n=41)	26.5 ± 3.4 (n=33)	6.0 ± 1.3	6.2 ± 2.3
10000m	23.9 ± 2.4 (n=34)	27.2 ± 3.4 (n=30)	-	-
Mean; ±90%CL	*24.9;±0.3*	*26.7;±0.5*	*5.5;±0.2*	*5.4;±0.3*
High Jump	26.1 ± 2.5 (n=36)	25.6 ± 2.5 (n=28)	6.1 ± 1.8	4.0 ± 1.5
Pole Vault	26.6 ± 1.9 (n=37)	24.7 ± 2.5 (n=33)	5.2 ± 1.6	5.5 ± 1.5
Long Jump	24.9 ± 2.0 (n=42)	26.5 ± 2.8 (n=37)	5.0 ± 2.3	4.9 ± 1.1
Triple Jump	25.7 ± 2.0 (n=32)	25.5 ± 2.8 (n=30)	5.2 ± 1.8	5.1 ± 1.3
Mean; ±90%CL	*25.8;±0.3*	*25.6;±0.4*	*5.4;±0.3*	*4.9;±0.2*
Shot Put	27.6 ± 1.8 (n=28)	27.0 ± 3.2 (n=28)	5.3 ± 1.8	4.9 ± 2.0
Discus Throw	28.5 ± 2.2 (n=29)	28.1 ± 3.9 (n=27)	5.8 ± 1.4	5.6 ± 1.7
Hammer Throw	28.2 ± 2.9 (n=23)	24.8 ± 2.4 (n=35)	6.0 ± 2.3	3.9 ± 1.1
Javelin Throw	27.8 ± 2.9 (n=27)	26.7 ± 3.8 (n=19)	5.1 ± 1.5	5.8 ± 2.5
Mean; ±90%CL	*28.0;±0.4*	*26.7;±0.6*	*5.6;±0.3*	*5.1;±0.3*
Decathlon	26.0 ± 2.0 (n=44)	-	-	-
Heptathlon	-	26.5 ± 2.5 (n=38)	-	-

Data for individual events are mean ± SD; means of the event groups show 90% confidence limits (90%CL).
[a]Uncertainty (90% confidence limits) for pairwise comparisons all ~ ±1.1 y. A difference in peak age of > ~0.5 y between any pairs is clear (e.g., men vs women 800m or men 100m vs discus throw). A difference in peak age of > ~0.2 is clear for any comparison of event-group means.
[b]Uncertainty (90% confidence limits) for pairwise comparisons all ~ ±0.7 y. A difference in the width of the window of > ~0.4 y between any pairs is clear. A difference in the width of the window of > ~ 0.1 y is clear for any comparison of event-group means.

deviation representing differences between athletes must arise from uncertainty in the estimate of each athlete's age of peak performance. We explored the magnitude of that uncertainty using bootstrapping for a sample of the athletes and we found the following: female 200m runner: 26.4 ± 2.0 y; male 200m runner: 25.6 ± 1.3 y; female 1500m runner: 26.1 ± 1.6 y; male 1500m runner: 26.0 ± 1.8 y; female long jumper: 23.3 ± 0.5 y; male pole vaulter: 25.1 ± 0.7 y. Note that these are typically somewhat less than the standard deviations for between subjects variation for their events shown in the table. The uncertainties in the age of peak performance provided by the bootstrapping for each of the selected athletes were typically half of those for the between subject differences.

The width of the window for peak performance about the age of peak performance for men and women was the same (4.7 ± 1.3 y). Sprints and hurdles runners had shorter peak performance windows than those of middle- and long-distance runners, jumpers and throwers. Men runners had narrower peak performance windows than those of men field event athletes, whereas women runners had similar duration peak performance windows to those of women field event athletes.

Figure 2 illustrates the magnitude of the differences between the age of peak performance for men and for women and between event groups. Further, the magnitude of the differences of the length of the window for men and for women and between event groups is also shown.

DISCUSSION

In a study of the age at which men and women Olympic gold medalists (1948 – 1980) achieved their Olympic performance, Schultz and Curnow [1] concluded that the mean age for peak running performance in men increased with the length of the race. For women, they surmised that that the pattern was similar, although the number of observations available for the long distances was limited because distances over 400m had only recently been added to the Olympic competitions. Schultz and Curnow further concluded that for women, the age of peak performance was consistently younger than that of men by approximately one year. Smith [5] in a study of training for elite performance stated that distance runners will realize top-level performance in their late twenties or early thirties. Findings by Horwill [2] using past and present world record holders concluded that male middle-distance runners run their fastest times at around the age of 25, while the male long-distance runners run their fastest times around the age of 29; similar to Schulz and Curnow's conclusion that the mean age for peak running performance in men increases with the length of the race. For women runners, Horwill concluded that the peak performance age is approximately two years later than it is for men; opposite to Schultz and Curnow's finding that the age of peak performance for women was consistently younger than that of men by approximately one year. Our data shows somewhat different trends and patterns to both Schulz and Curnow and to Horwill. The age at which male and female 800m and 1500m runners reach their peak in our data is similar to that of Horwill and that of Schultz and Curnow. However, both Horwill's and Schultz and Curnow's premise that mean age for peak running performance increases with the length of the race was not supported by our results. Indeed, we showed the opposite for the men's running events, whereby the age at peak for male 10000m runners (23.9 ± 2.4 y) was a year younger compared to that for the male 800m runners (24.9 ± 2.0 y), while the age at peak in these two events for women was the same (27.0 ± 2.6 y vs 27.0 ± 3.4 y). The reasons for the differences in our findings to those of Horwill and of Schultz and Curnow include sample size and the distinctiveness of the athletes in the data. Schultz and Curnow used the Olympic gold medal winning performance as the "peak" performance, while Horwill used a cohort of British athletes who set world records. Our sample size was much

Peak Age - Men

	Middle Distance	*Jumps*	*Throws*
Sprints & Hurdles	Trivial (0.1)	Small (0.3)	Large (1.2)
Middle- Distance		Small (0.4)	Large (1.3)
Jumps			Moderate (1.0)

Peak Age - Women

	Middle Distance	*Jumps*	*Throws*
Sprints & Hurdles	Small (0.4)	Trivial (0.0)	Small (0.4)
Middle- Distance		Small (0.4)	Trivial (0.0)
Jumps			Small (0.4)

Window - Men

	Middle Distance	*Jumps*	*Throws*
Sprints & Hurdles	Large (1.3)	Large (1.3)	Large (1.4)
Middle- Distance		Trivial (0.1)	Trivial (0.1)
Jumps			Trivial (0.1)

Window - Men

	Middle Distance	*Jumps*	*Throws*
Sprints & Hurdles	Large (1.3)	Moderate (0.8)	Moderate (1.0)
Middle- Distance		Small (0.3)	Small (0.2)
Jumps			Small (0.2)

Age at Peak Performance (Men vs Women)

Sprints	Small (0.2)
Middle-distance	Moderate (0.8)
Jumps	Trivial (0.1)
Throws	Small (0.5)

Window of Peak Performance (Men vs Women)

Sprints	Trivial (0.0)
Middle-distance	Trivial (0.1)
Jumps	Small (0.3)
Throws	Small (0.3)

Figure 2. Magnitudes of the Difference in Age of Peak Performance and the Length of the Window between Men and Women and Between Event Groups

larger and more internationally diverse. Further, Schultz and Curnow presumed that the gold medal winning performance was the athlete's career best performance, but it has been shown [8] that an athlete's career best performance in running events does not always occur at a major games; it is more likely to be achieved at a lesser quality competition. In the field events, the women jumpers in our study were of a similar age (~ 25.7 y) at peak performance to that of their male counterparts. Male jumpers in our study had a higher age at peak performance (24.9 ± 2.0 y to 26.6 ± 1.9 y), compared to that of male jumpers (23.1 y) in the study of Schultz and Curnow, while female high and long jumpers in our study had a higher age at peak performance (25.6 ± 2.5 y and 26.5 ± 2.8 y) compared to an age of 23.6 y in the study of Schultz and Curnow. For the throwing events our data showed similar age (~27 y to 28 y) at peak performance for the men and for the women, whereas Schultz and Curnow showed data for only the shot put; 24.4 y for men and 26.1 y for women.

The sport of track-and-field has changed considerably since most of the athletes included in the study of Schultz & Curnow competed. These changes include: a) a more competitive environment favoring late maturers; b) the introduction of higher-level competitions in the years between Olympic Games; and c) the participation of geographical and ethnic segments of the world population who previously did not compete at high-level competitions which may account for the differences in age at peak performance between our study and that of Schultz and Curnow. The concept of training age also needs to be considered when assessing the age of peak performance. Athletes who begin their specialization training at a young age are more likely to reach their peak performance at a relatively younger age than their peers who started to specialize somewhat later.[5] Further, some athletes may improve by the same amount as their peers but because of different training methods and competition opportunities, take longer to reach their peak. In past generations there was the expectation that age favored the male middle- and long-distance runners and that these athletes' self-selected themselves into longer endurance events as they got older. This occurrence probably goes some way to explain Schultz and Curnow's assertion that mean age for peak running performance increases with the length of the race. Our study showed the opposite pattern, whereby male 10000m runners achieved their peak performance earlier than 800m runners. The reason is probably due to athlete ethnicity linked to socio-economic factors. The male 10000m runners in our data set were comprised mainly of North and East African ethnicity, who appear to be predisposed to the longer running events and take up the event at a young age. East African athletes in particularly, have a way of life that is centered on running at a very early age. One Kenyan coach quoted in Finn [15] said 'It takes 10 years of training to build enough of an endurance base to be good at long-distance running. By the time a Kenyan is 16, he is already there.' This anecdotal comment is supported by Scott et al. [16], who found that a high proportion of the Ethiopian runners travelled (ran) long distances to school each day; by Saltin et al. [17] who showed that Kenyan boys who travelled to school by walking and running had a 30% higher $\dot{V}O_{2max}$ than those who did not, and by Onywera et al. [18], who found that Kenyan runners travelled further to school, mostly by running, than controls.

There has been no previous research undertaken on the window of peak performance in track-and-field athletics. Although there were clear differences in the duration of the window between men sprinters and hurdlers and athletes in the other events, there is no obvious explanation for this. The longer duration of the window in the men's middle-distance events may be related primarily to physiological attributes where it takes longer to acquire endurance capacity, but equally, this ability is able to be sustained for longer. There may also be less of an age-related decline in men middle-distance runners. In the men's field events, where there is a high skill component, it is assumed that once the technical skill has been acquired it is possible to maintain that attribute for a longer period. Conversely, with the men sprinters and hurdlers, who have the shortest window, the explanation probably relates to the events being not as technical as the others and being based primarily on a high component of power. Unlike the men, there was no difference in the duration of the window between the women's events. There is no easy explanation for why women sprinters and hurdlers have a window duration similar to women athletes in the other events, while their male counterparts have a shorter duration window. As athletes' preparation for major competitions is based around the four-year Olympic cycle, it is fair to surmise from the results of this study that all athletes will reach their age of peak performance within one Olympic cycle. Sprinters and hurdlers are less likely to hold their peak throughout a subsequent Olympic cycle, while men throwers are the most likely to hold their peak throughout two Olympic cycles depending on their age during the initial Olympic cycle.

CONCLUSION

We calculated the age of peak performance and the duration of the window of peak performance for elite track-and-field athletes. Our findings are at variance with previous calculations of the age of peak performance, which were based on the calculation of the age of the single best, or presumed career-best performance of the athlete. We found the opposite pattern to the assumed premise that the mean age for peak running performance in men increases with the length of the race. Further, we found that women reached their age of peak performance at about the same time as the men, whereas one previous study indicated that women reached their age at peak performance one year earlier than men, while another indicated that women were two years older than men when they reached their peak performance. The reason for the differences between previous studies and the current study may be that the modern-day sport is characterized by different trends in participation, ethnic representation, professionalization and specialization that could account for differences between events and for changes to the age at peak performance of previous generations. We found the duration of the window of peak performance was similar for men and women, with men sprinters and hurdlers having a shorter window than male athletes in all other events. Knowing the age of their peak and the period over which they can maintain that peak would benefit athletes and their coaches when considering selection of and preparation for specific events at international level.

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