

Status of swimming skills development among swimmers of different ages and genders - medalists at the XXXIII Olympic Games 2024, Paris, France

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Abstract.

Purpose of the study: to assess the level of achievements and swimming skills development among swimmers who won medals in pool and open-water (marathon) swimming events at the xxxiii olympic games 2024, paris, france. *material.* a summarized overview of the official competition protocols for 19 event categories at the xxxiii olympic games 2024 in paris, france, was conducted. it included both male and female athletes (87 men and 87 women, totaling 174 participants). *results.* the leading countries in olympic swimming at the xxxiii olympic games paris 2024 were represented by 19 national teams: usa – 28 medals (10 men + 18 women), australia – 19 (7 + 12), china – 12 (5 + 7), canada – 8 (3 + 5), france – 7 (6 + 1), italy – 6 (5 + 1), hungary – 5 (5 + 0), great britain – 5 (5 + 0), germany – 3 (2 + 1), ireland – 3 (2 + 1), netherlands – 3 (1 + 2), sweden – 2 (0 + 2), south africa – 2 (0 + 2), romania – 2 (1 + 1), hong kong – 2 (0 + 2), greece – 1 (1 + 0), japan – 1 (1 + 0), south korea – 1 (1 + 0) and switzerland – 1 (1 + 0). the age characteristics of the medal-winning swimmers were analyzed in detail. no significant differences in age between men and women were observed in seven events. the greatest age differences were noted in nine events, where men were older by 5–6 years. conversely, in four events women were older than men by 3–6 years. the overall average age was 24.73 ± 2.38 years for men and 24.00 ± 1.78 years for women ($t = 0.403$, $p > 0.05$), indicating no statistically significant age difference between genders. regarding swimming speed, the smallest gender difference was recorded in the 10,000 m marathon event (0.11 m/s), followed by freestyle (0.12 m/s), medley (0.155 m/s), relay (0.15 m/s), breaststroke (0.16 m/s), backstroke (0.16 m/s) and butterfly (0.185 m/s). the largest difference was noticed in freestyle events, reaching 0.203 m/s. the overall average difference in swimming speed between male and female medalists was 0.16 m/s (men: 1.83 ± 0.15 m/s; women: 1.67 ± 0.14 m/s; $t = 7.63$, $p < 0.05$), which was statistically significant. the greatest gender speed disparity was observed in the 50 m sprint (0.25 m/s), followed by 100 m events (0.19 m/s), 200 m events (0.154 m/s), relay swimming (0.15 m/s), stayer events (0.128 m/s) and marathon swimming (0.11 m/s). these findings indicate a consistent trend: the shorter the distance, the greater the speed difference between genders. *conclusion.* the results of the xxxiii olympic games paris 2024 in pool swimming and marathon swimming events show the dominance of top nations like the usa, australia and china, with both male and female athletes performing at similarly high levels. although men outperformed women by an average of 0.16 m/s, particularly in sprint events, the gap narrows over longer distances, reflecting progress in training and competitive equity.

Keywords: prestigious competitions, male swimmers, female swimmers, swimming distances, average speed of medalists, difference in indicators.

Introduction

As highlighted by the specialized literature and practice experience, swimming is one of the most popular sports among young people and adults. Therefore, the International Swimming Federation (in French language - Fédération Internationale de Natation) - FINA, always includes swimming in the program of the next Olympic Games, held jointly with the International Olympic Committee - IOC. The headquarters of FINA is located in the city of Lausanne – Switzerland. FINA is officially recognized by the IOC and is one of its partners in the Olympic Games - aquatic sports. Currently, a number of 207 national swimming federations from all continents of the world are members of FINA (Mountjoy, 2015; Mountjoy, Miller, & Junge, 2019; Osmani, 2020). The International Swimming Federation - FINA was officially renamed World Aquatics in January 2023, as voted and approved during the Extraordinary General Congress held in Melbourne, Australia.

Men's swimming events were introduced at the First Olympic Games, starting from 1896, and women's swimming was included only in 1912. Since 2008 swimming competitions at the Olympic Games have included both pool swimming and open water swimming events - in particular on marathon distances (Eichenberger, et al., 2013; Vogt, et al., 2013; Nikolaidis, et al., 2018; Knechtle et al., 2020).

There were monitored the performances of swimmers throughout the Olympic Games 1896-1936 (first stage of the Olympic Games holding). According to the results of the medalists in swimming, a ranking of 19 leading participating teams was determined (Ganchar, O., 2013a; 2013b, 2013c). The largest number of medals was received by the teams of: USA, Great Britain, Japan, Germany, Hungary, Sweden, Australia, Netherlands, Austria.

At the second stage of the Olympic Games (from 1948 to 1991), the most successful of the 32 medal-winning countries, according to O. Ganchar (2013d, 2013e), were the following swimming teams: USA, GDR, Australia, USSR, Hungary, Canada, Great Britain, Germany, Netherlands and FRG.

During the third stage of the Olympic Games (from 1996 to 2012) and the editions of Rio de Janeiro-2016 and Tokyo-2021, the following countries were the best of the 39 participating teams in terms of medals obtained in swimming: USA, Australia, Japan, China, Germany, Netherlands, France, Russia, Hungary, Great Britain. This fact is shown by the studies conducted (O. Ganchar, 2013f; I. Ganchar, 2022a, 2022b).

The parameters of the swimming motor skills development among the medalists at the XXXII Olympic Games in Tokyo-2021 were also studied (I. Ganchar, 2022-c). These games were supposed to take place in 2020 but were postponed because of the Covid-19 pandemic. The best teams from 21 countries, by awarded medals, were: USA, Australia, Great Britain, Italy, China, Canada, Russia, Japan, Hungary, Germany.

Studying the general status of sports achievements from the 1st to the XXXII Olympic Games (O. Ganchar, 2013g; 2018, 2020; 2021, I. Ganchar, 2022a, 2022b, 2022c) highlighted that 54 countries were more successful as for the number of medals won and 22 of these countries became the best: USA, Australia, Germany (FRG), GDR, Japan, Great Britain, Hungary, Netherlands, USSR, Canada, China, France, Sweden, Italy, Russia, South Africa, Brazil, Denmark, Austria, CIS, Ukraine, Romania.

The general results (I. Ganchar, 2007; 2023) allow to draw the latest conclusions and recommendations regarding the relevance of assessing the swimming skills development among swimmers - medalists of the Olympic Games from 1896 to 2021. This enables us to learn more on the trends within the swimming teams participating in these extremely important competitions. After the 2024 Olympic Games ending, all information became available and understandable to performers, specialists and swimming enthusiasts on the Internet sites: www.swimrankings.net ; www.wikipedia.org ; www.omegatiming.com ; www.swimnews.com .

Therefore, the obtained results can significantly enrich the studies conducted by well-known domestic and foreign scientists such as M. Dutchak (2009) who analyzed the theory and practice of sports for all in Ukraine. These results supplement and clarify the fundamental research on the paths of success of performance swimmers, which has been carried out for a long time by V. M. Platonov (2000, 2004, 2012, 2013, 2015a, 2015b, 2017, 2021). Numerous foreign scientists and specialists focused on the improvement of competitive swimming. The state of swimming in the 21st century is thoroughly analyzed (Colwin Cecil, 1994), taking also into consideration the information provided by other scientific works like the handbook of sports medicine in swimming field (Costill, Maglischo, & Richardson, 1992).

Other specialists determined the guidelines of the new science of swimming (Counsillman, & Counsilman, 1994) and studied the indicators for sports swimming technique or for speed swimming (Bartkowiak, 1995; Maglischo, 2003). They monitored the compliance with the requirements of a technically correct swimming (Giehrl, 1996) or gathered valuable information in a "Coaching Bible" for swimming (Hannula & Thornton, 2001). Given the current progress in the theory and practice of pool and long-distance (marathon) swimming, more information on the swimming events of the 2024 Olympics in Paris will be extremely useful in training for the next XXXIV Olympic Games, which are to be held in Los Angeles in 2028.

Purpose of the study: to assess the level of swimming skills development among elite swimmers who won prizes in the sports and marathon swimming events at the XXXIII Olympic Games 2024, Paris, France.

The objectives of the study were: 1) to determine the differences in the parameters of swimming motor skills development in the strongest swimmers - winners at the XXXIII Olympic Games 2024; 2) to implement the most notable results of the research in modern training experience in order to improve the swimming skills in different age groups.

Material and methods

A theoretical analysis of the specialized literature was carried out, focusing on the objective assessment of swimming skills development in men and women at prestigious competitions. Documentary materials (namely the official protocols of competitions for 174 elite swimmers – 87 men and 87 women – medalists at the 2024 Olympic Games in Paris) were summarized. The general ranking does not take into consideration the gender and age of the swimmers. Information is available on the sites: www.wikipedia.org; www.swimrankings.net; www.omegatiming.com; www.swimnews.com.

Using a preliminary and comparative experiment, data were obtained that enabled us to find out and compare the generalized indicators of the average speed in various swimming styles (men and women) on all distances of sports and marathon swimming according to the competition program of the 2024 Olympic Games.

Mathematical statistics was also used as it became absolutely necessary for determining the difference in the indicators of the top swimmers' average speed at the significance level $p < 0.05$.

Results

By analyzing in detail, the results in terms of gold, silver and bronze medals received by swimmers, important data on the ranking of participating teams were revealed, characterizing the level of Olympic swimming development shown in the XXXIII Olympic Games 2024, Paris, France (Table 1). These data highlight clearly the indicators of swimming skills development in the top swimmers who won medals on various distances. The data also determine the differences in the dynamics of results among male and female swimmers of different age groups.

Table 1. monitoring the results of swimming teams at the xxxiii olympic games 2024 paris, france based on the number of gold, silver and bronze medals received

ranking	ranking of participating countries	gold		silver		bronze		total		total
		men	women	men	women	men	women	men	women	
1.	usa	3	5	4	9	3	4	10	18	28
2.	australia	1	6	4	5	2	1	7	12	19
3.	china	2		2	1	1	6	5	7	12
4.	canada		3	1	1	2	1	3	5	8
5.	france	4			1	2		6	1	7
6.	italy	2		1		2	1	5	1	6
7.	hungary	3		1		1		5		5
8.	great britain	1		4				5		5
9.	germany	1		1			1	2	1	3
10-11	ireland	1				1	1	2	1	3
10-11	netherlands		1			1	1	1	2	3
12.	sweden		2						2	2
13.	south africa		1		1				2	2
14.	romania	1				1		2		2
15.	hong kong						2		2	2
16-17	greece			1				1		1
16-17	japan			1				1		1
18-19	south korea					1		1		1
18-19	switzerland					1		1		1
medals		19	18	20	18	18	18	57	54	111
total		37		38		36		111		111

notes: number of medals for men, number of medals for women; in the mixed 4x100m medley relay consisting of 2 men + 2 women

The leaders of Olympic swimming were the national teams of 19 countries worldwide: USA-28 (10 men + 18 women), Australia-19 (7 + 12), China-12 (5 + 7), Canada-8 (3 + 5), France-7 (6 + 1), Italy-6 (5 + 1), Hungary-5 (5 + 0), Great Britain-5 (5 + 0), Germany-3 (2 + 1), Ireland-3 (2 + 1), Netherlands-3 (1 + 2), Sweden-2 (0 + 2), South Africa-2 (0 + 2), Romania-2 (1 + 1), Hong Kong-2 (0 + 2), Greece-1 (1 + 0), Japan-1 (1 + 0), South Korea-1 (1 + 0), Switzerland-1 (1 + 0) medals. So, regarding male swimmers, the most successful were representatives of the USA-10, Australia-7, France-6, China-5, Italy-5, Hungary-5, Great Britain-5, Canada-3, while regarding women - USA-18, Australia-12, China-7, Canada-5. A similar review of the results in the final competitions of the olympic games 2024 highlighted the modern features of medalist swimmers (men and women), typical for participants in these prestigious world competitions taking into account their almost similar age of 24 years. this data can be a guideline for team coaches (table 2).

The absence of age-related changes in data regarding men compared to women was recorded in 7 cases along the specified observation period, namely in the events of 400 m freestyle, 200 m backstroke, 200 m breaststroke, 200 m butterfly, 400 m individual medley, and 4 × 100 m, 4 × 200 m freestyle relays. the largest differences (6-5 years) between men and women were recorded in swimming 8 distances: 100 m backstroke, 50, 800, 1500 m freestyle, 100 breaststroke, 200 m medley, 4×100 m combined and 4+100 m mixed combined. also, a significant difference in the age indicators of women from men is identified in 4 cases at the level of 6-5-3 years. This situation is observed in the following swimming distances: 100 m, 200 m freestyle, 100 m butterfly, 10,000 m marathon swimming (men, 24.73 ± 2.38 ; women, 24.00 ± 1.78 ; $t = 0.403$, $p > 0.05$).

Table 2. summary table of the differences in the results of medalists and finalists of different ages and genders in the swimming events at the olympic games 2024, paris, france

swimmer results			distance, swimming style	age of swimmers, years		
men	women	difference		men, n=87	women, n=87	± difference
21.37	23.96	2,59	50 m freestyle	31	26	+5-
47.10	52.26	5,16	100 m freestyle	22	28	-6+
1.44.75	1.53.87	9,12	200 m freestyle	21	24	-3+
3.43.70	4.01.36	17,66	400 m freestyle	26	26	0
7.42.10	8.18.01	35,91	800 m freestyle	25	22	+3-
14.34.88	15.37.17	62,29	1500 m freestyle	26	24	+2-
52.23	57.65	5,42	100 m backstroke	29	23	+6-
1.54.64	2.04.52	9,88	200 m backstroke	24	24	0
59.04	1.05.47	6,43	100 m breaststroke	29	24	+5-
2.06.84	2.19.96	13,12	200 m breaststroke	25	25	0
50.11	55.81	5,70	100 m butterfly	22	28	-6+
1.51.92	2.03.98	12,06	200 m butterfly	22	22	0
1.55.12	2.07.18	12,06	200 m medley	26	21	+5-
4.06.74	4.32.01	25,27	400 m medley	20	20	0
3.10.11	3.39.80	29,69	4×100 m freestyle relays	23	23	0
7.04.05	7.46.31	42,26	4×200 m freestyle relays	23	23	0
3.27.95	3.51.99	24,04	4×100 m medley relays	26	23	+3-
2 men	2 women	3.37.91	mixed 4×100 m medley relays	27	22	+5-
1.49,72	1.48,04	+1,68	mixed 4×100 m medley relays	27	22	+5-
1.49.98.1	1.58.50.4	8,52.3	10000 m marathon	23	28	-5+

notes: age difference of prize-winning swimmers: men, 24.73±2.38; women, 24.00±1.78; t= 0.403; p>0.05.

Along with the above data, it should be emphasized that there are more significant differences in the average speed of swimmers participating at events on various distances, as evidenced by the differences between men and women at the level of - 0.16 m/s (mean ±sem): men, 1.83±0.15; women, 1.67±0.14; t=7.63, p<0.05, as shown in table 3.

Table 3. differences in average speed (different swimming styles) highlighted by the results of medalists of various ages and genders at the olympic games, paris-2024, france

distance (m), swimming stroke	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 results, m/s, men/women	of
50 m freestyle	50:21,37-50:23,96	2,33-2,08=0,25	0,203	0,16±0,14 t=7,63, p<0,05 1,24:8=0,16	
100 m freestyle	100:47,10-100:52,26	2,12-1,91=0,21			
200 m freestyle	200:1.44,75-200:1.53,87	1,90-1,75=0,15			
400 m freestyle	400:3.43,70-400:4.01,36	1,79-1,66=0,13	0,12		
800 m freestyle	800:7.42,10- 800:8.18,01	1,73-1,61=0,12			
1500 m freestyle	1500:14.34.88-1500:15.37,17	1,71-1.60=0,11			
100 m backstroke	100:52,23-100:57,65	1,91-1,73=0,18	0,16		
200 m backstroke	200:1.54,64-200:2.04,52	1,74-1,60=0,14			
100 m breaststroke	100:59,04-100:1.05,47	1,69-1,52=0,17	0,16		
200 m breaststroke	200:2.06,84-200:2.19,96	1,57-1,42=0,15			
100 m butterfly	100:50,11-100:55,81	1,99-1,79=0,20	0,185		
200 m butterfly	200:1.51,92-200:2.03,98	1,78-1,61=0,17			
200 m medley	200:1.55.12-200:2.07,18	1,73-1,57=0,16	0,155		
400 m medley	400:4.06,74-400:4.32,01	1,62-1,47=0,15			
4×100 m freestyle	400:3.10,11-400:3.39,80	2,10-1,90=0,20	0,15		
4×200 m freestyle	800:7.04,05-800:7.46.31	1,89-1,72=0,17			
4×100 m medley	400:3.27,95-400:3.51,99	1,92-1,72=0,20			
mixed 4×100 m medley	200:1.49,72-200:1.48,04	1,82-1,85=0,03	0,11		
10 km marathon	10 km :1.49.98,1-10 km:1.58.50.4	1,51-1,40=0,11			

notes. difference in average swimming speed: men, m/s (mean ±sem): men, 1,83±0,15; women, 1,67±0,14; t=7,63, p<0,05.

The smallest difference in results is found out in the following events: marathon swimming at 10,000 m - 0.11 m/s; freestyle swimming - 400-800-1500 m at the level of - 0.12 m/s; complex swimming 200-400 m - 0.155 m/s; relay swimming 4×100 m, 4×200 m freestyle, 4×100 m in the combined relay and mixed relay - 0.15 m/s.; in backstroke swimming up to - 0.16 m/s at 100-200 m and breaststroke up to 0.16 m/s at 100-200 m; in swimming 100-200 m butterfly - 0.185 m/s. the largest difference was identified in swimming short distances 50-100-200 m freestyle at the level of - 0.203 m/s.

Thus, in regard to swimming skills development, the total average difference between all studied results of the medalists at these prestigious competitions of the 2024 olympics in paris is at a reliable level of - 0.16 m/s (total difference in average swimming speed, m/s (mean $\pm$ sem): men, 1.83 $\pm$ 0.15; women, 1.67 $\pm$ 0.14; $t=7.63$, $p<0.05$).

Table 4 shows the differences among the results of medalists in different swimming styles on certain swimming distances, starting from 50 m to the marathon events. so, the biggest difference in average speed between men and women is most characteristic for the 50 m swimming distance – 0.25 m/s, as well as for 100 m in different swimming styles at the level of – 0.19 m/s; also 200 m in different styles – 0.154 m/s, then in the 4 $\times$ 100 m relay, 4 $\times$ 200 m freestyle, 4 $\times$ 100 m in combined relay and mixed relay – 0.15 m/s, then in swimming 400-800-1500 m in different swimming styles up to – 0.128 m/s, as well as in the 10,000 m marathon swimming – 0.11 m/s.

The overall average difference between all the results of the swimmers-medalists in the olympic games in paris-2024 is at a significant level - 0.16 m/s (overall difference in average swimming speed, m/s (mean $\pm$ sem): men, 1.83 $\pm$ 0.15; women, 1.67 $\pm$ 0.14; $t=7.63$, $p<0.05$).

Table 4. summary table of the difference in average speed on various swimming distances as shown by the results of finalists and medalists in the olympic games - 2024, paris, france

distance, swimming style	average swimming speed, distance, time, m/s, men/women	difference in average speed, swimming men/women	rank of difference in distance and swimming style, m/s, men/women	difference of results, m/s, men/women
50 m freestyle	50:21,37-50:23,96	2,33-2,08=0,25	0,25	0,982:6=0,163 0,16±0,14 t=7,63, p<0,05 1,24:8=0,16
100 m freestyle	100:47,10-100:52,26	2,12-1,91=0,21	0,76:4=0,19	
100 m backstroke	100:52,23-100:57,65	1,91-1,73=0,18		
100 m breaststroke	100:59,04-100:1.05,47	1,69-1,52=0,17		
100 m butterfly	100:50,11-100:55,81	1,99-1,79=0,20		
200 m freestyle	200:1.44,75-200:1.53,87	1,90-1,75=0,15	0,77:5=0,154	
200 m backstroke	200:1.54,64-200:2.04,52	1,74-1,60=0,14		
200 m breaststroke	200:2.06,84-200:2.19,96	1,57-1,42=0,15		
200 m butterfly	200:1.51,92-200:2.03,98	1,78-1,61=0,17		
200 m medley	200:1.55.12-200:2.07,18	1,73-1,57=0,16		
400 m freestyle	400:3.43,70-400:4.01,36	1,79-1,66=0,13	0,51:4=0,128	
400 m medley	400:4.06,74-400:4.32,01	1,62-1,47=0,15		
800 m freestyle	800:7.42,10-800:8.18,01	1,73-1,61=0,12		
1500 m freestyle	1500:14.34.88-1500:15.37,17	1,71-1.60=0,11		
4×100 m freestyle relay	400:3.10,11-400:3.39,80	2,10-1,90=0,20	0.15	
4×200 m freestyle relay	800:7.04,05-800:7.46.31	1,89-1,72=0,17		
4×100 m medley relay	400:3.27,95-400:3.51,99	1,92-1,72=0,20		
mixed 4×100 m medley relay	200:1.49,72-200:1.48,04	1,82-1,85=0,03		
10000 m marathon	10 km:1.49.98,1-10 km:1.58.50,4	1,51-1,40=0,11	0,11	

notes. difference in average swimming speed: men, m/s (mean $\pm$ sem): men, 1,83 $\pm$ 0,15; women, 1,67 $\pm$ 0,14; $t=7,63$, $p<0,05$.

Discussion

First of all, it should be noted that informational materials related to the analysis of Olympic Games results over a long historical period (1896–2024), concerning both male and female athletes, are often reflected

in the theory and practice of physical education and sports only in general terms—usually by team and occasionally in episodic detail. The ranking of nations is typically established based on the number of gold medals, followed by silver and bronze. Consequently, a more detailed and nuanced examination of Olympic swimming achievements becomes particularly significant for both theoretical analysis and practical application in the context of modern Olympic competition (Mountjoy, 2015; Osmani, 2020).

When evaluating absolute performance levels, it is essential to consider not just medal counts, but also the average swimming speed achieved by winners across various distances and swimming styles. Such an approach allows for a more objective assessment of the development and expression of complex motor skills in swimming. It also provides valuable insight into the physical and technical capabilities of elite male and female swimmers of different ages who participate in high-stakes competitions such as the Olympic Games (Nikolaidis et al., 2018; Knechtle et al., 2020; Eichenberger et al., 2013). These indicators can serve as a reliable measurement system for understanding the current state of performance in Olympic swimming and its evolution over time.

The XXXIII Olympic Games, held in Paris-2024 (France), clearly demonstrated the dynamic development of competitive Olympic swimming on a global scale. As the theory and practice of sports swimming demonstrate, the achievements of swimmers during the most prestigious swimming competitions gradually and dynamically change under the influence of targeted training of gifted performers. This should happen with the help of effective methods, rational means and methodological techniques for their targeted application, as evidenced by the long-term experience of periodically holding the swimming events (for men since 1896 and for women since 1912) within the Olympic Games. Therefore, it is important for specialists and coaches of teams from different continents to know what indicators their athletes should be trained for, the level of achievements on certain swimming distances, the priorities of performance in competitions of swimmers of different genders, ages and sports qualifications. This has been repeatedly emphasized by scientists from different countries, as numerous publications confirm: Counsilman, 1994; Maglischo, 2003; Platonov 2015, 2017, 2021. So, it is highly important to have reliable information about the existing differences in achievements among men and women at these outstanding competitions in the modern conditions of their holding, in order to analyze the dynamics of these indicators' development.

As the ranking indicators presented in Table 1 show, the leading nations in Olympic swimming, according to the number and type of medals obtained during the analyzed period, were the national teams of 19 countries. The United States leads with a total of 28 medals (10 for men and 18 for women), followed by Australia with 19 (7 + 12), China with 12 (5 + 7), and Canada with 8 (3 + 5). Other notable countries include France (7: 6 men + 1 woman), Italy (6: 5 + 1), Hungary (5: all men), Great Britain (5: all men) and Germany (3: 2 + 1). Further down the ranking, several nations reached equal total medal counts, such as Ireland and the Netherlands—each with 3 medals—resulting in shared 10th–11th positions. Similarly, Greece and Japan (1 medal each) occupy the 16th–17th positions, while South Korea and Switzerland, also with one medal each, are ranked jointly 18th–19th. From a gender perspective, male swimmers dominated in terms of diversity of countries achieving success, with top placements by the USA (10), Australia (7), France (6), China (5), Italy (5), Hungary (5), Great Britain (5) and Canada (3). In contrast, the women's category had a more concentrated dominance by the USA (18), Australia (12), China (7) and Canada (5). This distribution highlights several critical trends. Firstly, the United States demonstrates not only consistent excellence but also gender balance in performance, maintaining a high medal count in both men's and women's events. Secondly, Australia and China reinforce their traditional strength in women's swimming, with Australia surpassing its male counterparts in both number and type of medals. Thirdly, several European countries—such as Hungary and Great Britain—show a strong presence exclusively in the men's category, which may suggest a gender disparity in development programs or competition depth. The close values in total number and type of medals, such as those observed for Ireland–Netherlands and Greece–Japan, reflect an increasingly competitive global swimming environment where emerging nations are capable of securing Olympic podium finishes. These data emphasize the importance of analyzing not only the medal count but also the gender-specific contributions and event specializations, which provide deeper insights into the structural strengths and focus areas of national swimming programs (Bratta, 2024; Capranica et al., 2013; Lorenzo-Calvo et al., 2021).

As shown in Table 2, no significant age-related differences were observed between male and female medal-winning swimmers at seven events during the analyzed period. These included the 400 m freestyle, 200 m backstroke, 200 m breaststroke, 200 m butterfly, 400 m individual medley, as well as the 4×100 m and 4×200 m freestyle relay events. The similar age range in these events suggests a consistent age-related performance peak among both genders for middle-distance and medley events. However, the greatest age discrepancies—ranging from 5 to 6 years—were observed across eight events: 100 m backstroke, 50 m, 800 m and 1500 m freestyle, 100 m breaststroke, 200 m individual medley, 4×100 m medley relay and the 4×100 m mixed medley relay. In these swimming events, female athletes tended to achieve high performance at younger ages compared to their male counterparts. This is consistent with existing literature suggesting that female swimmers often reach their peak performance earlier due to physiological and developmental factors (Klara, Dalton, & Milivoj, 2024). Furthermore, a marked age gap of 3 to 6 years favoring younger female swimmers was observed in four other events: 100 m and 200 m freestyle, 100 m butterfly and 10,000 m open water marathon swimming.

Despite these differences, statistical analysis indicates that the average age of medal-winning swimmers at the 2024 Olympic Games did not significantly differ between genders (men: 24.73 ± 2.38 years; women: 24.00 ± 1.78 years; $t = 0.403$; $p > 0.05$). This result underlines the relative uniformity in the age profile of elite swimmers, regardless of gender, particularly at the highest level of international competition (Tchamkerten et al., 2024). The stability of average age across 19 Olympic swimming events may reflect optimized long-term development pathways and training methodologies of the athletes, ensuring that peak performance is sustained into the mid-20s. This balance reflects both physiological maturity and psychological readiness required for medal-winning performances on the Olympic stage (Kojima, 2017). In conclusion, while age variations exist between male and female swimmers across certain swimming events—especially at sprint and long-distance—the general tendency points to a harmonization of age-related performance peaks in modern elite swimming, further emphasizing the role of scientific training, early talent identification and individualized career planning (Yustres et al., 2020).

A detailed review of the final starts provides valuable insights into the level of development of swimming skills among top swimmers who earned medals at various distances. This analysis allows us to identify differences in performance dynamics between men and women of similar ages, while also highlighting the critical importance of performance indicators in these famous competitions. The data in Table 3, which focuses on the average swimming speed in different styles, and Table 4, which explores performance across distances ranging from 50 meters to marathon events, underscore the significance of these metrics in understanding the skill development of elite swimmers. The results of the monitoring analysis, based on data from medal-winning swimmers, reveal a significant difference in the average swimming speed between men and women, with a gap of 0.16 m/s. Specifically, the average swimming speed for men was 1.83 ± 0.15 m/s, while for women it was 1.67 ± 0.14 m/s, with a t-value of 7.63 and a p-value < 0.05 .

This difference is statistically significant and reflects the longstanding trends observed in elite Olympic swimming performance (Pyne et al., 2004). It is noteworthy that this disparity in speed is consistent across different swimming distances, which emphasizes the inherent physiological advantages men have in terms of muscle mass and cardiovascular capacity (Smith et al., 2002). However, these results also illustrate the high level of skill development and adaptation that female swimmers exhibit in response to the demands of international competitions (Costa et al., 2012). The statistical significance of this difference in average speed between male and female swimmers highlights the importance of further research into the dynamics of swimming performance, as well as the training methodologies that can support new progress in both men's and women's events. The gap noticed in swimming speeds also has important implications for how we understand the training processes, physiological adaptations and the competitive strategies employed by swimmers at the highest level (Wei et al., 2014). Moreover, this finding offers essential theoretical and practical information on the progression of Olympic achievements, contributing to a deeper understanding of the development of swimming motor skills in elite athletes.

In conclusion, the analysis of performance speeds at the Olympic Games serves as a critical indicator of swimming skills development. The documented differences between men and women across various distances, particularly the sprint and endurance events, offer a comprehensive view of the dynamics shaping the sport. These findings not only shed light on the gender-based physiological disparities but also underscore the impressive developments in technique, endurance and strategy among the top female swimmers, whose performances continue to improve in response to evolving competition standards.

Conclusions

1. The analysis of the medal results from swimmers representing 19 countries at the XXXIII Olympic Games in Paris - 2024 provides extremely important information on the development of pool and open-water (marathon) swimming skills. The data reveals key trends in the dynamics of swimming performance across various distances, highlighting the achievements of medal-winning athletes. Among the top-performing countries, the USA, Australia and China led the medal count, with the USA dominating in both men's and women's events.

The results also highlight significant differences in performance dynamics between male and female swimmers, as well as variations based on age groups, revealing the current trends in Olympic swimming development. Notably, the USA excelled in both male and female categories, with the most medals overall. This analysis offers a comprehensive understanding of the state of Olympic swimming at the 2024 Games, providing valuable information for trainers, athletes and experts in the field. These findings contribute to shaping future training strategies and identifying key areas for further skill development in elite swimmers.

2. At the XXXIII Olympic Games 2024 in Paris, the age characteristics of medal-winning swimmers were analyzed in detail, revealing that men and women had a nearly identical mean age of 24 years (men: 24.73 ± 2.38 ; women: 24.00 ± 1.78), with no significant age-related differences ($t = 0.403$; $p > 0.05$). Age differences were not observed in seven events across both genders, including the 400 m freestyle, 200 m backstroke, 200 m breaststroke, 200m butterfly, 400m individual medley and the 4x100 m and 4x200m freestyle relays. However, larger age disparities (ranging from 5 to 6 years) were found in eight events, including the 100 m backstroke, 50m, 800m, 1500m freestyle, 100m breaststroke, 200 m medley, 4x100 m combined and 4x100 m

mixed relays. These results highlight the overall age similarity among top-performing male and female swimmers, further emphasizing that age does not significantly impact performance at the elite level.

3. At the finals of the XXXIII Olympic Games in 2024 in Paris, the dynamics of the average swimming speed difference between men and women were analyzed across various swimming styles and distances. The smallest speed difference was observed in marathon swimming (10,000 m) at 0.11 m/s, followed by freestyle events at 400 m, 800 m and 1500 m (0.12 m/s), individual medley at 200m and 400 m (0.155 m/s), relay events (0.15 m/s), breaststroke at 100 m and 200 m (0.16 m/s), backstroke at 100m and 200m (0.16 m/s) and butterfly at 100m and 200m (0.185 m/s). The largest speed difference was recorded in the 50m, 100m and 200m freestyle events at 0.203 m/s. Generally, the total difference in swimming speed between male and female swimmers - medalists at the 2024 Olympics - was statistically significant at 0.16 m/s (men: 1.83 ± 0.15 m/s; women: 1.67 ± 0.14 m/s; $t = 7.63$, $p < 0.05$).

4. At the XXXIII Olympic Games in 2024 in Paris, the dynamics of the average speed difference between male and female medal-winning swimmers across various swimming distances were analyzed. The largest speed difference was observed in the 50m freestyle (0.25 m/s), followed by the 100m freestyle (0.19 m/s) and 200m freestyle (0.154 m/s). A difference of 0.15 m/s was recorded in relay events such as the 4×100m freestyle, 4×200m freestyle, 4×100m medley relay and mixed relay. The differences in longer distances like the 400 m, 800 m and 1500m freestyle ranged up to 0.128 m/s, with the smallest difference in marathon swimming (10,000 m) at 0.11 m/s. Overall, the total average speed difference between male and female prize-winning swimmers at the 2024 Olympics was significant at more than 0.16 m/s (men: 1.83 ± 0.15 m/s; women: 1.67 ± 0.14 m/s; $t = 7.63$, $p < 0.05$).

5. The results of this research provide crucial insights for coaches, athletes and swimming enthusiasts at all levels, including professionals, amateurs and veterans. The novelty and findings of the study are also relevant for the theory and practice of training specialists in physical education and sports, particularly those focusing on swimming in educational institutions across Ukraine and beyond. The research emphasizes the importance of understanding gender differences in swimming performance at prestigious events like the European and World Championships, World University Games and the Olympics. Further studies should explore these differences to enhance training and development strategies.

The study also highlights the significance of understanding how swimming motor skills are developed across different age groups and genders, as well as the impact of male dominance in competitive swimming. By analyzing past achievements and comparing them to current performance trends, we can continue to improve and refine training methods to foster the growth of sports and marathon swimming skills across generations.

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