

## Monitoring the differences in swimming skills development among men and women medalists at the 21<sup>st</sup> World Aquatics Championships - Doha 2024, Qatar

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### Abstract:

*Aim:* This study aimed to identify differences in the parameters of swimming skills development among prize-winning swimmers of varying ages and genders, based on the results of the 21<sup>st</sup> World Aquatics Championships, held on February 2–18, 2024, in Doha, Qatar. *Material:* Achievements of 111 men and 111 women prize-winning swimmers were analyzed across 50 events in both sport and marathon swimming. *Methods:* The study used a theoretical analysis of the specialized literature and practical experience, along with a preliminary experiment, generalization of documentary materials and mathematical statistics. *Results:* A total of 31 countries won medals at the 21<sup>st</sup> World Aquatics Championships (Doha 2024). The USA recorded the most successful performances with 20 medals in swimming, followed by Australia with 16 medals in swimming and 2 marathon swimming medals, Italy (12+2), China (11), the Netherlands (6+2), Great Britain (7+1), Canada (7), Germany (6), France (2+3) and New Zealand (4). Countries in the second tier of rankings included Sweden (4 medals), South Korea (3), Portugal (2+1), Spain (2+1), Hong Kong (3), Hungary (1+2), Poland (3), Ireland (2), Lithuania (2), Japan (2) and Austria (2). Each one of the remaining countries, including Ukraine, Switzerland, Denmark, Israel, South Africa, Greece, Belarus, Bosnia and Herzegovina, Egypt and Brazil, won a single medal. Age-related differences were identified across distances. Men had a 1-7-year age advantage at seven distances, while no age difference was observed at five distances. Women had a 1-6-year age advantage at 13 distances. The overall average age of both groups was similar (men = 24.24 ± 1.88 years, women = 24.44 ± 2.04 years; t = 0.747; p > 0.05). Regarding swimming speed, the largest differences between men and women were observed in relay events (0.21 m/s), short-distance freestyle (50 m: 0.215 m/s; 100 m: 0.196 m/s), backstroke (0.196 m/s), butterfly (0.176 m/s) and breaststroke (0.176 m/s). The smallest differences were noted in long-distance freestyle events (400-800-1500 m: 0.135 m/s) and mixed relays (4×100 m freestyle and medley: 0.12 m/s). The overall difference in average swimming speed across all events was 0.16 m/s (men = 1.84 ± 0.16 m/s; women = 1.68 ± 0.14 m/s; t = 2.225; p < 0.05). *Conclusion:* The 21<sup>st</sup> World Swimming Championships highlighted the dominance of top-performing countries, with the USA, Australia and Italy leading in both quality and quantity of medals. Gender-based analysis revealed significant disparities in average swimming speed, particularly at shorter distances and relay events, with men demonstrating consistently higher speeds. However, smaller differences were observed in long-distance and mixed relay events, indicating the decreasing performance gap in endurance-based disciplines. So, these findings underscore the continuous evolution of competitive swimming performance across genders and distances.

**Keywords:** prestigious competitions, prize-winning swimmers, team rating, swimming distances, average speed, difference in achievements

### Introduction

The 21<sup>st</sup> World Aquatics Championships - Doha 2024 once again showed the dynamic evolution of competitive swimming on a global scale. As swimming continues to develop through enhanced training methodologies, strategic periodization and technological progress in sports science, national teams are increasingly including athletes across both sport and marathon swimming events. This integration allows for more flexible and effective team compositions that boost the overall medal potential at prestigious international competitions. Despite the high visibility of results, there remains a gap in the literature concerning the nuanced comparison between men and women performance metrics—particularly regarding age distribution, swimming technique and speed over various distances. Previous studies (Ganchar, 2015; Androsova, 2014; Platonov, 2011)

have explored elements of training methodology, psychological readiness and technical refinement. However, comprehensive data-driven analyses of recent elite performances are still limited, especially in the context of combined sport and marathon swimming achievements.

As the experience of theory and practice shows, the World Aquatics Championships are the most prominent international competition, which has been held since 1973 under the control of FINA (International Swimming Federation). They include swimming in a pool and open water—marathon swimming, starting in 1991—as well as diving, water polo and synchronized swimming. The swimming program has gradually been supplemented and expanded. It started from 29 types and reached 34 ones in 1991 and up to 50 types in total, for men and women, in 2024. Therefore, the opportunities for swimmers of each country to demonstrate personal achievements, which characterize a more reliable level of motor skills development in sport and marathon swimming, are expanding (Ganchar et al., 2021).

Specific information on the current parameters of swimming skills differences in athletes, depending on their age and gender, is found very sporadically and fragmentarily. This fact is evidenced by the publications on the theory and methodology of physical education and sports (Androsova, 2014; Hlukhov, 2023). Some authors (Bolshakova, 2015; Ganchar, 2018, 2020) published convincing papers on the specifics of men's and women's training based on similar opportunities for the formation of swimming skills. This area of research is also comprehensively presented in foreign information sources of literature and practice (Hannula & Thornton, 2001; Maglischo, 2003; McLeod, 2010).

A detailed analysis of the performance of swimmers in the World Championships highlights a continuous improvement in results, attributed to progress in training methodologies and increased specialization (Ganchar et al., 2018, 2023). Moreover, studies point out that gender-based differences in skill acquisition and performance outcomes can be linked to physiological and biomechanical factors, requiring specific training adaptations (Tarasevych, 2021; Platonov, 2011a, 2011b, 2021). The influence of periodization in long-term training programs has also been extensively studied (Bolshakova, 2015; Hruzevych, 2015). Its effectiveness in optimizing swimmers' performance at various stages of development has been demonstrated (Hellard, 2013; McGibbon et al., 2018; Neiva et al., 2014).

Recent monitoring efforts have aimed at assessing the progress of motor skills among elite swimmers, contributing to the refinement of coaching strategies and talent identification (Ganchar et al., 2023). International studies corroborate these findings, highlighting the importance of integrating biomechanical analysis with physiological assessments to enhance competitive performance (Schubert, 1990; Guzman, 2006; Salo & Riewald, 2008). Thus, the ongoing evolution of swimming training methodologies underscores the necessity for continuous research and data-driven decision-making in competitive swimming (Huang & Yongquan, 2025; Staunton et al., 2024a, 2024b).

Valuable information was collected during the Doha World Aquatics Championships in 2024 regarding the difference in the results achieved by men and women across various swimming distances. This relevant and reliable information will be used by coaches and swimmers in the training for the future World Championships of 2026.

*The purpose of the study* is to determine the level and degree of development of motor skills parameters in prize-winning swimmers. Therefore, the dynamics of the results in the swimming finals of the 21<sup>st</sup> World Aquatics Championships (February 2-18, 2024 - Doha, Qatar) was thoroughly observed and analyzed.

*Research task:* 1) to determine the differences in the parameters levels of swimming motor skills development among elite swimmers (prize winners) who participated in the prestigious competitions within the 21<sup>st</sup> World Swimming Championships in Doha-2024; 2) to apply the most notable results of the conducted studies to the modern practice experience for improving the swimming motor skills in different age groups. Based on the formulation of the research tasks, an appropriate object of study was selected: the dynamics of swimming skills formation in young people and adults at the current stage of sport and marathon swimming skills development.

## **Material & methods**

*Participants:* 111 men and 111 women among the strongest swimmers from 31 countries of the world, who became finalists and prize-winners (receiving gold, silver and bronze medals) at all 50 distances of sport and marathon swimming within the 21<sup>st</sup> World Championships – Doha 2024, Qatar

*Procedure:* The main research methods used were the following: theoretical analysis of specialized literature and practical experience, generalization of documentary materials, preliminary experiment, mathematical statistics. The *theoretical analysis of literature* on the topic included 33 sources, namely well-known specialists and experts. The *generalization of documentary materials* involved the analysis of official protocols of competitions within the 21<sup>st</sup> World Championship Doha-2024 (February 2-18) attended by athletes representing 199 countries of the world. These protocols were posted on the websites: [www.fina.org](http://www.fina.org); [www.swimrankings.com](http://www.swimrankings.com) ; [www.omegatiming.com](http://www.omegatiming.com). *Preliminary experiment:* the results of 3 prize-winners at each swimming event, with the calculation of their average swimming speed and average age, were taken as a

basis. Table 1 presents the results by the number of medals received by men and women, including also their average age and average swimming speed indicators, Table 2: the preliminary experiment allowed us to compare the average swimming speed of men and women in the same styles over similar swimming distances, which is reflected, respectively, in Table 3 and Table 4.

*Mathematical statistics:* Mean  $\pm$  S.E.M. (standard error of mean), indicators of the difference in the average results of men and women were calculated by means of the Student's t-test at a significance level of  $P < 0.05$  using Excel.

## Results

Analyzing the final starts in the 21<sup>st</sup> World Championships Doha 2024 enables the study of the swimming motor skills development in the more vital swimmers (prize winners). The recorded indicators reveal the highest level of development of swimming skills in elite swimmers participating in these prestigious competitions.

Table 1. Monitoring the results of swimming teams at the 21<sup>st</sup> World Swimming Championships Doha-2024, Qatar by the number of gold, silver and bronze medals received

Ranking of participating countries	Golden		Silver		Bronze		Total		Together
	men	women	men	women	men	women	men	women	men/ women
1. USA	4	4	3	3	6		13	7	20
2. Australia	2+	1	5	4+	1	3	8+	8+	16++
3. Italy		2	5+		3+	2	8++	4	12++
4. China	5	2		3		1	5	6	11
5. Netherlands		3++	2	1			3	3++	6++
6. Great Britain		2	1	1	3+		4+	3	7+
7. Canada	1			1		5	1	6	7
8. Germany		1	1	1	1	2	2	4	6
9. France	+		++	1	1		1+++	1	2+++
10. New Zealand	1	1		1		1	1	3	4
11. Sweden		2		1		1		4	4
12. South Korea	2		1				2	1	3
13. Portugal	2					+	2	+	2+
14. Spain	1		1	+			2	+	2+
15. Hong Kong		1		1		1		3	3
16. Hungary	+				1+		1++		1++
17. Poland					2	1	2	1	3
18. Ireland	2						2		2
19. Lithuania		1	1				1	1	2
20. Japan	1				1		2		2
21. Austria			1		1		2		2
22. Ukraine	1						1		1
23. Switzerland			1				1		1
24. Denmark				1				1	1
25. Israel				1				1	1
26. South Africa					1		1		1
27. Greece					1		1		1
28. Belarus						1		1	1
29. Bosnia and Herzegovina						1		1	1
30. Egypt						1		1	1
31. Brazil						+		+	+
Marathon	+++	++	+++	++	+++	++	9	6	15
Medals	22+3	20+2	22+3	20+2	22+3	20+2	66+9	60+6	126+15

*Notes:* the + - icon indicates medals won in open water long-distance swimming event (marathon swimming); in the 4×1500m relay (2 men + 2 women), medals are indicated for men and in mixed relays of 2 men/women.

Competitors from 31 countries were awarded with medals. So it was found that the most successful performance was recorded by the athletes from the USA: 20 medals in sport swimming, Australia:16+2 marathon swimming, Italy:12+2, China:11, Netherlands:6+2, Great Britain:7+1, Canada:7, Germany:6, France:2+3, New Zealand:4 medals. The *next ten teams* ranked by the number and classes of medals include

Sweden:4 medals, South Korea:3, Portugal:2+1, Spain:2+1, Hong Kong:3, Hungary:1+2, Poland:3, Ireland:2, Lithuania:2, Japan”2 medals.

*The third group of ten countries included:* Austria-2, Ukraine-1, Switzerland-1, Denmark-1, Israel-1, South Africa-1, Greece-1, Belarus-1, Bosnia and Herzegovina-1, Egypt-1 and Brazil - 1 medal in marathon swimming. Among men swimmers, the most successful athletes were: USA:13 medals, Italy: 8+2 marathon, Australia:8+1, China:5, Great Britain:4+1, France:1+3, Hungary:1+2, Netherlands-3 medals. As for women swimmers, they received medals as follows: Australia:8+1, USA:7, China:6, Canada:6, Netherlands:3+2, Sweden:4, Germany:4, Italy:4, New Zealand:3, South Korea:3, Hong Kong:3 medals. Therefore, the overall ranking of the performance of world strongest swimmers was the indicator of the awards received (quantity and type) by the prize-winning swimmers at the 21<sup>st</sup> World Swimming Championships - 2024 Doha, Qatar (Table 1).

As shown in Table 2, the most significant age advantage of male participants over female participants was found in the range of 1-7 years (7 cases): 50-100 m backstroke, 50-100 m breaststroke, 200-400 m individual medley, 4×100 m medley relay. The absence of age differences between men and women was observed in 5 cases: 200 m backstroke, 200 m butterfly, 4×100 m medley relay 4×100 freestyle medley relay and 4×1500 m marathon relay. Meanwhile, the predominance of women over men occurred in 13 cases (1-6 years), namely: in 50-100-200-400-800-1500 m freestyle, 200 m breaststroke, 50-100 m butterfly, and 4×100 m freestyle relay, 4×200 m freestyle relay, as well as in marathon swimming 5000-10000 m (mean ±S.E.M.: men =24.24 ±1.88 years; women =24.44 ±2.04 years; t=0.747; p>0.05).

Table 2. Summary table of average results and ages of finalists and prize-winners in the 21<sup>st</sup> World Aquatics Championships (Doha-2024, Qatar)

Swimmer results			Distance, swimming style	Age of swimmers, years		
men	women	difference		men=111	women=111	± difference
21,47	23,85	2,38	50 m freestyle	27	29	-2+
47,67	52,55	4,88	100 m freestyle	24	26	-2+
1.45,02	1.55,55	10,53	200 m freestyle	24	25	-1+
3.42,84	4.01,15	18,31	400 m freestyle	22	23	-1+
7.42,29	8.19,07	36,78	800 m freestyle	23	24	-1+
14.41,17	15.53,72	1.12,55	1500 m freestyle	23	24	-1+
24,30	27,49	3,19	50 m backstroke	20	22	+2-
52,91	58,86	5,95	100 m backstroke	25	22	+3-
1.55,56	2.07,29	11,73	200 m backstroke	20	20	0
26,40	29,64	3,24	50 m breaststroke	28	22	+6-
58,83	1.05,67	6,84	100 m breaststroke	28	21	+7-
2.08,34	2.21,32	12,98	200 m breaststroke	24	25	-1+
23,04	25,24	2,20	50 m butterfly	23	29	-6+
51,25	56,61	5,36	100 m butterfly	23	24	-1+
1.54,56	2.05,57	11,01	200 m butterfly	22	22	0
1.57,01	2.08,27	11,26	200 m individual medley	24	23	+1-
4.10,87	4.37,45	26,58	400 m individual medley	28	22	+6-
3.11,81	3.37,16	25,35	4×100 m freestyle relay	23	26	-3+
7.01,95	7.49,85	47,90	4×200 m freestyle relay	22	24	-2+
3.30,87	3.56,25	25,38	4×100 m medley relay	26	26	0
2 men	2 women	3.20,36	4×100 m freestyle medley mixed	-	-	-
95,40	106,25	10,85	4×100 m freestyle medley mixed	23	23	0
2 men	2 women	3.40,55	4×100 m medley mixed	-	-	-
1.52,32	1.50,44	1,88	4×100 m medley mixed	26	24	+2-
51.29,3	57.34,6	6.05,3	5000 m marathon	27	30	-3+
1:48.24,3	1:57.27,6	9.03,3	10000 m marathon	25	29	-4+
1:03.54,3	1:03.54,3	together	4×1500 m marathon mixed	26	26	0

*Age difference* (mean ±S.E.M.): men, 24.24 ±1.88 years; women, 24.44 ±2.04 years; t= 0,747; p>0.05.

The difference in the results between men and women is most characteristically reflected in the calculations of the average swimming speed. They are manifested by different swimming styles and the increased length of the distance covered. So, the results of prize-winning swimmers should be considered in the ratio of the average swimming speed at certain distances, as well as overcoming one or another swimming styles (Table 3, 4).

The most remarkable difference in the results of men and women in terms of average swimming speed is most evident in the 4×100 m relay, 4×200 m freestyle and the 4×100 m medley relay – 0,210 m/s; in sprint distances of 50-100-200 m freestyle – 0.196 m/s; also in butterfly swimming distances of 50-100-200 m – 0.176 m/s, then in breaststroke swimming distances of 50-100-200 m – 0.176 m/s. This is also noted in backstroke swimming distances of 50-100-200 m – 0.176 m/s and in medley swimming distances of 200-400 m – 0.145 m/s. The smallest difference in the achievements of men and women concerns mostly overcoming the long distances of 400-800-1500 m freestyle

swimming – 0,13 m/s, marathon swimming at 5000-10000 m and mixed relay 4×1500 m – 0.145 m/s; also medley relays 4×100 m freestyle and 4×100 m in the medley relay – 0.12 m/s.

Table 3. Dynamics of the difference in the results recorded by men and women (finalists and prize winners) in the 21<sup>st</sup> World Aquatics Championships (Doha-2024, Qatar) by swimming styles

Distance (m), swimming style	Average swimming speed, distance, time, m/s, men/women	Difference in average swimming speed, men/women	Rank of difference in distance and swimming style, m/s, men/women	Difference of results, m/s, men/women
50 m freestyle	50:21,47 -50:23,85	2.32-2.09=0.23	0.59:3=0.196	0.16 ±0.166 t= 2.225, p<0.05
100 m freestyle	100:47,67-100:52,55	2.09-1.90=0.19		
200 m freestyle	200:1.45,02-200:1.55,55	1.90-1.73=0.17		
400 m freestyle	400:3.42,84-400:4.01,15	1.79-1.66=0.13	0.39:3=0.13	
800 m freestyle	800:7.42,29-800:8.19,07	1.73-1.60=0.13		
1500 m freestyle	1500:14.41,17-1500:15.53,72	1.70-1.57=0.13	0.59:3=0.196	
50 m backstroke	50:24,30-50:27,49	2.05-1.82=0.23		
100 m backstroke	100:52,91-100:58,86	1.89-1.69=0.20		
200 m backstroke	200:1,55,56-200:2.07,29	1.73-1.57=0.16	0.53:3=0.176	
50 m breaststroke	50:26,40-50:29,64	1.89-1.68=0.21		
100 m breaststroke	100:58,83-100:1.05,67	1.70-1.52=0.18		
200 m breaststroke	200:2.08,34-200:2.21,32	1.56-1.42=0.14	0.53:3=0.176	
50 m butterfly	50:23,04-50:25,24	2.17-1.98=0.19		
100 m butterfly	100:51,25-100:56,61	1.95-1.76=0.19		
200 m butterfly	200:1.54,56-200:2.05,57	1.74-1.59=0.15	0.29:2=0.145	
200 m individual medley	200:1.57,01-200:2.08,27	1.70-1.56=0.14		
400 m individual medley	400:4.10,87-400:4.37,45	1.59-1.44=0.15	0.63:3=0.21	
4×100 m freestyle relay	400:3.11,81-400:3.37,16	2.08-1.84=0.24		
4×200 m freestyle relay	800:7.01,95-800:7.49,85	1.89-1.70=0.19		
4×100 m medley relay	400:3.30,87-400:3.56,25	1.89-1.69=0.20	0.24:2=0.12	
4×100 m freestyle mixed	200:1.35,40-200:1.46,25	2.09-1.88=0.21		
4×100 m medley mixed	200:1.52,32-200:1.50,44	1.78-1.81=0.03	0.29:2= 0.145	
5000 m marathon	5 km:51.29,3-5 km:57.34,6	1.61-1.44=0.17		
10000 m marathon	10 km:108.24,3-10km:117.27,6	1.53-1.41=0.12		
4×1500 m marathon mixed	6 km:63.54,3= a/s*1.56 m/s	1.56; 3834.3		

Notes: the icon "a/s\*" indicates the average swimming speed for the participant in competition: 2 men + 2 women.

Therefore, the total difference between men and women as for the average swimming speed using the existing swimming styles in these prestigious modern competitions is more than 0.16 m/s (p<0.05).

Table 4. Dynamics of the difference in results recorded by men and women (finalists and prize winners) in the 21<sup>st</sup> World Aquatics Championships (Doha-2024, Qatar), by swimming distances

Distance, swimming style	Average swimming speed, distance, time, m/s, men/women	Difference in average swimming speed, men/women	Rank of difference in distance and swimming style, m/s, men/women	Difference of results, m/s, men/women
50 m freestyle	50:21,47 -50:23,85	2.32-2.09=0.23	0.86:4 = 0.215	0.16 ±0.166 t= 2.225, p<0.05
50 m backstroke	50:24,30-50:27,49	2.05-1.82=0.23		
50 m breaststroke	50:26,40-50:29,64	1.89-1.68=0.21		
50 m butterfly	50:23,04-50:25,24	2.17-1.98=0.19	0.76:4 = 0.190	
100 m freestyle	100:47,67-100:52,55	2.09-1.90=0.19		
100 m backstroke	100:52,91-100:58,86	1.89-1.69=0.20		
100 m breaststroke	100:58,83-100:1.05,67	1.70-1.52=0.18	0.76:5 = 0.152	
100 m butterfly	100:51,25-100:56,61	1.95-1.76=0.19		
200 m freestyle	200:1.45,02-200:1.55,55	1.90-1.73=0.17		
200 m backstroke	200:1,55,56-200:2.07,29	1.73-1.57=0.16	0.54:4 = 0.135	
200 m breaststroke	200:2.08,34-200:2.21,32	1.56-1.42=0.14		
200 m butterfly	200:1.54,56-200:2.05,57	1.74-1.59=0.15		
200 m individual medley	200:1.57,01-200:2.08,27	1.70-1.56=0.14	0.87 = 0.174	
400 m freestyle	400:3.42,84-400:4.01,15	1.79-1.66=0.13		
400 m individual medley	400:4.10,87-400:4.37,45	1.59-1.44=0.15		
800 m freestyle	800:7.42,29-800:8.19,07	1.73-1.60=0.13		
1500 m freestyle	1500:14.41,17-1500:15.53,72	1.70-1.57=0.13		
4×100 m freestyle relay	400:3.11,81-400:3.37,16	2.08-1.84=0.24		
4×200 m freestyle relay	800:7.01,95-800:7.49,85	1.89-1.70=0.19		
4×100 m medley relay	400:3.30,87-400:3.56,25	1.89-1.69=0.20		
4×100 m freestyle mixed	200:1.35,40-200:1.46,25	2.09-1.88=0.21		

4×100 m medley mixed	200:1.52,32-200:1.50,44	1.78-1.81=0.03	0.29 = 0.145
5000 m marathon	5 km:51.29,3-5 km:57.34,6	1.61-1.44=0.17	
10000 m marathon	10 km:108.24,3-10km:117.27,6	1.53-1.41=0.12	
4×1500 m marathon mixed	6 km:63.54,3= a/s*1,56 m/s	1.56; 3834,3	

Notes: the icon "a/s\*" indicates the average swimming speed for the participant of the competition: 2 men + 2 women. Difference in average swimming speed (mean  $\pm$ S.E.M.): men = 1.84 $\pm$ 0.16 m/s; women = 1.68 $\pm$ 0.14 m/s;  $t=2.225$ ,  $p<0.05$ .

The most remarkable difference in the results of men and women in terms of average swimming speed can be observed in sprint distances of 50 m by various styles – 0.215 m/s, then in swimming distances of 100 m – 0.190 m/s, then in relay swimming – 0.174 m/s, and swimming distances of 200 m – 0.152 m/s. A minor difference in the achievements of men and women concerns mostly overcoming the long distances of the 400-800-1500 m freestyle swimming – 0,135 m/s, the long distances of the 5000-10000 m marathon swimming and the 4×1500 m mixed relay – 0,145 m/s; also, the medley relay of 4×100 m freestyle and 4×100 m in the mixed relay – 0,12 m/s. Thus, the total difference between men and women in terms of average speed of swimming by existing styles during these highly important competitions is more than – 0.16 m/s ( $p<0.05$ ).

## Discussion

Indicators in Table 1 show the current state of achievements of the best swimming teams in the world, including sport swimming and marathon swimming. We consider these indicators in aggregate, since numerous swimmers combine their successful performances over sport and marathon swimming distances. This fact provides additional opportunities for swimming teams to raise their ratings of successful performances at prestigious competitions. In our case, this is demonstrated by Table 1, which refers to the results of a study that allowed us to take into account the results of marathon swimming participants in the team rating. Swimming experts know how swimming technique is often combined by participants over marathon swimming distances. According to our data (Ganchar, 2015-a), the finalists and prize-winners of the World Swimming Championships (1973-1991, at the 1<sup>st</sup> stage of their holding) had a fairly similar level of achievement assessment (in points according to the FINA-2012 table), both men (respectively 810-789-775=2374:3=791 points) and women (819-787-779=2385:3=795 points). The overall average score, i.e. the “price” of a gold medal for men + women was calculated as follows: 810+819=1629:2=815 points; the “price” of a silver medal, respectively: 789+787=1576:2=788 and the “price” of a bronze medal: 775+779=1554:2=777 points. Therefore, the existing practice of determining the team rating, which is primarily considering gold awards first, and only then silver and bronze ones, needs to be revised. The class of medals should be taken into account in the presence of an equal number of medals. The advantage in the team rating is given as follows: first gold, then silver, then bronze medals. So, any advantage of the quantity of any medal should take into account the priority of their class, which is reflected in Table 1.

As for the similarity ( $p>0.05$ ) of the age parameters of men and women, this is determined according to Table 2 and is almost 24 years. The greatest advantage of male participants’ age over female participants was in the range of 1-7 years, as found out in 7 events (different distances). The absence of a difference in the age of men compared with the age of women was observed across 5 swimming distances; at the same time, the predominance of women’s age (1-6 years) over men occurred across 13 swimming distances. This provides team coaches with additional information about the real possibilities of including new reliable athletes in the team, at the current competitive stage, and predicting their participation in future competitions.

The difference of the results recorded by men compared to women’s results is most characteristically reflected in the calculations of average swimming speed. The results depend both on different swimming equipment and increased length of the distance covered. Thus, the results of prize-winning swimmers as well as the distances covered with a particular swimming equipment should be taken into account when calculating the average swimming speed at individual distances (Table 3, 4). Given these conditions, it is realistic to obtain objective and reliable results that reflect the modern experience of holding prestigious competitions. Comparing the average swimming speed in men and women when covering the distances in sport and marathon swimming during the World Championship-2024 highlighted a reliable level, almost 0.16 m/s: men, 1.84  $\pm$ 0.16 m/s; women, 1.68  $\pm$ 0.14 m/s;  $t=2.225$ ,  $p<0.05$ .

The study of O. Androsova (2014) presents data on the swimming specialized training. The author identifies the specific stages in teaching the swimming to students in sports schools, which provides the coach with diagnostic and prognostic indicators for the gradual growth of swimmers’ achievements in school conditions. Programming the swimming training within the physical education of students is more and more important according to I.G. Glukhov (2023). It involves the creation and implementation of programs (algorithms) of the educational process, which consistently solve specific tasks of increasing complexity, as well as the basic tasks of physical education of students.

The dissertation of I. Bolshakova (2015) focuses on the study of the consequences of long-term training periodization of swimmers. The paper highlights the history of the development of knowledge on building numerous stages of training, which is not consistent with advanced sports practice. In the modernization of the training process of swimmers at the stage of preliminary basic training, I. Gruzevych (2015) recommended that young athletes use the endogenous hypoxic breathing technique. This recommendation is due to the fact that the oxygen content in the inhaled air is about 18%.

According to the biokinematic analysis of the technique conducted by I. Kolisnyk (2012) and the identification of shortcomings in the structure of the somersault, a method for improving the technique of performing somersaults as a holistic motor action for freestyle swimming was developed. The results of a sociological survey carried out by D. Kachurovsky (2014) with performance swimmers reveal that athletes lack motivation and strong ethical beliefs as basis for moral and volitional training, very good sports results and self-improvement.

O. Ozerova (2006) considers that the tactical training of swimmers of different skill levels and specialization increases their special training, which allows swimmers to become aware of their own capabilities in the process of competitions for further improvement.

Research by O. Politko (2013) shows that there is a tendency in the modern conditions of sports swimming development to expand the starting range due to the performance of athletes at the main and additional competitive distances. The dissertation of O. Tarasevich (2021) presents the influence of classes in the individual cyclic sports (swimming inclusively) belonging to different classification groups, on the formation of the gender type of male and female athletes who have sports qualifications from mass categories to masters.

The studies of O. Ganchar (2015-a, -b, -c, 2018-a, 2018-b, 2020, 2021-a, 2021-b) trace the direction of assessing the achievements of swimming teams at the World Aquatics Championships at the 1<sup>st</sup> stage of their regular holding from 1973 to 1991. These studies also identify the features of performance indicators dynamics assessment for the strongest swimming teams at the World Aquatics Championships during the 2<sup>nd</sup> stage, during the period 1994–2013, and also in 2015, 2017, 2019, 2022, 2023 (I. Ganchar, 2023a, 2023b). This was made possible by using the appropriate Internet resources: [fina.org](http://fina.org); [sports-reference.com](http://sports-reference.com); [swimrankings.net](http://swimrankings.net); [omegatiming.com](http://omegatiming.com).

In the fundamental works of the famous swimming specialist V.M. Platonov (2011a, 2011b, 2021) and Y.M. Shkrebtitya (2006), the modern system of targeted sports training in swimming is revealed in detail and comprehensively. The whole arsenal of means of restoring performance and increasing the capabilities of the educational and training process for elite swimmers is presented to ensure a proper and reliable training for highly important competitions. The progressive thinking of local scientists is significantly supplemented by in-depth studies of foreign specialists such as D. Hannula (2001), the author of a swimming guide, a kind of Bible for swimming coaches. Other specialists, like E. Maglischo (2003), detail the secrets of the fastest swimming. The author M. Schubert (1990) carefully characterizes sports competitive swimming. B. Lucero (2013) recommends additional swimming drills. Moreover, R. Guzman (2006) proposes a lot of targeted drills for specific movements and styles in swimming. McLeod Ian (2010) focuses on the anatomy of swimmers and the enhancement of strength, speed and endurance in swimming. Authors like Salo Dave and Riewald Scott (2008) dealt with the full conditioning in swimming.

These informative materials are not always available to a large number of specialists and swimming enthusiasts, for the development of their personal competence. This specialized literature is essential for a real improvement of sport and marathon swimming, in view of the next World Championships in 2026.

## Conclusions

At the 21<sup>st</sup> World Aquatics Championships (Doha 2024, Qatar), the United States was the most successful country in swimming, winning 20 medals, followed by Australia with 16 medals in ordinary swimming and 2 in marathon swimming, while Italy received 12 medals in ordinary swimming and 2 in marathon swimming. Other top-performing countries included China with 11 medals, the Netherlands with 6+2 marathon, the United Kingdom with 7+1 medals and Canada with 7, underscoring their dominance in aquatics. The distribution of medals among the 31 countries reflects the global aquatics competition, with major contributions from top-ten nations such as Germany with 6 medals, France with 2+3 marathon, New Zealand with 4 medals and Sweden with 4 medals. In the men's category, the USA led with 13 medals, followed by Italy (8+2) and Australia (8+1) with notable performances in both swimming and marathon. Among the women, Australia stood out with 8 swimming medals and 1 marathon swimming medal, followed by the USA (7) and China (6), as well as Canada (6). These results highlight the increasing depth and diversity of international swimming competition across continents at the modern World Aquatics Championships.

The analysis of gender differences in prize-winning swimmers at the 21<sup>st</sup> World Aquatics Championships (Doha 2024) highlighted distinct dynamics in age-related performance across various events. Notable age differences between men and women (ranging from 1 to 7 years) were observed in seven events, including the 50-100 m backstroke, 50-100 m breaststroke, 200-400 m individual medley and 4×100 m medley relay. In

contrast, no significant age differences were found in five events, such as the 200 m backstroke, 200 m butterfly and several relay and marathon swimming distances. Interestingly, women demonstrated a consistent age advantage over men in 13 events, including freestyle distances (50-1500 m), the 200 m breaststroke, 50-100 m butterfly, relay events, and marathon swimming distances (5000-10000 m). These findings underscore the complex interplay of gender, age, and motor skill development in elite swimming performance.

The analysis of average swimming speeds at all events with various distances during the 21<sup>st</sup> World Aquatics Championships (Doha 2024) revealed significant gender differences. The largest disparities were observed in relay swimming (0.210 m/s), freestyle over short and medium distances (0.196 m/s) and backstroke (0.196 m/s). Moderate differences were found in butterfly (0.176 m/s), breaststroke (0.176 m/s) and individual medley events (0.145 m/s), as well as marathon swimming distances (0.145 m/s). The smallest differences were recorded in freestyle and breaststroke over specific distances (0.12 m/s) and mixed relays (0.10 m/s). On the whole, these findings point out the consistent variation in swimming speed between men and women across all event categories, highlighting the physiological and biomechanical factors influencing performance at elite levels.

Analyzing the average swimming speeds at the 21<sup>st</sup> World Aquatics Championships (Doha 2024) revealed the most pronounced gender differences in sprint events, with the largest disparities recorded at 50 m (0.215 m/s) and 100 m (0.190 m/s) distances, followed by relay swimming (0.174 m/s) and 200 m events (0.152 m/s). Moderate differences were observed in marathon swimming (5000-10000 m) and mixed relays (4×1500 m) at 0.145 m/s, while the smallest differences occurred in longer freestyle distances (400-800-1500 m) and 4×100 m relays (0.12-0.135 m/s). Overall, the average speed difference between men and women across all events exceeded 0.16 m/s, reflecting physiological and technical factors that influence performance at elite levels.

The study of the results of prestigious competitions such as the 2024 World Aquatics Championships allowed us to obtain the latest real indicators of the development of sports and marathon swimming skills among young people of different ages and genders. They regularly train on different continents, according to the theoretical and practical experience of their mentors. The athletes develop their personal physical capabilities, the level of motivational capabilities and the mentality of improvement. Therefore, the clarification of the real personal achievements of athletes should have diagnostic and prognostic application at numerous stages of the educational and training process in sports swimming.

The latest data obtained will make a significant contribution to the further improvement of the existing system of strong support for very important competitions based on the application of a gender approach. This will be needed to clarify the opportunities for young people of different ages and sexes to perform properly as stronger swimmers, using the example of prestigious competitions such as all World Aquatic Championships for 1973-1991 period, followed by the 1994-2024 period and the challenges of the present. This also details the existing trends in the gradual development of indicators of the sport and marathon swimming skills development among young people of different ages and gender.

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