ANAEROBIC POWER AND DEVELOPMENT OF FATIGUE IN FREESTYLE SPRINT SWIMMING

Maren Witt, Jürgen Küchler

Institute for Applied Training Science Leipzig, Germany

INTRODUCTION

The race structure in 100 m freestyle differs between athletes in one competition and is also dependend on the state of conditioning of an athlete in the course of several years (Küchler/1993). Figure 1 shows typical variants. In 100 m - freestyle swimming the highest speed is reached at the beginning. The values vary between 95 and 100 % of individual maximum in the first and between 85 and 90 % in the last quarter of the race. Athletes of the first group reached higher velocities at the end of first lane. Members of the second group succeded, contrary to the first group, to perform an almost constant velocity up to finish. Popov showed that one athlete can reach top results with both approaches. We found that the loss in velocity in the second group increases with a higher swim velocity at the beginning related to individual maximum.
We expect that metabolic muscle properties determine the optimal race structure for the athlete.
In literature there are conflicting views on the relationship between anaerobic swimming and dry-land power (Costill/1983; Höltke/ 1992; Johnson/1993; Tanaka/1993). Therefore the aim of the study was to describe the relationship between swimming performance and anaerobic dry-land power test to develop posibilities for specific anaerobic power diagnosis in a standardized dry-land test.

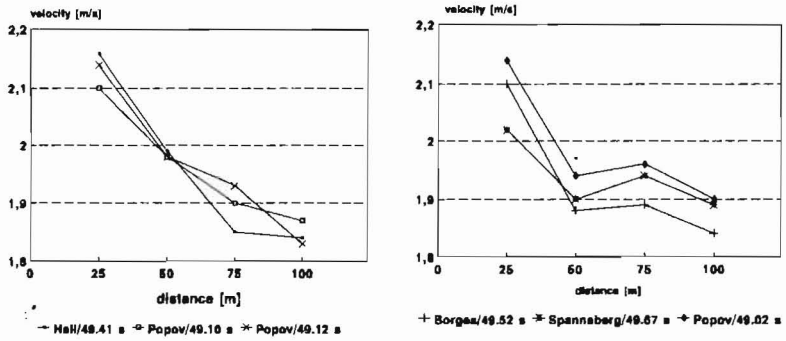

figure 1: race structure of freestyl sprint (athlete, final time)

METHODS

Members of the German national swim team were tested on the biokinetic swim bench. 42 athletes performed a test lasting one minute on level 5. The work per repetition was represented in percent of the personal maximum (10 RM). Additionally for some athletes the 50 m - and 100 m - freestyle sprint speed was analysed. The swiming speed in 100 m - sprint was expressed in percent from the maximum in 50 m - sprint.

Table 1: Comparison of maximum velocity in 50 and 100 m freestyle competition and mean velocity in 100 m freestyle sprint

swimmer	compe-tition	100 m - time	v_{max} 50 m	v_{max} 100 m	v_{mean} 100 m
Popov	OG92	49.02	2.24	2.14	1.985
Popov	EC95	49.10	2.18	2.10	1.96
Popov	WC94	49.12	2.16	2.14	1.97
Hall	WC94	49.41	2.14	2.16	1.96
Borges	WC94	49.52	2.10	2.10	1.94
Biondi	OG92	49.53	2.24	2.14	1.97
Spanneberg	EC95	49.67	2.15	2.02	1.94
Majolis	WC94	50.20	2.14	2.05	1.93
Prigoda	OG92	50.25	2.20	2.17	1.96
Zikarsky,Bj.	GC95	50.35	2.08	2.05	1.92
Le	WC94	54.01	1.99	1.94	1.79
Lu	WC94	54.15	1.90	1.86	1.77
Zhuang	OG92	54.64	1.95	1.84	1.77
van Almsick	WC94	54.77	1.92	1.88	1.77
Thompson	OG92	54.84	1.95	1.86	1.77
van Almsick	GC95	55.17	1.91	1.85	1.755
van Almsick	EC95	55.34	1.91	1.88	1.75
Plewinski	OG92	55.72	1.94	1.86	1.755
Martino	WC94	55.77	1.90	1.82	1.72
Franco	EC95	56.51	1.90	1.82	1.71
Mescheriakova	EC95	56.78	1.90	1.82	1.71
Osygus	EC95	56.89	1.87	1.82	1.71

RESULTS

Figure 2 summarizes the results. There are athletes with high as well as smaller conformity between intensities in water and dry-land test. High conformity indicates that the swimming performance is strongly influenced by anaerobic capacity of working muscles. The conformity increases when both tests are performed with only a small temporal interval.

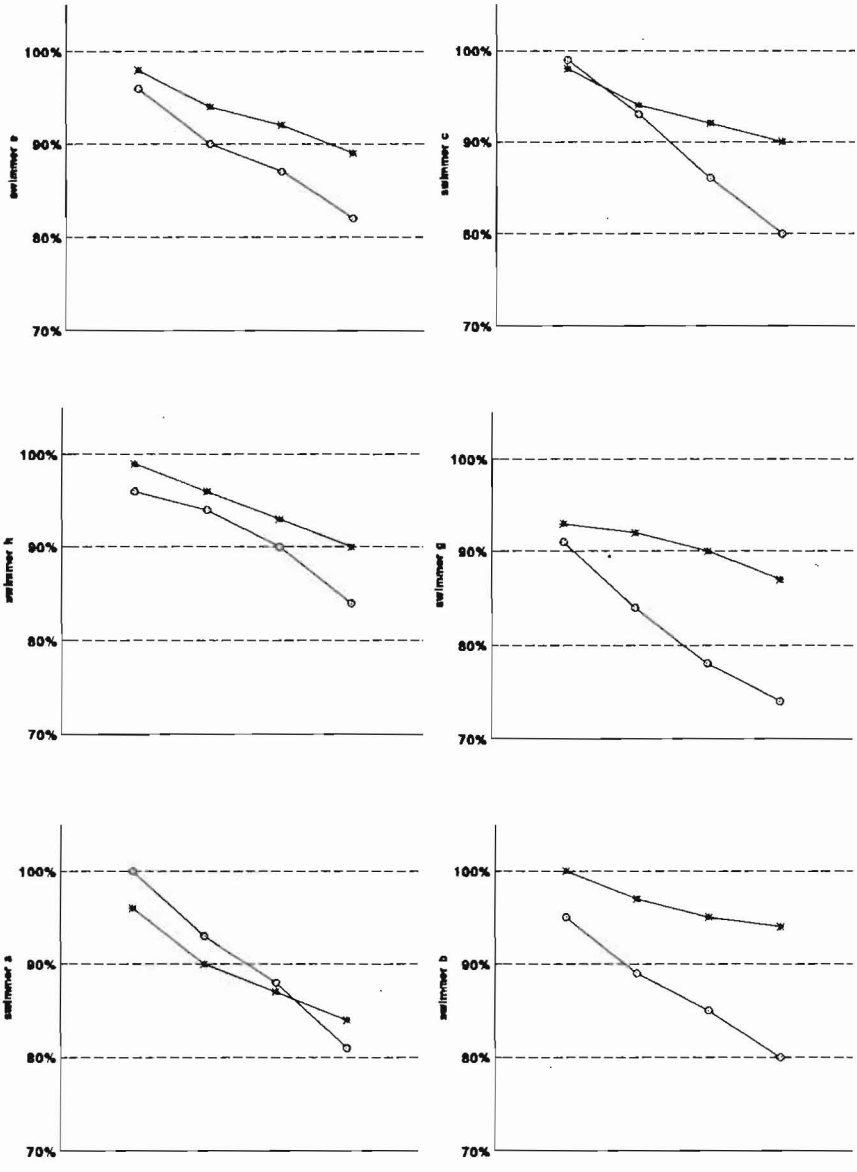

figure 2: Comparison of intensitics in swimming (stars) and dry-land power test (circles)

Athletes a, h and e show similar intensities in swim race and dry-land test. Athlete g performed only low intensities at the beginning in both tests. This is not typical for sprinters. Decrease in intensity in dry-land power test characterises the level of anaerobic glycolytic metabolism. In this respect individual differences

between top athletes were found. We observed variations in intensity at tests on the biokinetic swim bench during the year too. This is an expression of variations (work per repetition and speed per quarter in % from maximum) of metabolic muscle properties. Dry-land testing on a swim bench can help the athlete to know more about metabolic properties of his „swim" muscles in the whole season. For a comparison of swimming and dry-land power it is necessary to use relative values in form of intensity of the maximum.

Differences in the final swim time are results of lower speed at beginning and/ or of higher decrease in swim velocity during the race. This decrease of velocity is an expression of muscle fatigue. The results of competition analyses of top athletes correspond to results of dry-land power tests on the biokinetic swim bench.

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