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KEY BREATH-HOLDING PARAMETERS IN ELITE ARTISTIC SWIMMING TEAMS UNDER THE 2022–2025 World Aquatics REGULATIONS

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Abstract. **Aim.** This study aimed to identify breath-holding standards for elite artistic swimming teams during the free routine performance at the 2020 (2021) Olympic Games. The goal was to help elite athletes minimize potential long-term health risks associated with prolonged breath-holding. **Materials and methods.** The study analyzed variables such as the time spent above and below the water surface, the classification and number of hybrids, the timing of each hybrid, and the numerical value assigned to each hybrid. **Results.** The findings revealed an inverse relationship between prolonged breath-holding and the quality of performance in the free routine. The best ratio between breath-holding underwater and breathing above the water is 1:1, with underwater durations not exceeding 25 seconds and the number of hybrids limited to a maximum of 8. **Conclusion.** To mitigate the risk of REDs and its associated negative health impacts, breathing patterns should be adjusted to the athlete's functional fitness and specific performance requirements.

Keywords: breath-holding, artistic swimming, hybrids, REDs

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ОСНОВНЫЕ ПАРАМЕТРЫ ЗАДЕРЖКИ ДЫХАНИЯ ВЫСОКОКВАЛИФИЦИРОВАННЫХ СИНХРОНИСТОК ОЛИМПИЙСКИХ КОМАНД ПО НОВЫМ ПРАВИЛАМ World Aquatics НА 2022–2025 ГОДЫ

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Аннотация. **Цель:** определить стандарты задержки дыхания во время выполнения произвольной программы командами по синхронному плаванию, участвовавшими в Олимпийских играх 2020 (2021), чтобы помочь высококвалифицированным профессиональным пловцам избежать возможных долгосрочных последствий для здоровья в результате превышения этих ограничений. **Материалы и методы.** В качестве переменных в исследовании использовали продолжительность времени над и под поверхностью воды, тип и количество комбинаций, тайминг каждой комбинации, числовое значение каждой комбинации. **Результаты** показали, что наблюдается обратная зависимость между длительностью задержки дыхания и качеством выполнения произвольной программы в синхронном плавании. Лучшим соотношением задержки дыхания под водой и дыхания над водой признано соотношение 1:1 с продолжительностью нахождения под водой не более 25 секунд и общим количеством комбинаций не более 8. **Заключение.** Спортсменам следует выбрать подходящий режим дыхания, основанный на функциональной подготовленности и уникальных критериях эффективности,

чтобы избежать синдрома REDs, поскольку он негативно влияет на все системы организма, приводя к ухудшению показателей здоровья.

Ключевые слова: задержка дыхания, синхронное плавание, комбинация, REDs

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Introduction. The accumulation of carbon dioxide and the corresponding decrease in oxygen levels during physical exertion can lead to energy insufficiency and a loss of focus and concentration, impairing athletic performance. Consequently, the selection and analysis of appropriate breathing patterns have become an essential area of study in artistic swimming.

Artistic swimming is a highly demanding aquatic sport that combines elements of swimming, dance, ballet, and gymnastics. Athletes perform timed, choreographed routines synchronized to music [20] and execute them both above and below the water's surface, with competitors performing solo, duet, mixed duet, and team routines. Swimmers are required to complete a program of complex maneuvers while listening to music [26].

These routines can be performed in either a free routine, where the swimmers are freely choosing their choreography, contents, order of figures, and hybrids, or they can compete by executing a technical routine [10, 11]. Artistic swimmers must efficiently use the energy of their bodies while doing these motions above and below the water's surface in order to perfect the performance. The amount of oxygen that skilled swimmers can consume and the degree of their physiological adaptation have a considerable impact on this energy.

The bradycardic reaction is the most important physiological response for artistic swimmers holding their breath below the surface of the water, and this phenomenon occurs while they are doing so [28]. The health of artistic swimmers can benefit from and suffer from spending a lot of time underwater. Artistic swimmers are more effective at producing aerobic energy while holding their breath due to established lung adaptations such as improved total lung capacity, vital capacity, forced expiratory volume, and inspiratory capacity. This has been scientifically demonstrated by various studies. The artistic swimmer's performance during the routine may be hampered by time if they repeatedly experience anoxia and carbon dioxide buildup since they will get distracted and disorganized [5].

Despite the physiological benefits that breath-holding exercises can provide for swimmers, underwater swimming for extended periods of time may have long-term negative health implications. Repeating inappropriate breath holding may cause RED-S (Relative Energy Deficiency in Sport), and the artistic swimming routine may result in a lack of energy needed to support the performance [16, 23].

Since it adversely affects every body system and has a detrimental impact on health [6], it is becoming more prevalent because it may impair immune, cardiovascular, metabolic, hormonal, and physiological functions [14, 15]. The amount of time that each artistic swimmer spends underwater varies greatly. It is crucial for artistic swimmers to understand precisely how long they must stay underwater and how to increase this capacity through individualized training based on age groups, personal development, and functional readiness [4, 5, 24, 26]. To help swimmers efficiently use the energy they produce to perform the routine of elaborate, complicated moves with a higher quality rather than just holding their breath for a longer period of time, breathing pattern analysis helps the trainer identify the key factors.

Numerous studies have shown the effects of breath holding in artistic swimming, but they have only looked at reports of breathing pattern analysis in relation to side effects of prolonged time underwater on swimmers' health and side effects on overall score, particularly for Olympic teams competing in artistic swimming. The artistic swimming results for the free routine at the most recent Olympic games in 2020 (2021) revealed a very competitive level between all teams from different regions of the world, according to the latest Olympic games that were held in Tokyo in 2021. As each team displayed distinctive breathing patterns and challenges, their skills and abilities became clearer.

However, the Russian team was and continues to be a case that merits investigation. Since 2006, it has been ranked as artistic swimming's best Olympic champion. Additionally, Ukraine had the greatest performance in Europe, followed

Table 1

Time limits and corresponding numerical values for hybrid categories

Time underwater (TU, seconds)	TU1 ≤ 6	TU2 (7–15)	TU3 (16+)
Numerical value of the TU in the routine	0.05	0.1	0.2

Note. Time underwater (TU) = Time of breath holding underwater.

by Italy and Spain, and the People's Republic of China had the best team in Asia, followed by Japan. Canada took part in this competition and finished sixth. The Egyptian team is also thought to be the only team from Arab countries and Africa to have competed in the Olympic Artistic Swimming competition. Thus, the current study was conducted to demonstrate a better understanding of the breath holding variants for all artistic swimming teams that competed at the Olympic games in 2020 during performing the free routine; the duration of each hybrid*, the number of hybrids performed during a routine, the category, and the timing of each hybrid to manage the energy required to perform these number of movements throughout the routine by managing oxygen consumption and lowering oxygen dept.

Materials and methods. Nine national artistic swimming teams that competed in free routines were chosen straight from the Tokyo 2020 (2021) Olympic Games. These teams are the Russian Olympic Committee, the People's Republic of China, Ukraine, Japan, Italy, Canada, Spain, Egypt, and Australia since Greece was disqualified due to the presence of four coronavirus-positive players on their roster. The teams are listed based on the results of the last Olympic games. This study aims to develop the breathing pattern strategy or variations for the highly qualified artistic swimming Olympic teams according to the new World Aquatics rules 2022–2025.

The researcher used the manual tracking mode of the "Tracker 6.0.1" software tool to track the markers manually and evaluate the breath-holding parameters during the free routine from a video recording. The study's factors include the time duration below the surface of the water, the classification and the number of hybrids, the timing of each hybrid, and the numerical value of each hybrid. This new method of analysis is utilized to categorize the time restriction for each hybrid into three groups and their associated numerical values according to the new scoring system of World Aquatics 2022–2025 (Table 1) [11, 25].

Results. ***Time analysis.*** According to World Aquatics regulations, each team had to complete their tech-nical routine in 4:00 minutes because the length of the free routine was determined by the first artistic swimmer's movement [10, 11]. The fol-lowing chart clarifies how various breathing pat-terns were used by the participating teams. The fin-dings indicate that the nine teams spent a mean total of 57.8% of their time under the water and 42.2% of their time above it. For each hybrid, the top two teams were only allowed to stay un-derwater for a total of 23–24 seconds. With the exception of the Russian team, who utilized a 1:1 ratio for holding their breath below the water and taking oxygen above the water, we came to the conclusion that the majority of teams hold their breath by spending more time below the surface of the water (Fig. 1). Additionally, we can see that the Spanish team had the highest percentage of apneas because they spent 68% of their time below the water's surface and only took in oxygen at a height of 32% above the water. Although they spent more time underwater, they did not significantly lose their synchronization score or focus, as evidenced by the fact that they placed sixth in the technical team competition at the Olympic Games 2020 (2021).

The execution score (performance quality) measures the level of excellence in performing all motions, as well as the synchronization of timing for each movement, between-player synchronization, and synchronization below and above the surface. According to the results of the free routine at the 2020 (2021) Olympic Games, Spain scored more for execution than the teams that followed it in the rankings (Egypt and Australia). This refers to their ability to execute consistently for a longer period of time under oxygen deprivation pressure compared to the four teams behind them in the ranking. We must remember that holding our breath affects more than just the execution score.

As a result, we can draw the conclusion that the Russian team employed a clever tactical stra-

* Hybrid = it is the time of breath holding under the surface of the water during performing the routine, even the free routine of the technical routine.

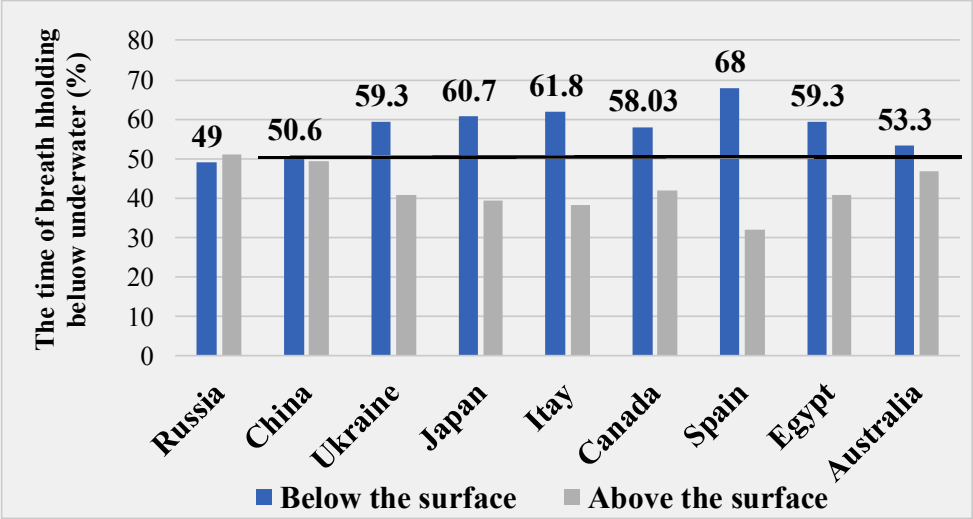

Fig. 1. Distribution of time spent above and below the water surface in free routines among Olympic teams at the 2020 Olympic games

tegy for breathing patterns by splitting their time practically equally between holding their breath and taking in oxygen above the water's surface. The Australian team also made an effort to do the same breathing techniques as the Russian team, but they performed worse than the Russian team overall in terms of execution, artistic impression, and difficulty.

Therefore, they finished last in this tournament. Because various elements influence the plan of the artistic swimming routine, we can conclude that employing the identical plan for another team does not definitely result in receiving the greatest score.

Classification and number of hybrids below the surface of the water. Each routine consists of a number of hybrids, and each hybrid entails a number of underwater movements. As each hybrid begins with the first swimmer moving under the water and ends when any swimmer's head is over the water, determining the number of hybrids depends on the new World Aquatics scoring sys-tem that was published in 2022. Additionally, entering the front bike or back tuck is incorpo-rated [11, 25]. The new Fina guidelines include a number of criteria for evaluating the process, namely base marks for acrobatics, hybrid base marks, hybrid families and bonuses, and evalua-tion of the technical required elements. The hybrid's base mark can be calculated using a scale of three categories to evaluate each hybrid's time limit. And to categorize these hybrids, we may use the formula TU (time underwater) = TU1 or TU2 or TU3, where TU1 represents the hybrid's time (6 seconds or less), TU2 the hybrid's time (7–15 seconds), and TU3 the hybrid's time (16 seconds or more) [11, 25].

The number of hybrids used by each team is shown in the table. Each team's classification is based on how well they do under the new FINA scoring system in 2022. For each routine, there are often 8 to 10 hybrids in total. In addition, Spain uses the highest classification, TU3, three times in their routine, compared to the majority of teams that only use it once or twice. They placed sixth in this tournament despite using the longest hybrids (Table 2).

The Russian team, on the other hand, once presented a hybrid from the TU3 category. They therefore focused on the excellent quality and not the quantity of the elements that were available. While Australia executed 80% of its routine from the TU2 category, Italy and Egypt only performed 66% of it, which was an unreasonable performance that the teams should avoid in the future. The above-mentioned categories of each hybrid and the number of each category must be taken into account when determining how much energy to distribute throughout the creative swimming practice.

Timing of each hybrid and it's category. The hardest minute of the routine is generally thought to be the final minute. The body tries to continue functioning at its best despite indicators of weariness from oxygen debt and a visible build-up of lactate in the blood as a result of fatigue. The body starts to fight exhaustion with time, albeit less successfully than at the start of the program.

Consequently, each hybrid's timing with

Table 2

Distribution of hybrid elements by team and classification under World Aquatics new scoring system (2022–2025)

Olympic teams		TU1 ≤ 6 sec	TU2 7–15 sec	TU3 16 sec +	Total number of hybrids during the routine
1	Russia	2	3	1	6
2	China	2	4	2	8
3	Ukraine	5	4	2	11
4	Japan	5	4	2	11
5	Italy	1	6	2	9
6	Canada	6	3	2	11
7	Spain	2	4	3	9
8	Egypt	3	6	0	9
9	Australia	2	8	0	10
x		**3.2**	**4.6**	**1.6**	**9.3**

Note. Time underwater (TU) = Time of breath holding underwater.

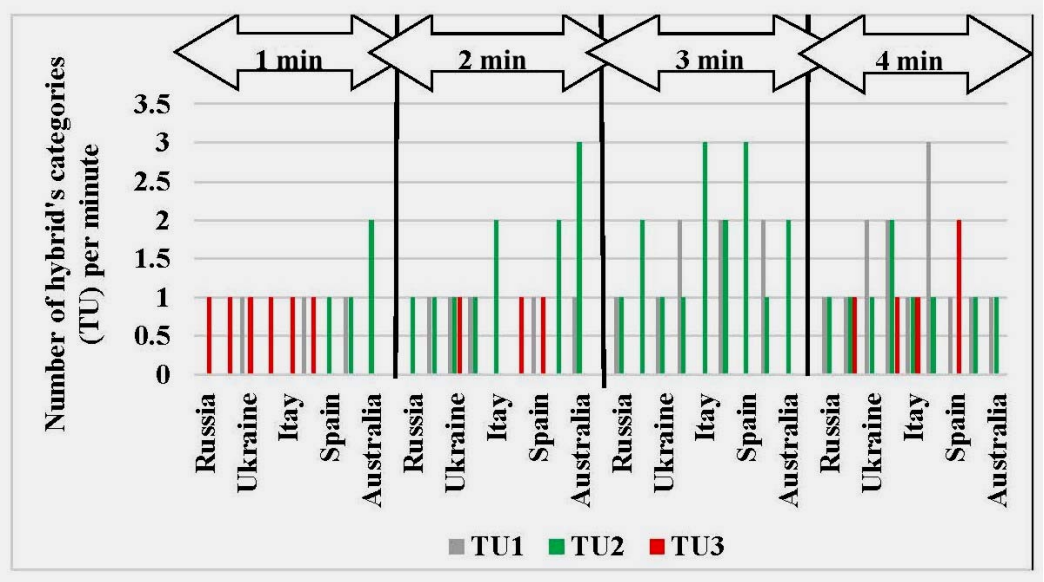

Fig. 2. Number of hybrid's categories per minute for all artistic swimming teams that performed the free routine at the Olympic games 2020 (2021): TU1 = ≤ 6 sec, TU2 = 7–15 sec, TU3 = 16 sec +

a distinct category in the free routine for each nation was examined. As it is considered an unreasonable way to lose energy, it is concluded that the Spanish team performed the hardest category, TU3, in the final minute while experiencing symptoms of fatigue. In addition, they were not prepared for this intensity when they performed TU2 dramatically in the third minute. China, Japan, and Italy were the next to do the same category TU3 in the last seconds, repeating the same mistake (Fig. 2).

Correlation between quality and quantity

In September 2022, a numerical value of TU1 = 0.05, TU2 = 0.1, and TU3 = 0.2 was implemented for each category of time under water based on the revised scoring system [16]. However, the teams that spend longer submerged and receive higher TU ratings are not always the best capable of receiving higher overall scores. Undoubtedly, part of the challenge is the team spending more time below the water's surface than the others, but the quality of the motions is more crucial than their quantity or number.

In artistic swimming, the final score is calculated by adding the execution score, which measures the level of performance, plus the artistic impression score and the difficulty score. The execution score is important because it reflects how perfectly each element performed during the performance (performance quality). But it is also

important to remember that the quality of performance is influenced by the entire program, not just the evaluation given for this criterion.

According to the new World Aquatics scoring system in effect from 2022 to 2025, the following figure illustrates the relationship between the numerical value of the TU (the numerical value of perfor-ming for a longer period of time under the water) and the execution score (quality of performance) during the free routine. As evidenced, the Rus-sian team had a well-considered breathing strat-egy throughout training. Despite receiving the lowest total score in TU (quantity), they achieved the greatest total score in execution (quality); therefore, they won the gold medal. The Egyptian team attempted to match the Russian team's numerical value as closely as possible, but they were unable to do so because they spent an excessive amount of time underwater (around 59% compared to 49% for the Russian team), which reduced their overall score and caused them to finish in the lowest place (Fig. 3).

Spain had the greatest TU score, but as we already noted, this team spent too much time underwater and performed too many TU3 in the highest category. They suffered from a loss of vitality and synchronicity as a result, which affected their performance grade. Therefore, Spain demonstrated a lower performance score when compared to the top five countries in the ranking (Russia, China, Ukraine, Japan, and Italy), which shows the quality of performance (Fig. 3).

In conclusion, teams that received higher scores for TU (breath-holding time value) by performing a higher-level TU (spending more time below the surface of the water) received a lower score for execution, which reflects the quality of their performance. Also, as a result, these teams will not necessarily get a higher final score.

Discussion. A great level of physical fitness, technical skill mastery, and artistic ability is essential for this sport [22, 28]. Li Li et al. concurred in 2020 that artistic swimming designs should be understood to depict the routine's performance in a meaningful way. Additionally, they stated that artistic swimming "stresses both the manner and shape" and is "an epitome of the scene in life" [13]. The routine in artistic swimming is described by M. Nakashima et al. as "a collection of artistic elements that are strung together and choreographed to music and may utilize costume themes" [17].

Movements are performed both above and below the water's surface in intricate choreographic exercises. Because actions made without oxygen below the water's surface are seen to be more difficult, movements made above the water's surface are thought to be easier. When performing a routine, artistic swimmers experience a reduction in gas exchange and a rapid rise in physiological pressure. As carbon dioxide collected and oxygen levels dropped, gas exchange during the artistic swimming practice was restricted. Despite what has been said, some coaches believe that the more artistic swimmers hold their breath, the more difficult the swim will be and the higher the overall score will be. It is understandable that the new scoring system 2022–2025

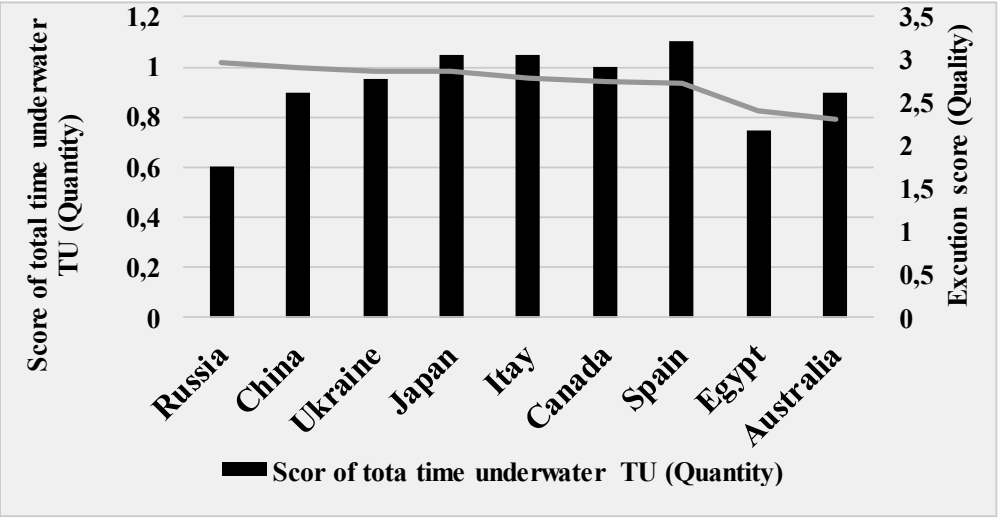

Fig. 3. Correlation between the TU score (quantity) and the execution score (quality) during the free routine at the Olympic games 2020 (2021): TU score – score of the number of categories under the surface of the water for each hybrid during the whole routine; Execution score – quality of performance during the whole routine

is giving a higher point for spending more time below the surface as hybrid time categories TU3 (16 sec +) are getting a higher score than TU1 (≤ 6 sec) [11]. However, holding one's breath for an extended period of time beyond the physiological capacity of the swimmer will unquestionably result in steadily worse performance quality throughout the program, which will lower the overall score. Therefore, based on their physical capabilities, skill performance, and oxygen consumption level, the trainers need to manage the amount of time that the artistic swimmers must spend below the surface of the water without oxygen [25].

The most important physiological reaction for artistic swimmers when holding their breath below the water's surface is bradycardia [28]. For 51 artistic swimmers, static and dynamic breath holding was measured in B.G. Dimitrova (2015). There was also a distinction between passive and active static breath holding or apnea. The findings demonstrated that the artistic swimmer's body had become accustomed to apnoea by using a particular activity as a result of regular artistic swimming training. It emphasized the value of practising breathing in and out of the water, particularly static breathing exercises for preparing teenagers using measured usage of heart rate and pulse [7].

It has also been demonstrated that providing a reservoir for pulmonary gas exchange enables the skilled swimmer to hold their breath for longer periods of time while maintaining a lower heart rate. As a result of the developed lung adaptations, such as better total lung capacity, vital capacity, forced expiratory volume, and inspiratory capacity, artistic swimmers will produce aerobic energy more effectively when holding their breath. After determining the proper breathing pattern, it can be accomplished by selecting the proper training loads and methodologies. Therefore, it is crucial for artistic swimmers to understand how long they must stay underwater in seconds and how to increase this capacity through training [4, 5, 24, 26].

The possible long-term negative effects of spending a lot of time underwater on swimmers' health, in addition to the physiological adaptation that the swimmer can obtain through breathing practice, are undeniable. According to Auer RN and Sutherland GR, the performance of the artistic swimmer during the routine would be hampered over time as they lose focus and attention due to the build-up of carbon dioxide and repeated lack of oxygen [5]. They will thus gradually lose motor control while doing the creative swimming practice. In this situation, deductions in synchronization, clarity, execution, and other areas will start to be given to the artistic swimmers [4, 18].

Additionally, holding your breath during an artistic swimming routine may result in a lack of energy needed to support your performance, and repeatedly holding your breath inappropriately may result in RED-S (Relative Energy Deficiency in Sport) [16, 23], since it adversely affects every body system and has a detrimental impact on health [6]. It is becoming more prevalent because it may impair immune, cardiovascular, metabolic, hormonal, and physiological functions [14–27].

For a recent instance, the free and technical movements of the Russian and Egyptian teams have been compared at the Olympics in 2020 (2021). As a result of completing a greater percentage of their total free movements underwater (59%) than the Russian team (34%), the Egyptian team lost performance quality more quickly than the Russian team. As a result, the Russian team took first place, and the Egyptian team came in eighth [8, 9].

Although each artistic swimmer should complete the exercise in the same amount of time, there is a significant difference in how long each one spends underwater. The amount of energy released while completing the routine varies, regardless of the variance in the amount of time that artistic swimmers spend underwater. This is caused by the various amounts of time that each artistic swimmer spends submerged, as well as the occasionally required variations in movement speed and intensity between artistic swimmers. For instance, some artistic swimmers must spend longer under than others during the routine's required lift in order to assist other swimmers in performing the lift. While other artistic swimmers are expected to undertake acrobatic movements that call for special power and fast speed [17].

Teams and duets had shorter breath-holding time than solo events, according to Alentejano et al. (2008). During the artistic swimming national championship, the top 11 Canadian artistic swimmers under the age of twenty had their solo routine times examined. He investigated the relationship between the amount of time artistic swimmers spent above the water's surface while breathing oxygen and the distance they covered horizontally, and he found that it was only possible to spend no more than 40 seconds below

the water's surface for as many as 6 to 8 hybrids during each solo routine [3].

A different physiological response to exertion related to performance during competition was demonstrated by Lara Rodriguez-Zamora et al. in their study from 2012, which showed increases in heart rate and blood lactate for the thirty-four senior and junior artistic swimmers who took part in this study [24].

The trainer must apply the best tactic in the routine by allocating positions in the routine depending on the capacities, capabilities, and competence of each artistic swimmer, which explains the variation in each player's abilities. The participants must be chosen based on their skills because artistic swimmers perform diverse roles [4, 24, 26, 28].

In artistic swimming competitions, breathing pattern analysis may examine not only how long the swimmer stays under but also how many movements they make and when they make them. In a study for artistic swimming, mixed duet-free routine choreographies were analyzed in 11 countries in 2017 and 11 countries in 2019. There are several classifications for analyzing the routine approach. Jumping into the pool, acrobatic moves, related activities, arm movements, and leg movements have all been categorised independently in this study as choreographies. Arm movements were examined in 4 sections (single arm, double arms, single arm boost, and double arms boost), and leg movements in 5 sections (single leg, double legs, turns, splits, and barracuda [1, 2].

The amount of energy required to execute all motions as accurately as possible depends on the difficulty of the element, timing, and delay or free breathing. This amount can be directly influenced by the distribution of hybrids and their timing. Breathing pattern analysis is a crucial step in today's process of examining performance and scoring systems. The expertise of artistic swimmers, a competitive category, artistic swimming performance's association with evaluating athletes' technique and delivering a relevant piece of information are thus additional elements for competition analysis [19].

The trainer can regulate the tactical plan for the quantity and timing of things that should be executed in each minute, but all of these taken together have a direct impact on the final result. Each artistic swimming team must have a breathing pattern that works for them specifically. That demonstrates the importance of routine analysis in creative swimming. Due to the fact that it will evaluate the trainer, the ideal plan for breathing patterns that are suitable for their creative swimmers can be chosen. In order to improve swimming performance, it is crucial and helpful for all athletes and coaches involved in artistic swimming to theoretically clarify the breathing pattern plan of the routine [12, 17].

The aforementioned evidence demonstrates how analyzing breathing patterns during a routine clarifies the plan of breathing, including how long each hybrid should last, how many hybrids should be performed during a routine, and the timing of each hybrid. By controlling oxygen consumption and lowering oxygen deficit, the body is able to function as well as it can for a longer period of time. Additionally, it's crucial to select breathing patterns that work for you based on your age group, personal development, and functional readiness. In order to determine the relationship between training techniques, loads, and testing with these patterns, the breathing pattern is analyzed.

Conclusion. In order to get the optimum performance, a breathing pattern for artistic swimming must be selected based on the physical prowess and skills of each team. To perform with greater quality than just in larger quantities, teams are generally urged to select a number of free or technical hybrids. Their proportion, category, and timing should ideally correspond to their functional readiness and capabilities. It is recommended to not spend more than 50% + 2 of the routine's total duration below the water's surface by a ratio of 1:1 for no more than 22 seconds +2.

To maintain performance for as long as possible, swimmers must strike a balance between holding their breath and oxygen intake above the surface of the water and avoiding suffering from a shortage of oxygen for a longer period of time. That could cause health issues and will demonstrate the team's level of technique. It is also recommended that the Spanish team reduce the percentage of breath holding during each hybrid to achieve higher performance, because as they recorded longer durations below the surface, they did not lose coordination and concentration as much, as evidenced by their team's execution score, which reflected the level of excellence in performing the skills for all movements and synchronization below and above the surface, as they also won sixth place. While the Australian and Egyptian teams need to enhance their physiological skills because they employed the same breathing pattern as the Russian team, they also re-

quire additional threshold training because all teams spent less time below and above the surface than the necessary ratio.

There is no need to spend too much time below the water's surface. As a result, it is critical to select the correct timing of the hybrids and their category, as well as their quantity per minute, because as all of the fatigue factors begin to appear, it will affect the quality of execution and synchronization as the motor control and muscles will be worse than at the start of the routine. As a result, the outcomes will be influenced. It is strongly advised that the Egyptian squad alter their breathing pattern distribution as well as their breathing duration ratio above and below the water's surface.

As a total number of hybrids for each routine, teams should perform 8–10 hybrids. Using the highest category TU3 at the end of the routine is likewise discouraged, as is performing TU3 twice every minute. Because of the pain, the body wants to keep operating at its peak, despite indicators of weariness from oxygen deficiency and a significant build-up of lactate in the blood. Over time, the body begins to resist fatigue symptoms, albeit less effectively than at the start of the program. In practice, teams that spend more time below the surface of the water have a larger numerical value for TU, but they are not always the ones with the highest total scores. As a result, artistic swimmers should avoid exceeding these limits because the quality of the motions is more essential than the number of movements or the amount of time.

Taking everything into account, we can confidently state that there is no perfect plan, but there is a perfect plan that is appropriate for your team. As a result, it is critical to connect all of the elements of the breathing patterns plan of the creative swimming practice. As we can see, utilizing the identical plan for another team does not always result in the highest score because other elements influence the strategy of the artistic swimming routine. As a result, selecting proper breathing patterns reflects on the oxygen intake throughout the competition routine and its positive or negative impacts on technique, quality, and total score, which may improve or ruin health over time.

Thus, analysing and comparing the time duration above and below the surface of the water, classification and number of hybrids, timing of each hybrid, the numerical value of each hybrid for all high-class artistic swimming teams helps to identify the limit of the breath holding parameters for highly qualified artistic swimming teams depends on their ability and capability.

Using a suitable strategy for breathing during the routine allows the development of a breathing strategy to achieve high-level athletic performance and avoid the RED-S (Relative Energy Deficiency in Sport) phenomenon.

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