

## **VARIABILITY OF THE SOMATIC FEATURES AND RESULTS OF FEMALE FINALISTS IN THE 800 METERS FREESTYLE AT FINA WORLD SWIMMING CHAMPIONSHIPS**

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### **Key words:**

- athletic competition,
- FINA World Championships,
- swimming,
- age,
- results

### **Abstract:**

**Introduction:** Competition in the long distance swimming events not only requires high level of technical skills, physical preparation or deliberative tactic, but also abilities to appropriately redistribute a swimming velocity over the distance.

**Purpose of research:** The purpose of this paper is to gather information about age, athletics level of performance, swimmers energy management and somatic features variability of the best long distance female swimmers in the world.

**Material and methods:** Results of female finalists in 800 meters freestyle event were researched and compared. Data contains results from three consecutive FINA World Swimming Championships: Shanghai 2006, Manchester 2008 and Dubai 2010. Analysis of variance using the ANOVA Test, Post-Hoc Test and Tukey's Test (RIR) to evaluate swimming velocity dynamics, differences of the results in each of the championships and the impact of the age on results.

**Results:** Results analysis indicated that the competition was progressing dynamically, regardless the best result achieved during FINA World Championships in Manchester (2008). Evaluation of swimming velocity at each quarter of the distance indicated, that middle quarters (between 200 and 600 meter) are being swam with the lowest velocity and the first quarter with highest. Somatic features analysis indicated slim body type of the best female swimmers. On the other hand, the average age of female medalists during consecutive championships raises, despite absence of significant correlation between age and results.

**Conclusion:** Despite the change of rules regarding racing suits, it can be anticipated that the results are going to be improving as an evidence shows that the progression of athletics level of performance between 2006 and 2010 has raised by 1,2%. Swimming with an even velocity over the majority of distance with ability to accelerate gives more chance to succeed. Such ability is characteristic feature of more experienced swimmers.

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## **INTRODUCTION**

Sports competition in swimming is quite specific. It contains of two aspects: first, is the watery environment which is different to the one people adapted to, and second, is the absence of interactions between competitors during the race. In swimmers, as in other

disciplines, athletes perform at the highest and prestigious level of competition e.g. World Championships. The difference between swimming and other disciplines, is that the venue length changes from 25 meters to 50 meters swimming pool every year, During the Olympic year, at FINA World Championships, swimmers compete in the 25 meter long venue. To make it even more interesting, changes occur also in the swimming events itself. The longest female swimming event in the 25 meter swimming pool is the 800 meters freestyle, but in the 50 meter swimming pool it changes to 1,500 meters freestyle. Such difference was introduced at FINA World Championships for the first time in the 2001.

An important element in the preparation of a competitor is his technical skills related to overcoming significant resistance in the aquatic environment. Swimmers capable of better lay the water can swim with higher velocity than the technically weaker competitors, with similar propulsion force [1, 5, 6]. Over long distance in swimming, gaining 0,01s at least one length of the pool translates to a few tenths at the end of the distance. The other increasing resistive drag element is friction between water molecules and the body. To the end of 2009 competitors can use the swimsuits covering about 70% of the body, which were made of materials greatly increase the buoyancy of the swimmer and reduced friction, so that the propulsion movements were more effective [2, 18].

Currently, swimmers can only wear swimming suits which cover certain areas of their body. This rule was however introduced recently. Prior to that, swimmers were allowed to wear racing suits which covered almost whole swimmer's body. Nowadays, female swimmers can only wear suits which have uncovered back and cover legs to the knee level only. Male swimmers on the other hand, can only wear only shorts which cover legs to the knee level but do not extend above the navel [4]. Before the audit regarding racing suits, the impact of technology on the results progression was evident. During FINA World Swimming Championships in Rome only, 43 new world records were set. All swimmers who set a new world record was wearing high technology suits. On the other hand, during the FINA World Swimming Championships in Dubai (2010) only four new world records were set.

Currently, the results are driven by the level of physical performance, race tactics and the level of somatic features. Worth to mention is the career time lengthening phenomenon (up to 27 years), especially in the short events such as 50m and 100m [7, 8]. At Olympic Games 2008 the average age of female swimmers competing in the 800 meters freestyle event was 20. However, recently this average age is being gradually elevated amongst long distance female competitors – 1,500 meters freestyle [19].

The interesting is factor of somatic features level. One of those very important features is the swimmer's hight (lower and upper limb length, hand and foot size etc.) and it's relationship with swimmer's body mass. The question arises: are those features absolutely necessary to become a champion in 800 meter freestyle event? [11]

Competing in the longest event requires not only to have perfect technical skills such as turns, which are essential to quickly change directions when reaching the wall, but also skills which allow swimmer most efficiently manage his energy systems during the race.

When in the highest level of competition women finalists present similar technical, physical and psychological skills, the better tactical preparation and strongest finish are therefore factors which decide who wins the race [14, 15, 17].

## **PURPOSE OF RESEARCH**

The purpose of this paper is to gather information about athletics level of performance, swimmers energy management and somatic features variability of the best long distance female swimmers in the world. Therefore four questions are to be challenged:

1. Does the age of competitors affects the results?
2. What tactical approach is the most effective?

3. Where there any vital, athletic level of performance and somatic features differences between female finalists of FINA World Swimming Championships?
4. How was the 800 meter freestyle results progressing over the period of four years?

### RESOURCES AND METHODS:

The results of twenty four female finalists in the 800 meters freestyle event were researched and compared. Data contains of eight top results from each consecutive FINA World Swimming Championships: Shanghai 2006, Manchester 2008 and Dubai 2010.

The source of the above data was the official European Federation of Swimming (LEN) website and another swimming federations of Europe [20].

The statistical analysis included:

- Descriptive analysis
- calculations of the speed of each 50, 100, 500 and the whole distance using following formula:  $v = d / t$   
where:  $v$  – velocity,  $d$  – distance,  $t$  – time
- differential analysis between segments ( $1/4$ ,  $1/2$ ,  $3/4$  of the distance, and the whole distance)
- calculation of the athletic performance level using following formulas:

$$d[s] = \bar{x}_A - \bar{x}_S$$

$$d[\%] = \frac{\bar{x}_A - \bar{x}_S}{\bar{x}_S} \times 100 \%$$

where:

$d[s]$  – athletic performance level difference in seconds

$d[\%]$  – athletic performance level difference in percentage

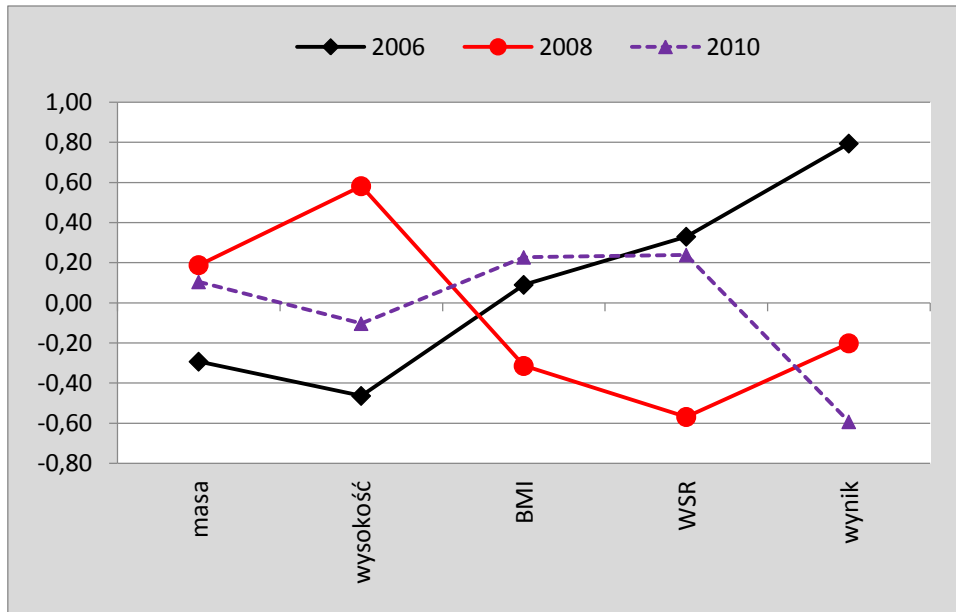
$\bar{x}_A$  – average arithmetical value – worse results

$\bar{x}_S$  – average arithmetical value – better results.

- Analysis of variance using the ANOVA Test, Post-Hoc Test and Tukey's Test (RIR) to evaluate swimming speed change dynamics and the impact of age between each competitor.
- Calculations performed in aid of software Statistica 9.0.

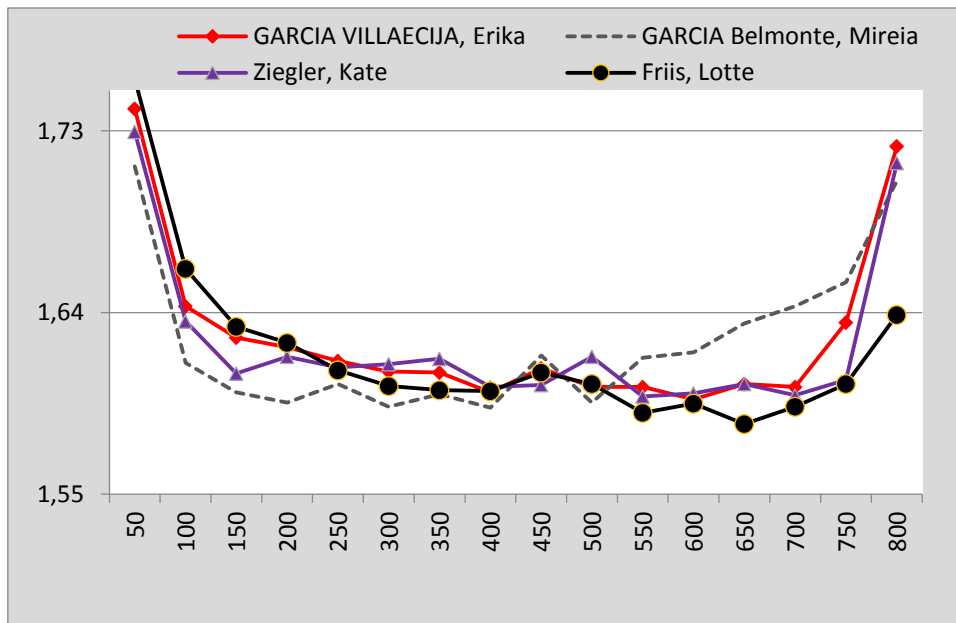
### RESULTS AND DISCUSSION

The range of the age of FINA World Swimming Championships finalists was between 19 and 22. The oldest finalist was 26 years of age in the 2008 and 2010. The age span in Dubai 2010 in the 800 meter freestyle event was significant. In the same final event were competing swimmers of the longest competing experience (26 years), and the youngest, 15 years old swimmer who finished fifth (tab. 1). It could be said that the experience of Spanish swimmer Erika Garcia Villaecija, gained competing in three consecutive FINA World Championships, had significant impact on her final position. She finished fifth in 2006, fourth in 2008, and in Dubai (2010) she won gold. The least age span was recorded in Shanghai 2006 – 16-23 years of age. The somatic features level analysis (fig.1) indicates, that the tallest swimmers were competing in 2008 (181cm), and the shortest in 2006, who also were classed as lightest. Rohrer's factor indicates, that all the competitors were characterized by lean body shape (tab. 2).



**Fig. 1.** Moto-somatic profiles 8 top swimmers of FINA World Championships in 800 meters freestyle

The skills of the energy management during the long distance race is often a deciding factor when it comes to taking places at the end of the race. The high speed in the beginning of the race doesn't usually mean that it can be held over the whole distance. Only adequately scheduled tactic as well as athletics performance level allows swimmers to perform the whole distance at the high level. It was clearly visible during the FINA World Championships in 2010. Dutch swimmer Lotte Friis was at the lead for the first 600 meter, however her swimming speed was gradually decreasing and other swimmers were closing. The final 200 meter part of the race was deciding. The skill of acceleration at the last 200 meter part of the race was definitely a strength of a twenty years old Spanish swimmer Garcia Belmonte, Mireia. She was swimming at the 7th position at the first part of the race and therefore moved up and finished at the medal position. Belmonte was at the 6th position before the final 200 meter of the race, where she accelerated by 3,45 seconds and finished the race at 2nd position. Similar tactic was used by another Spanish swimmer, Garcia Villaecija Erika, who swam the last 200 meter by 2,74 seconds faster than her 3rd 200 meter of the race (fig. 2). Another example could be Chinese swimmer who was at the last position after first 600 meter. She also decided to accelerate at the end of the race by 2,65 in her last 200 meter what allowed her to finish 5th. It seems to be very important in long distance swimming, that swimmers are not only able to perform the whole distance in constant speed but also have an ability to gradually increase it every 200 meter. All the swimmers from a medal position possessed such ability although, the particular attention should be focused on mentioned Belmonte, as well as swimmers competing in Manchester 2008: Rebecca Adlington (gold medalist), and Kylie Palmer (silver medalist) who swam each 200 meter faster by 1,09 and 2,33 seconds.



**Fig. 2.** Swimming velocity of female finalists of 800m freestyle in FINA World Championships Manchester 2010 (4 top competitors)

Needless to mention, swimming race analysis clearly did not point out any significant influences of high technology racing suits on the results progression (fig. 1,3,4). Only gold medalist from 2010 finished the race slower (8:11.61) than the gold medalist from 2008, Rebecca Adlington (8:08.25). The rest of the competitors finished the race significantly faster. Similar situation takes place when compared results from 2010 and 2006 where results improve again. It is also worth to mention results achieved by a gold medalist from Dubai, Erika Garcia Villaecija (26 years old), who also participated in three previous championships. The career development of this 26 years old swimmer can be described as a constant progression after reaching the senior age. In the age of 18, her 800 meter freestyle result was 8:50,62 (FINA World Cup, Berlin 2002). In the following FINA World Championships, as this is the subject of this analysis, her results were also gradually improving. In the FINA World Championships in 2006 she swam 800m in 8:27,17; it was not her best result in that period tough. In 2008 championships (Shanghai) her result was 8:13,93. She happened to achieve even better result during European Championships (Debrecen 2007) – 8:12,40 (silver medal) Her last FINA World Championships were her best of all: the World Champion title and her new personal best time of 8:11,61 - without aid of high technology suits.

Detailed analysis of swimming velocity during next three consecutive FINA World Championships indicates following differences: 2010 finalists (fig.3) swam the first 400m and last 100m at the highest swimming velocity, although the middle section of the race similar to the finalists from 2008. The swimming velocity of competitors ranked 4-8 (fig.5) indicates domination of finalists from 2010, but analysis of a gold medalist shows domination of competitors from 2008 (fig.6). It should be noted that even though swimming velocity of competitor from 2010 was a little lower and weaker between 250 and 600 meter, it was gradually increasing during the last 200 meters what eventually allowed her achieve a personal best result.

The comparison of the swimming velocity of the finalists in three consecutive FINA World Championships (2006, 2008, 2010) together with a final results (fig.4) shows, that swimming velocity of competitors in 2010 was clearly highest during first 400 meters and last 100 meters of a whole race. It was also adequate to the result which was also better from other finalists. Analysis of the variances shows, that difference in swimming velocity of the

competitors in 2006 and 2010 was statistically significant during on the distance between 200th and 800th meter. Variances in swimming velocity between finalists from 2006 and 2008 was also recorded in the middle of the distance 400-650m.

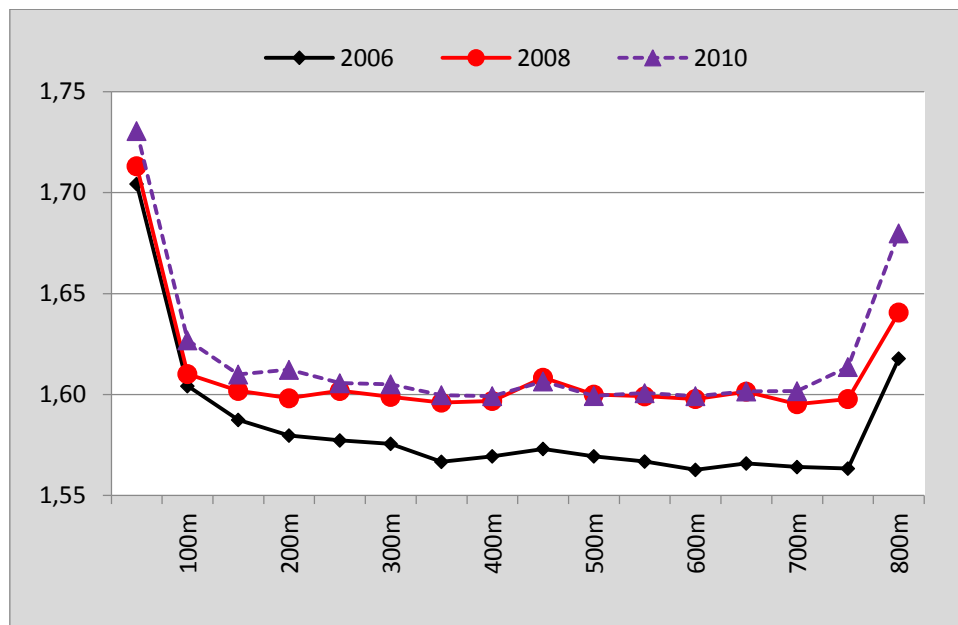


Fig. 3. Swimming velocity of finalists in 800 meter freestyle in FINA World Championships

Table 3 shows the differences in athletic performance level amongst the best 800 meter freestyle female swimmers of the FINA World Championships and the detailed analysis indicates that level of the athletic performance was improving. The negative variance was achieved when comparing the group of medalists from championships in 2010. The differences were slightly positive towards medalists from 2008 (0,69% and 0,16%). However, velocity level of all finalists recorded constant increase, and the most significant variances recorded between finalists of 2006 and finalists of both 2008 and 2010 championships (1,3% and 1,82%). The variance level between finalists of 2008 and 2010 championships was only 0,51%.

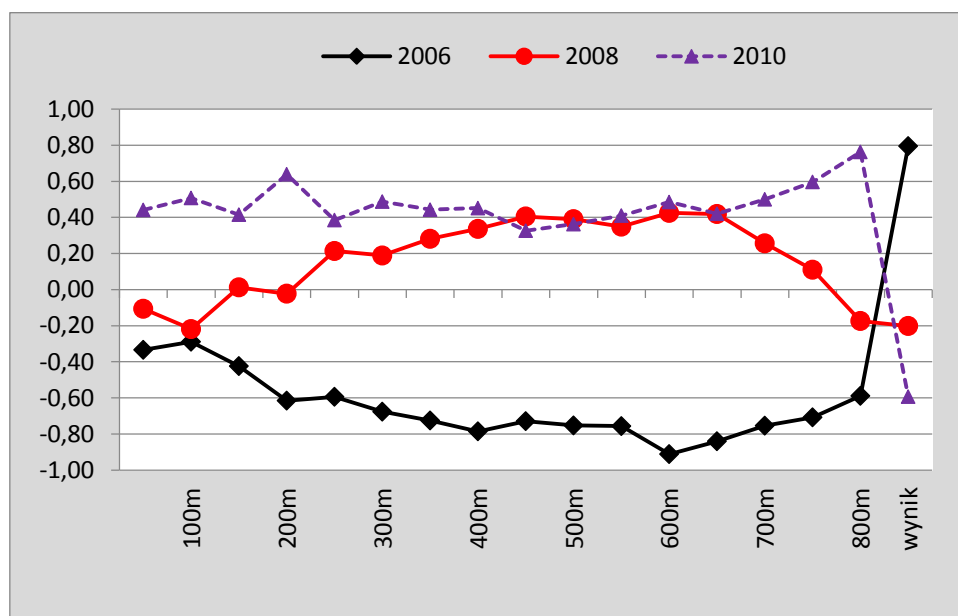


Fig. 4. Normalized values of swimming velocity and the final result

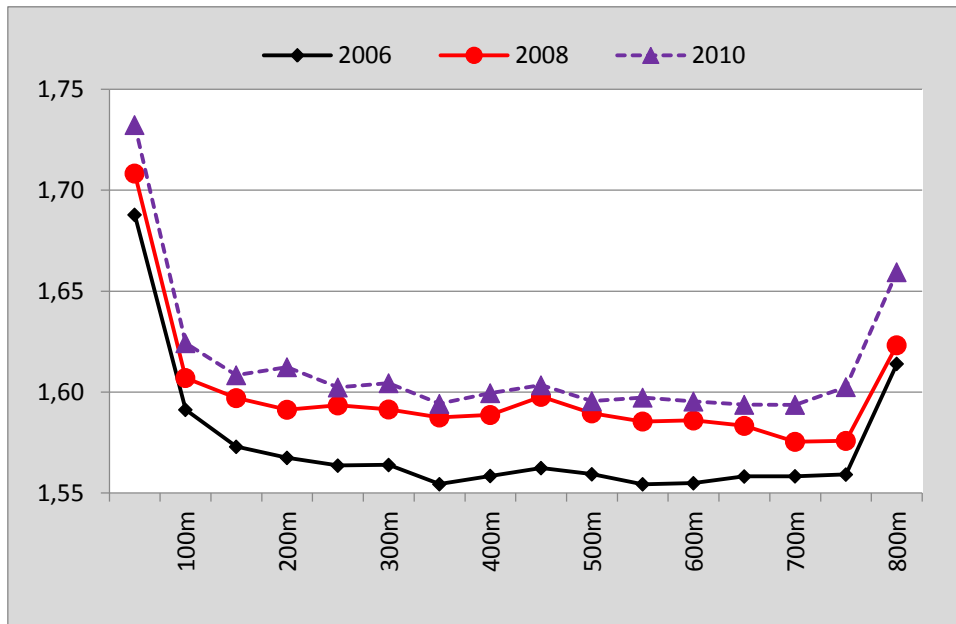


Fig. 5. Swimming velocity swimmers ranked 4-8 in 800 meter freestyle in FINA World Championships

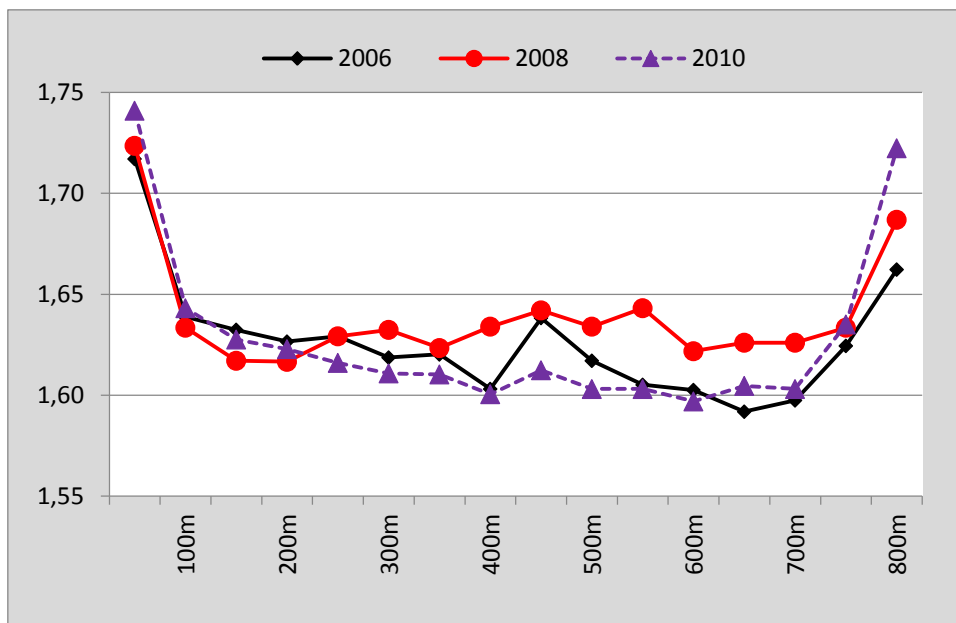


Fig. 6. Swimming velocity of gold medalists in 800 meter freestyle in FINA World Championships

## CONCLUSIONS

Data analysis established the following:

1. Competition was progressing dynamically. The athletic level increased between 2006 and 2010 amongst finalists by 1,2%
2. The best result was achieved during FINA World Championships in Manchester (2008)
3. Dividing distance onto four sections indicated that the middle section of the whole distance (200-600m) was the slowest and the first 200 the fastest.
4. Swimming velocity analysis of the 100m sections indicated that there was no linear swimming pattern amongst the finalists.

5. The best swimmers characterized a medium shaped body type.
6. The age hadn't on impact the results.
7. The increase of the average age value of the medalists.

The 800 meter freestyle event at the FINA Short Course (25m) World Championships is one of the longest there. To succeed and achieve a great result it is depended on the level of physical and tactical preparation as well as skills of energy and velocity management during the whole distance. Most of the current long distance female swimmers tend to swim the middle section of the distance at a lower pace. Only swimming in the evenly distributed pace over the whole distance with an ability to accelerate in the last section gives a chance to succeed. The results achieved by the top finalists (1-3 position) shows an evenly distributed pace during the race.

A similar conclusion was reached by Erdmann and Lipinska, who made an analysis of the 800m female and 1,500 male freestyle races during the Olympic Games in Beijing [3, 9, 10].

Whilst analyzing the rests their achieved interesting data regarding age of the medalists. Increase in the average age of the medalists (19-23) can indicate the changes of the long term training approach of which the aim was to extend the athletic careers as well as achieving and maintaining high effectiveness when reaching the retirement. For the proof of above may stand the age of the finalists and medalists (26). Lately we are witnesses of such phenomenon amongst male swimmers too [7, 12, 13, 16].

The female 800 meter freestyle race analysis proofs that the athletic performance level has changed for better despite changes made to rules regarding racing in high technology suits. The aim of the FINA directories was to definitely reduce technology development impact on the results progression.

**Table 1.** FINA World Championships finalists age

World Championships	Group	Average	Span
2006	medalists	19	17-23
	finalists	19	16-23
	position 4-8	19	16-22
2008	medalists	20	18-24
	finalists	22	18-26
	position 4-9	22	19-26
2010	medalists	23	20-26
	finalists	21	15-26
	position 4-10	19	15-23

**Table 2.** Variance of the BMI and Rohrer's of the 800 freestyle finalists in FINA World Championships

World Chamionships	Group	BMI		WSR	
		average	span	average	span
2006	medalists	21,77	20,55-22,99	1,24	1,22-1,26
	finalists	20,93	19,15-22,99	1,21	1,08-1,26
	position 4-8	20,6	19,15-21-63	1,19	1,08-1,26
2008	medalists	20,9	19,15-21,91	1,19	1,08-1,26
	finalists	20,4	18,12-22,45	1,13	0,98-1,26
	position 4-8	20,02	18,12-22,45	1,09	0,98-1,22
2010	medalists	20,97	19,15-22,99	1,19	1,08-1,26
	finalists	21,11	19,15-22,99	1,2	1,08-1,26
	position 4-8	21,22	20-32-21,86	1,21	1,15-1,25



**Table 3.** Variances in athletic performance level in 800 meter freestyle

World Championships	Gold medalists		Medalists		Position 4-8		Final	
	d(s)	d(%)	d(s)	d(%)	d(s)	d(%)	d(s)	d(%)
2006-2008	3,74	0,77	3,88	0,79	8,01	1,58	6,46	1,30
2006-2010	0,38	0,08	3,07	0,62	12,56	2,53	9,00	1,82
2008-2010	3,36	-0,69	0,81	-0,16	4,55	0,92	2,54	0,51

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