SUMMARY

The Diversification and Development of Sprint Performance in Athletics

In this dissertation, I argue that the awareness of the relationship between sports performance and an athlete's age can translate into the possibility of predicting one's peak performance in any given sports discipline. Information about the age at which the peak-of-sports-form accrues, along with the optimal time to start the sporting rivalry and choice of the sports specialization is essential for selection and matching to the respective disciplines and competitions. Based on the study of the data, both practical forecasts and substantive suggestions regarding the future development of sports performances in active athletes can be drawn.

The main aim of the study was to evaluate the course of the successful sports careers of women and men sprint races (selected 100-, 200- and 400- meter runners) at various stages of the athletes' careers.

The primary research group consisted of 600 male and female sprinters specializing in competing in three sprint distances (100, 200, and 400 meters). The analysis took into account the differences in the Polish and Foreign competitors, female and male groups, and assessed the pace of reaching the peak of "sporting" performance in all examined groups. The statistical analysis included 6399 results of the best results from Poland and the rest of the world. The analyzed material comprises 1640 results of the fastest female athletes (running 100, 200, and 400 meters), 1,610 results of the world's fastest sprinters, along with 1,537 best results of Polish female athletes, and 1,612 results of the best Polish male competitors.

When examining the course and development of sports careers of competitors from Poland and the world, their best personal best results in each year of competitions were assigned to three research protocols that took into account three variables: age (protocol 1), the following years of their competition (protocol 2) and the period before and after their PB (personal best) record (protocol 3).

To characterize the changes taking place during the sports careers of the surveyed individuals, we used, among others, comparative analysis, basic statistical measures, and tests (ANOVA), segment regression model, and time series analysis (the so-called single base and chain indexes). In order to determine the relationship between individual competitions and the final result, we carried out the so-called **Pearson correlation analysis**[i].

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[i] **The Pearson correlation method** is the most common method to use for numerical variables, as it assigns a value between − 1 and 1, where 0 is no correlation, 1 is a total positive correlation, and −1 is a total negative correlation.

The analysis of the careers of the best Polish and world competitors, carried out in the dissertation procedure, allowed us to determine the optimal age of the successful sports career in individual sprint races. That took into account such variables as the sexual dimorphism and differences in sports ontogenesis between the competitors of individual sprint competitions from Poland and "Abroad/Foreign Athletes". In addition, the analysis of the collected data allowed to determine the differences in the development of the successful sports career in "early- maturing" athletes and "late-maturing" athletes.

The conducted investigation and the obtained results suggest the following conclusions:

- The peak of the most successful sports careers in the best foreign male athletes, in 100 m, ranges between the age of 22 to 31, and respectively 21 to 26 years amongst the athletes running 400 m. Subsequently, among women (100 meters runners), the same peak is observed between the ages 24-28 and 23-27 years of age in the females competing in 400 meters. Meanwhile, the highest "exercise capacity" in Polish competitors was noticed in the range of 22-28 years (100 m) and 22-31 years (in 400 m). Consequently, the gathered data suggests that the highest "exercise capacity" in female athletes from Poland is observed in a group of 22–27- year-olds (100 m) and 24–31-year-olds (400 m), respectively.

- Moreover, the Polish athletes showed a tendency to begin their sports careers at the age of 15, which was on average two years earlier in comparison with their foreign colleagues. When compared with the following years of their sports careers, it can be suggested that the most dynamic development of the sports careers among the surveyed athletes falls, on average, either until the age of 22-23 or in the first six years into their sports careers. Interestingly, it was also identified that while the foreign athletes showed a tendency to end their professional careers between the age of 32 and 34, the Polish athletes were more likely to retire from professional sport somewhat two years earlier at the age of 30-31. Still, there is very little evidence to suggest that there is a considerable difference in the length of their sports careers between the Polish and Foreign athletes, for a much closer comparative analysis indicates that both groups had shown a proclivity to end their sports careers in the 15th year of their sports careers.

- The analyzed data suggest that most competitors competing over a distance of 100 meters reached the peak of their speed abilities on average at the age of 23 and that they were able to maintain this "high level of performance" for an average of another ten years after reaching this peak.

- The most dynamic improvement in the level of sports results among the surveyed groups of sprinters was characteristic to the competitors competing over a distance of 400 m, especially into the first five years of their sports career. The slowest pace of development of the level of sports results was characteristic in the athletes specializing in 200 m run, except for the group of Polish female runners in this distance.

- The analyzed data also suggests that men (in sprints), on average, were able to reach the peak of their speed capabilities both two years faster and two years longer than their fellow female colleagues.

- Furthermore, the most dynamic development of the high level of sports results took place in the year preceding the achievement of PB by competitors of all the surveyed groups. Interestingly, the upcoming season was characterized by a significant decline in the level of sports performance. The degree was proportional to the degree of progress in the vast majority of the analyzed groups.

- It was also established that the period of specialized training necessary to achieve a record level of sports results among the studied groups of athletes characterized by a progressive pace of development of the level of sports results ranged from one to four years.

- What is more, Polish athletes competing in the 400 m distance characterized by a progressive rate of development of their athletic performance achieved significantly better results concerning early maturing athletes. Contrary to Polish runners and 400 m runners, only the world's best sprinters of the early-maturing group achieved record levels of sports results, that were unattainable for athletes clustered in the late-maturing group.

- Characteristically, during the development of their sports careers in almost all surveyed groups, the competitors recorded progress concerning their first starts. The upward dynamic of the results is greater in the early years of the start (shown in protocols 1 and 2) and weakens in the subsequent years, due to the stabilization of the results. Protocol 3 is noteworthy for it exemplifies continuous and dynamic progress in the development of the sports career, which continues uninterruptedly until the achievement of the life record. After this time, a period of decreasing results is observed.

- Polish athletes are characterized by greater dynamics in the development of their sports

career, compared to the base period when collated with the best sprinters in the world. It is also worth notice that the changes which took place at a given moment in the sports career of the surveyed athletes (concerning the preceding season) are characterized by high dynamics, and Chain indexes confirm the upward trend in the results achieved, which in the groups of all players continues until they attain the highest scores. The statistical data also indicates that in most of the cases, the moment of reaching the PB record in Protocol 3 preceded by a considerable increase, and according to the index values set out in protocols 1 and 2, it is also noticeable that achieving the highest result in one's career is usually followed by a steady decline in the level of future results. In addition, Protocol 3 also exemplifies substantial drops in the value of the chain indexes in the season following the record result