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MATHEMATICAL MODELS OF LONG-TERM ADAPTATION IN SWIMMING THEORY AND METHODS OF SPORTSMEN TRAINING

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Abstract. In swimming, as in other disciplines, it is extremely important to follow athletes' development. In order to do so we can use performance progression models. In models we can use the progress of top-level athletes as milestones we measure progress of our trainees. The athletes, during their careers, are known to have different periods of response to training practices so the models can be used to modify training routine so it is most beneficial to them. Furthermore, by using the trend of elite athlete's progression and following biological maturation we can create a long-term development model. These models include how their organism adapts to training routine in order for them to sustain top speed for longer duration.

There have been different kinds of performance progression analyzes for world championships and Olympics but not so much information about record holders, how did they progress in long-term training. By analyzing all-time top performance swimmers, we can analyze relationship between their training routine and their results. Thereafter, coaches and swimmers can use that model for monitoring and developing their own long-term training plan.

In this study the data from usaswimmig.com and swimranking.com databases were used to create 3 models: sprinters, middle distance swimmers and distance swimmers – 100m, 400m and 1500m, respectively. Each model was based on the all-time top 15 male swimmers. For each athlete performance at 3 distances was considered to acquire information on their endurance versus power, further in text referred as ratio. Thereafter, basic calculation was done to establish peak performance age and ratio between distances. Ratio shows how well athlete can keep same speed if distance is increased. For example, for sprinters there were 2 ratios calculated, 200 m versus 100 m and 100m versus 50 m distances. Afterwards, the inverse exponential cure was created for each group. Initial findings for sprinters showed that peak performance for 100m is at age 23.17. However, current world record holders age was 17.91 when he set it. Furthermore, the lowest ratio between times 200m and 100m has been achieved at age 16.2. It is highly possible, that this discrepancy is reflection of puberty stage when athletes demonstrate excellent efficiency in producing energy via oxidative pathways, comparable to that of anaerobic power in post-puberty. This needs to be considered while developing an athlete's aerobic endurance. After looking at performance progression model which gives an overview of different athletes' development, it shows that results during early childhood can't be taken into consideration for future result prediction. However, performance progression models help to understand how fast swimmers should be expected to swim at certain age. And the rate of progression is important to identify talented swimmers at as early stage as possible.