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The effect of different intensities of land and water warm-ups on 100 m performances in young swimmers

Mehmet Onur SEVER[1]

[1]Gumushane University, School of Physical Education and Sport, Gümüşhane, Türkiye

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Abstract

The aim of this study was to investigate the effect of different heating applications with varying intensities on the 100 m swimming performance of swimmers. Fourteen young swimmers (age: 12.50±0.76 years; height: 158.79±5.67 cm; body weight: 43.36±5.09 kg) participated in the study voluntarily. The swimmers were subjected to low and medium intensity heating protocols, using both static stretching and dynamic warming up techniques, both in and out of water. For the medium intensity heating, the maximum heart rate was taken as 70-79% and for the low intensity heating, the maximum heart rate was taken as 57-64%. The 100 m performance trials were timed using a stopwatch (Finis 3X-300M Chronometer, CA, USA) by an expert swimming coach and swimming referees. The statistical analysis of the test results was performed using the SPSS Statistics software When the data in our study were evaluated, it was found that there was no difference in the 100 m swimming performance of young swimmers aged 11-13 between low-intensity land (out of water) and in-water heating. Similarly, it is observed that medium-intensity land-based and water-based warm-ups do not positively affect the performance of the 100-meter swim, and they are not statistically significant. In conclusion, in our study, low and medium intensity land and in-water heating did not have a significant effect on the 100 m performance parameter in young swimmers.

Keywords: Swimming warm-up, land warm-up, swimming performance

Genç yüzücülerde farklı yoğunluktaki kara ve su ısınmalarının 100 m performanslarına etkisi

Özet

Bu çalışmanın amacı farklı şiddetteki ısınma uygulamalarının yüzücülerde 100 m yüzme performansı üzerini etkisini araştırmaktır. Araştırmaya 14 genç yüzücü (yaş: 12,50±0,76 yıl: boy uzunluğu: 158,79±5,67 cm: vücut ağırlığı: 43,36±5,09 kg) gönüllü olarak katılmıştır. Yüzücülere statik germe ve dinamik ısınma yöntemlerinin kullanıldığı su içinde ve su dışında orta ve düşük şiddette ısınma protokolü uygulanmıştır. Su içi ve su dışı orta şiddetli ısınmada maksimal kalp atım hızının %70-79 iken düşük şiddetli ısınmada maksimal kalp atım hızının %57-64'ü baz alınmıştır. 100 m performansına yönelik denemeleri zamanlama için uzman bir yüzme antrenörü ve yüzme hakemleri tarafından kullanılan bir kronometre (Finis 3X-300M Kronometre, CA, USA) ile ölçümler yapılmıştır. Test sonuçlarında elde edilen bulguların istatistik analizi, SPSS Statistics yazılımı kullanıldı. Çalışmamızdaki veriler değerlendirildiğinde, düşük şiddetli kara (su dışı) ve su içi ısınmalarının 11 – 13 yaş genç yüzücülerin 100 m yüzme performansları üzerinde herhangi bir farklılık bulunamamıştır. Aynı şekilde orta şiddetli kara (su dışı) ve su içi ısınmaların 100 m yüzme performanslarını olumlu yönde etkilemediği ve istatistiksel olarak anlamlı olmadığı görülmektedir. Sonuç olarak yaptığımız çalışmada, genç yüzücülerde düşük ve orta şiddetli su dışı ve su içi ısınmalar 100 m performans parametresinde etkili olmamıştır.

Anahtar kelimeler: *Yüzmede ısınma, kara ısınması, yüzmede performans*

Sorumlu Yazar/Corresponded Author: Mehmet Onur SEVER, **E-posta/e-mail:** m.onursever@gmail.com

Genişletilmiş Türkçe Özet makalenin sonunda yer almaktadır.

INTRODUCTION

In today's society, maintaining a habit of exercising has become increasingly important in preserving health. Parents direct their children towards various exercises to ensure they live a healthy and quality life. Engaging in regular physical exercise provides significant benefits for both physical and mental health in children and adolescents (Dokuzoğlu et al., 2022). Considering that a lifelong habit of exercising is acquired at an early age, participation in various sports activities is important for children's development of basic motor skills and growing up as healthier individuals. Families encourage their children to participate in swimming at an early age for the development of their motor abilities, physical, and physiological characteristics (Myer et al., 2016; Sever et al., 2021). However, since swimming requires high-level skills and coordination, it holds a significant place in the growth and development of children. On the other hand, early participation in swimming can create expectations of sporting success, which may require early specialization (Zatsiorsky et al., 2020).

In recent years, warm-up procedures aimed at improving motor skills and performance through water and land-based training have become important for coaches, researchers, and experts. Numerous studies have been conducted to confirm the effectiveness of different warm-ups with varying intensity, volume, rest, and specificity. Based on these studies, warming up is now recognized as a fundamental practice for enhancing performance (Cuenca et al., 2022; Mcgowan et al., 2016). Before a competition or training session, athletes engage in various activities called warm-ups, which include dynamic and static movements to prepare for the demands of the exercise or competition and reduce the risk of injury while optimizing performance (Mcgowan et al., 2015). The purpose of warming up is to prepare the athlete for the requirements of the training or competition (Swanson, 2006). A well-planned warm-up is believed to induce physiological changes and help an athlete focus on the next task, thus optimizing performance (Neiva et al., 2015).

It has been suggested that warm-up exercises lead to certain physiological and metabolic changes resulting from the increase in muscle temperature that affects performance (Bishop, 2003a). Warm-up has been extensively studied in the last decade (Neiva et al., 2015; Neiva et al., 2014). Warm-ups in individual or team sports typically involve short submaximal aerobic exercise bursts, followed by specific movements or stretching exercises (Mcgowan et al., 2015; Zois et al., 2011). In studies, the initial warm-up is performed at low intensity, while the next specific work can be done at higher intensity as preparation for the competition (McMillian et al., 2006). Additionally, warm-up may include dynamic or static stretching to reduce muscle stiffness and increase range of motion (Gil et al., 2019), agility exercises and plyometrics to enhance power output (Masamoto et al., 2003), and the use of heat-acclimation (Lovell et al., 2013).

Scientific research has not conclusively proven the effectiveness of warm-up routines. As a result, athletes and coaches design their warm-ups based on personal experience. The combination of multiple variables, the complexity of warm-up protocols (e.g., volume, intensity, and recovery interval), and the lack of standardized warm-ups make it difficult to characterize warming-up techniques (Fradkin et al., 2010). For instance, there is no scientific evidence of the effectiveness of warm-up routines in swimming, and studies have shown that the effect of warm-up on swimming performance is inconclusive (Robergs et al., 1990; Neiva et al., 2012). In swimming, the effectiveness of a warm-up strategy is known to depend on the intensity and duration of swimming and dry-land elements and the time between the end of warming up and the start of the competition (Mcgowan et al., 2016).

The variability in study design (e.g. protocol, selected outcomes, swimming efficiency, and swimmer's competition level) makes data comparison challenging. Therefore, the aim of this study was to elucidate the effects of water and land-based warm-up performed at different intensities on 100 m swimming performance in young swimmers and to propose optimized warm-up strategies.

METHOD

Research model

This study was designed to investigate the effects of randomly applied different warm-up protocols (water and land environments) on athletes' performance in a 100-meter swimming distance. Furthermore, the warm-up protocol was implemented using the trial and error method, which is one of the experimental research methods. The participants were randomly selected from the swimmers who participated in competitions during the 2022-2023 period. According to the study design, the body composition and 100 m performance tests of the volunteers were conducted on day 1 (Monday), and the warm-up and 100 m test measurements, which were another performance parameter, were carried out on day 2 (Tuesday), day 3 (Wednesday), day 4 (Thursday), and day 5 (Friday) (see Table 1).

Table 1: Timeline of study

Days	Measurement
Monday	Body Composition Analyse, General warm-up and 100 meter performance tests
Tuesday	Low Intensity out-of-water (land) warm-up + 100 meter performance tests
Wednesday	Medium intensity out-of-water (land) warm-up + 100 meter performance tests
Thursday	Low Intensity water warm-up + 100 meter performance tests
Friday	Medium intensity water warm-up + 100 meter performance tests

Research group

This study included 14 participants. All fourteen voluntary athletes, consisting of 6 swimmers in the backstroke style, 4 swimmers in the freestyle style, and 4 swimmers in the breaststroke style, participated in 100% of the different warm-up applications. The different warm-up applications were applied only once, and the athletes did not continue their swimming training during the warm-up sessions. Each of the different warm-up applications lasted for 25 minutes. All athletes participated in the 5-day warm-up program without any missing sessions or injuries. All participants and parents were informed regarding the research procedures, requirements, benefits, and risks, and written consent was acquired before the study. Besides, this study was approved by the Ataturk University Ethics Committee (2022/5) and was conducted under the ethical guidelines of the Declaration of Helsinki for studying humans.

Table 1. Demographic variables for participants

N	Age (years)	Height (cm)	Body weight (kg)
14	12.50±0.76	158.79±5.67	43.36±5.09

Test program

The testing program in the study lasted for five days, namely Monday, Tuesday, Wednesday, Thursday, and Friday. In the first testing program, height measurements were taken in the morning (10:00), and the participants' weights were determined using the Inbody 270 (California, USA) body analysis device. The "athletic" mode was selected on the device, and the weights were recorded via a computer connected to the device. In the other testing program, after the warm-up protocols according to the swimming pool program, the participants' 100-meter performances were measured using the Finish 3X-300M brand stopwatch (Finis 3X-300M Stopwatch, CA, USA). Before the assessments began, participants were asked to keep their usual dietary intake on the assessment days. After the players were introduced to the protocols of the tests, they were organized into three groups for the assessments.

Warm up program

In this study, a warm-up protocol of medium and low intensity was applied in water and on land using static stretching and dynamic warm-up methods. For medium intensity warm-up in water and warm-up on land, the maximal heart rate was considered to be between 70-79%, while for low intensity warm-up in water, the maximal heart rate was between 57-64%.

Table 3. Low and medium intensity in-water heating design

Working	Distance (m)	Time	Rest	Total Time
Foot Kick	4*50	6 min	3 min (Passive)	9 min = 540 sec
Swimming Drils	4*50	6 min	3 min (Passive)	9 min = 540 sec
Swimming Drils	4*50	4 min	3 min (Passive)	7 min = 420 sec
Total	600 m	16 min	9 min	1500 sec

Table 4. Low and medium intensity offshore (land) heating design

Movement	Time	Rest	Repetitions	Total Time
Inchworm	30 sec	30 sec	5	300 sec
Walk Down-Shoulder	30 sec	30 sec	5	300 sec
Plank Get Ups	30 sec	30 sec	5	300 sec
Burpee	30 sec	30 sec	5	300 sec
Mountain Climbing	30 sec	30 sec	5	300 sec
Total	150 sec	150 sec	25 Tekrar	1500 sec

The visuals of warm-up on land (or dry-land warm-up) according to Static Stretching and Dynamic Warm-up methods are given below;

Figure 1. Incworm

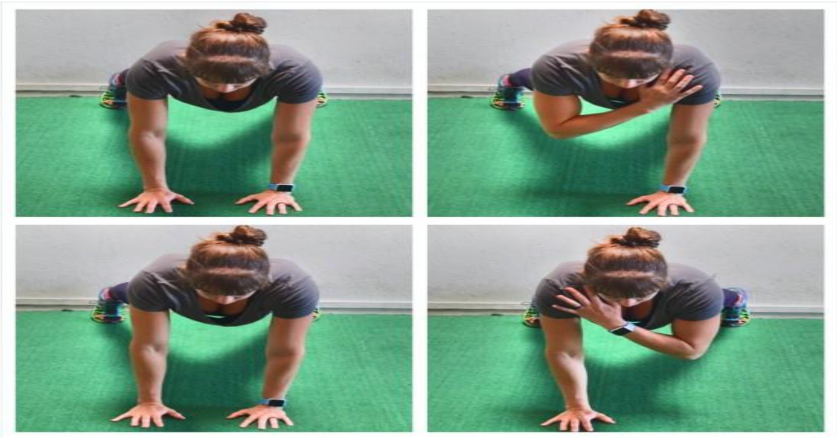

Figure 2. Walk down-shoulder

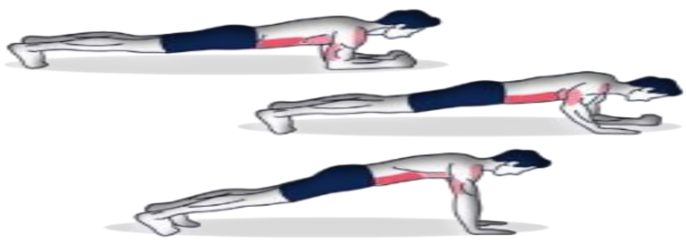

Figure 3. Plank Get Ups

Figure 4: Burpee

Figure 5. Mountain climbing

Anthropometric measurements

Participant Height and Body Composition Analysis: The heights of the participants were measured in centimeters using a wall-mounted stadiometer (Holtain Ltd, England) with the participant in anatomical position, barefoot, heels together, holding their breath, and their head in the frontal plane with the vertex touching the measuring board (Zileli & Söyler, 2018). In order to determine the body weights (kg) of the athletes in the study, an Inbody 270 (Japan) brand body analysis device was used (Sassi et al., 201; & Zileli & Söyler, 2022).

Analysis of 100-m Performance: In each measurement application performed for 100-meter performance, swimmers were instructed to mount the starting block after receiving official verbal commands and the starting signal, and to begin with a loud signal. Trials for 100-meter performance were measured with a stopwatch (Finis 3X-300M Chronometer, CA, USA) used by official swimming referees and an expert swimming coach (who holds a Level 3 swimming coaching certificate) for timing purposes. To ensure the visual testability of time measurements and control of time measurements, recordings were made with a Sony camera (Sony HDR-CX405) from the beginning of the test at zero time to the finish time. The video quality and shooting speed of the camera were 1080p 60fps. The 3D tracking mode was used to maintain clarity during performance.

Analysis of data

SPSS Statistics software (version 24, IBM Corporation, Armonk, NY, USA) was used for the current study's analysis. Shapiro-Wilk test were executed to analyze preliminary inspection of normality and homogeneity of the sample. Normality value was assumed since p>0.05.

FINDINGS

In the study, data from both female and male athletes were processed and analyzed together. A literature review revealed that Robertson et al. (2020), conducted their analysis on 6 male and 3 female athletes in the experimental groups. The analysis of the results of the four different warm-up protocols of the athletes participating in the study on their 100 m performance is given in Table 5. According to the findings, no significant difference was found in the effect of the four different warm-up protocols on 100 m performance. Figure 6 shows the graph of the average 100 m swimming performance of the athletes according to their swimming styles and warm-up types (Figure 6).

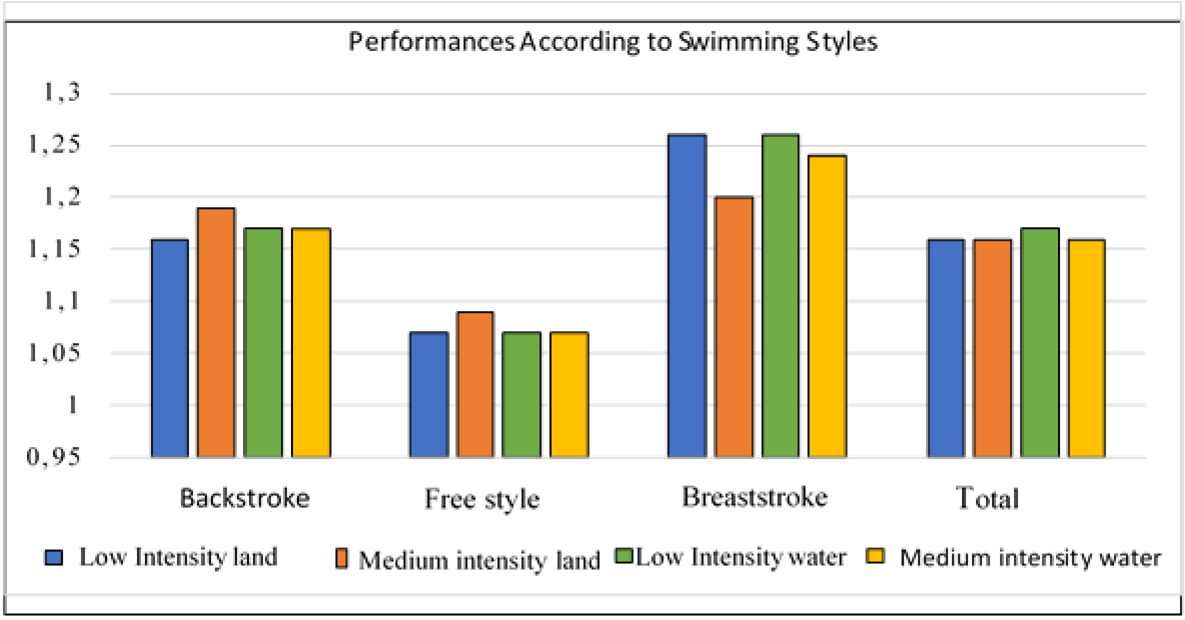

Figure 6. Average 100-m swimming performances of the participating athletes according to swimming styles and warm-up types.

Table 5. Mean 100-m swimming performances (in seconds ± standard deviation) of the participating athletes according to their swimming styles and warm-up types

	N	Low İntensity Land	Medium İntensity Land	Low İntensity Water	Medium İntensity Water	p
Backstroke	6	79.33±4.97	79.17±5.11	77.33±5.31	77.66±5.42	0.741
Free style	4	69.25±6.5	69.75±5.68	67.00±5.35	67.00±6.10	0.391
Breaststroke	4	86.75±6.10	87.00±6.80	86.50±6.1	84.25±6.1	0.920
Total	14	78.44±0.10	78.65±0.08	76.94±0.09	76.30±0.08	

When Tablo 5 is examined, it can be observed that the best performance of backstroke swimmers occurs during moderate-intensity land warm-up (X=79.17±5.11), while the worst performance is during low-intensity land warm-up (X=79.33±4.97). For freestyle swimmers, the best performance is achieved during low-intensity water warm-up (X=67.00±5.35), and the worst performance is during moderate-intensity land warm-up (X=69.75±5.68). As for breaststroke swimmers, the best performance is obtained during moderate-intensity water warm-up (X=84.25±6.1), and the worst performance is during moderate-intensity land warm-up (X=87.00±6.80). When all styles are considered together, the best performance is observed during moderate-intensity land and water warm-up (X=76.30±0.08), while the worst performance is during moderate-intensity land warm-up (X=78.65±0.08). Although there are differences in participants' performances across different swimming styles and warm-up types, these differences have been determined to be not statistically significant based on the variables of time and style duration.

DISCUSSION AND CONCLUSION

The aim of this study was to investigate the effects of different intensities of warm-up protocols on the 100 m swimming performance of swimmers. Four different warm-up protocols were applied to the same group on different days, and the aim was to determine which warm-up protocol was more beneficial for swimmers in terms of performance, 14 volunteer male and female swimmers participated in the study. In the study, it was found that there was no difference in the 100 m swimming performance of 11-13 year old swimmers between low-intensity land-based (out of water) and water-based warm-ups. In addition, it is observed that medium-intensity land-based and water-based warm-ups do not have statistically significant effects on the performance of the 100-meter swim.

According to the literature, warm-up protocols for sports induce an increase in muscle tissue temperature and result in many physiological changes, along with metabolic changes. Studies indicate that all these changes affect the athlete's performance (Bishop, 2003b). On the other hand, warm-up is an important factor in preventing injuries in athletes, as well as being a part of physical performance development. It is expressed that it is an effective practice in terms of developing joint resistance against loading and has many positive physiological effects on the cardiovascular system (Little & Williams, 2006). In literature reviews on swimming, warm-up has a positive effect on performance indicators for distances of 200m and above, while its effect on distances below 200m is less than 1% in the statistics conducted (Neiva et al., 2014). Researchers have not been able to fully explain the effect of warm-up on performance in short distances in studies conducted on swimming distances (Ballionis et al., 2012). In the study of Moran et al. (2012), who examined the effects of dynamic and static stretching practices on performance time in short distance swimming, no significant difference was found. Similarly, in the study conducted by Neiva et al. (2012), on female swimmers, there was no significant difference in short distance performance between no warm-up and regular warm-up practices.

An increase in muscle temperature following an active warm-up has the potential to enhance short-term performance in multiple ways (Bishop, 2003a). It has been reported that an increase in muscle temperature reduces muscle and joint stiffness, enhances the transmission speed of nerve impulses, and alters the force-velocity relationship (Febbraio et al., 1996). Similarly, an increase in core temperature has been reported to result in improvements in peak power and sprint capacity (Gil et al., 2019). On the other hand, it has been reported that medium -intensity active warm-up lasting at least 5 minutes increases muscle and core temperatures (Arnett, 2002; Bishop, 2003b; Zochowski et al., 2007).

In our study, the standard warm-up protocols for water and land (non-water) activities lasted a total of 25 minutes. McGowan et al. (2016), identified four main goals of warm-up before a competition with 46 swimming coaches; physiological (to increase body temperature and enhance muscle activation), kinesthetic (tactile preparation, increasing the "feel" of the water), tactical (practice race pace), and mental (improve focus and reduce anxiety). Additionally, they determined the volume of water-based warm-up to begin with 400-1000 m continuous, low-intensity swimming (%50-70 of perceived maximum effort), followed by 200-600 m drills and 1-2 sets of increasing intensity (%60-90) swimming, 3-4 repetitions of near-race or race pace (25-100 m; %90-100), and 100-400 m easy swimming.

In their study comparing the effects of different warm-up volumes on maximum 100 m freestyle swimming performance representing high-intensity domains, Neiva et al. (2015), reported that swimmers performed faster in the 100 m freestyle after a standard warm-up or a short warm-up. Additionally, they reported that none of the participants achieved a better time after a long warm-up compared to a short warm-up.

On the other hand, in another study evaluating the effects of 3 different warm-up protocols on swimming performance, reaction time, and dive distance, 3 warm-up protocols (Standard warm-up, no warm-up, and short warm-up) were used before 50-yard (45.7 m) freestyle swimming trials with 16 swimmers. It was found that the standard warm-up yielded better results statistically compared to the short warm-up (Balilionis et al., 2012).

The lack of a significant relationship found in the study, despite the negative or unchanged results in terms of performance, raises the possibility that athletes may have difficulty adapting to different intensities of warm-up. As a result, this may lead to athletes not showing the necessary changes or experiencing fatigue due to the intensity. It is therefore thought that the exercise protocol should be adaptive for athletes.

SUGGESTIONS

Based on the results obtained, it has been shown that 11-13-year-old swimmers need to perform at least medium intensity dry-land and in-water warm-up exercises to improve their 100 m performance. At the same time, it is believed that the in-water distance should be increased when compared to the literature. Individual analyses may be necessary to determine the best warm-up for swimmers. In addition, coaches emphasize the need for special or customized warm-up models as swimmers exhibit different individual responses. Alternatively, individual warm-ups including medium and high-intensity warm-ups are recommended. When performing warm-ups, coaches should take into account the transition period from pool warm-up to the race. Therefore, it is shown that coaches need to devote significant time and effort to determine the individual warm-up that the athlete needs, based on scientific studies.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Su ve kara antrenmanlarıyla motorik özelliklerin ve performans geliştirilmesine yönelik ısınma prosedürleri son yıllarda antrenörler, araştırmacılar ve uzmanlar için önem arz etmektedir. Farklı yoğunlukta, hacimde, dinlenme ve özgüllüğe bağlı olarak farklı ısınmaların etkinliklerini doğrulamak adına çok sayıda çalışma yapılmıştır. Bu çalışmalar ışığında artık ısınma, performansı artırmak için temel bir uygulama olarak kabul edilmektedir (Zatsiorsky et al., 2020).

Bireysel veya takım sporlarındaki bu ısınmalar, tipik olarak kısa submaksimal aerobik egzersiz patlamalarını ve daha sonra belirli hareketler veya esneme hareketlerini içermektedir (Mcgowan ve ark., 2015; Zois ve ark., 2011). Çalışmalarda ilk ısınma düşük yoğunlukta yapılırken, bir sonraki özel çalışma, müsabakaya hazırlık olarak daha yüksek yoğunlukta gerçekleştirilebilir (McMillian ve ark.,, 2006). Ayrıca kas sertliğini azaltmak ve hareket aralığını artırmak için dinamik veya statik esneme-(Gil ve ark., 2019), kuvvet üretimini artırmak için çeviklik egzersizleri ve plyometri (Masamoto ve ark., 2003) ve ısı-ekleme kullanımını içerebilir. (Lovell ve ark., 2013).

Çalışma tasarımındaki değişkenlik (örn. protokol, seçilen sonuçlar, yüzme verimliliği ve yüzücü rekabeti) veri karşılaştırmasını zorlaştırmaktadır. Bu nedenle, yapılan bu çalışmanın amacı, genç yüzücülerde farklı şiddetlerde uygulanan su ve kara ısınmalarının 100 m yüzme performansı üzerindeki etkilerini açıklamak ve optimize edilmiş ısınma stratejileri önermektir.

YÖNTEM

Bu çalışma yüzmede farklı ısınma protokollerinin (su ve kara ortamı) uygulandığı ve uygulanan bu farklı ısınma protokollerinin sporcular üzerinde 100 metre yüzme mesafe üzerine etkisi şeklinde dizayn edilmiştir. Araştırma tasarımına göre müsabaka düzeyinde yarışan gönüllü 9 kadın ve 5 erkek sporcudan oluşan örneklem grubu 3 farklı stilde yüzmektedir. Bunlar sırasıyla 6 sporcu sırtüstü stilde, 4 sporcu serbest stilde, 4 sporcu kurbağalama stilde yüzme performansı sergilemektedir. Yapılan çalışmada sporcular, 2022-2023 dönemi içinde yarışmalara katılan yüzücülerden rastgele örneklem yoluyla seçilmişlerdir. Çalışma tasarımına göre; gönüllü sporcuların vücut kompozisyonu ve 100 m performans testleri 1. gün (Pazartesi) ve diğer performans parametresi olan ısınma ve 100 m test ölçümleri ise 2. günde (Salı), 3. Günde (Çarşamba), 4. Günde (Perşembe), 5. Günde (Cuma) gerçekleştirilmiştir.

Bu çalışmada, analizler için SPSS İstatistik yazılımı (24. sürüm, IBM Corporation, Armonk, NY, ABD) kullanıldı. Ön inceleme için Shapiro-Wilk testleri normal dağılım ve örneklerin homojenliğini analiz etmek için gerçekleştirildi. $p>0.05$ olduğu için normal dağılım varsayıldı.

BULGULAR

Çalışmadan elde edilen bulgular aşağıda ifade edilmektedir:

Tablo 5 incelendiğinde sırtüstü yüzücülerin en iyi performansının orta şiddetli kara ısınmasında (X=79,17±5,11), en kötü performansın ise düşük şiddetli kara ısınmasında olduğu görülmektedir. (X=79,33±4,97). Serbest yüzücüler için en iyi performans düşük şiddetli su ısınmasında (X=67,00±5,35), en kötü performans ise orta şiddetli kara ısınmasında (X=69,75±5,68). Kurbağalama yüzücülerinde ise en iyi performans orta şiddetli su ısınmasında (X=84,25±6,1), en kötü performans ise orta şiddetli kara ısınmasında (X=87,00±6,80) elde edildi. Tüm stiller birlikte değerlendirildiğinde en iyi performansın orta şiddette kara su (X=76,30±0,08) olduğu, en kötü performans ise orta yoğunluklu kara ısınmasında olmuştur (X=78,65±0,08). Farklı yüzme stillerinde ve ısınma tiplerinde katılımcıların performanslarında farklılıklar olsa da süre ve stil süresi değişkenlerine göre bu farklılıkların istatistiksel olarak anlamlı olmadığı belirlenmiştir.

TARTIŞMA VE SONUÇ

Yapılan literatür çalışmalarına bakıldığında, spor branşlarına yönelik ısınma uygulamaları kas dokusunda sıcaklık artışı meydana getirmektedir bununla birlikte metabolik değişiklikler ile birlikte birçok fizyolojik değişimde ortaya çıkmaktadır. Tüm bu değişikliklerinde sporcunun performansını etkilediğini yapılan çalışmalar ifade etmektedir (Bishop, 2003a). Yüzme branşına yönelik literatür incelemelerinde 200 m performans ve üstü mesafelerdeki performans göstergelerinde ısınma olumlu-pozitif yönde bir etkiye sahipken, 200 m performans metreleri altındaki etkisi ise yapılan istatistiklerinde %1 den daha az olduğu görülmektedir (Neiva ve ark., 2014). Yüzme mesafelerine yönelik yapılan çalışmalarda araştırmacılar kısa mesafede, ısınmanın performansa etkisini tam olarak açıklayamamışlardır (Ballionis ve ark., 2012). Moran ve arkadaşları (2014)'nın kısa mesafe yüzmede, dinamik ve statik germe uygulamalarının performans zamanı üzerine inceledikleri çalışmada anlamlı farklılık bulunmamıştır. Yine aynı şekilde Neiva ve arkadaşları (2012)'nın kadın yüzücüler üzerine yapmış oldukları ısınmasız ve düzenli ısınma uygulamalarının kısa mesafe performans üzerine anlamlı bir farklılık bulunmamıştır.

Neiva ve arkadaşları (2015), farklı ısınma hacimlerinin, aşırı yoğunluk alanındaki performansı temsil eden maksimum 100 m serbest stil yüzme performansı üzerindeki etkilerini karşılaştırdıkları çalışmada yüzücülerin 100 m serbestte standart ısınma ve kısa ısınmadan sonra daha hızlı performans gösterdiklerini belirtmişlerdir. Ayrıca, hiçbir katılımcının uzun ısınma çalışmasından sonra kısa ısınma çalışmasına kıyasla daha iyi bir zaman elde edemediklerini bildirmişlerdir.

Elde edilen sonuçlar incelendiğinde 11-13 yaş grubu yüzücülerin 100 m performanslarını düşük ve orta şiddetli kara ve su ısınmalarının etkilemediği görülmektedir. Bu durumun yaş gurubu veya sezonun periyodu ile alakalı olduğu düşünülmektedir. Aynı zamanda literatür ile karşılaştırıldığında su içi mesafenin de artırılması gerektiği düşünülmektedir. Yüzücülerde en iyi ısınmayı belirleyebilmek için bireysel analizler gerekli olabileceği görülmektedir. Ayrıca, antrenörler, yüzücülerin farklı bireysel tepkiler verdiğinden, özel veya özelleştirilmiş ısınma modellerine olan ihtiyacı vurgulamaktadır. Alternatif olarak, bireysel ısınmaların orta ve artan şiddetteki ısınmaları içermeleri önerilmektedir. Isınmalar yapılırken eğitmenler (antrenörler), yüzücülerin havuz ısınmalarının ardından yarışa kadar olan geçiş sürecini göz önünde bulundurmalıdırlar. Genel anlamda bir yüzme yarışmasında sıralamayı saniyenin yüzde biri belirleyebilmektedir. Bundan dolayı da eğitmenlerin (antrenörlerin) sporcunun ihtiyacı olan bireysel ısınmayı belirlemek için bilimsel çalışmalar ışığında ciddi zaman ve çaba harcamaları gerektiğini göstermektedir.

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KATKI ORANI ***CONTRIBUTION RATE***	**AÇIKLAMA** ***EXPLANATION***	**KATKIDA BULUNANLAR** ***CONTRIBUTORS***
Fikir ve Kavramsal Örgü *Idea or Notion*	Araştırma hipotezini veya fikrini oluşturmak *Form the research hypothesis or idea*	Mehmet Onur SEVER
Tasarım *Design*	Yöntem ve araştırma desenini tasarlamak *To design the method and research design.*	Mehmet Onur SEVER
Literatür Tarama *Literature Review*	Çalışma için gerekli literatürü taramak *Review the literature required for the study*	Mehmet Onur SEVER
Veri Toplama ve İşleme *Data Collecting and Processing*	Verileri toplamak, düzenlemek ve raporlaştırmak *Collecting, organizing and reporting data*	Mehmet Onur SEVER
Tartışma ve Yorum *Discussion and Commentary*	Elde edilen bulguların değerlendirilmesi *Evaluation of the obtained finding*	Mehmet Onur SEVER

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