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Monitoring the psychological and physiological effects of 320k Sochi-Giresun marathon elite open water master swimming event

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Abstract

This study aims to investigate the psychophysiological responses of master swimmers from beginning to end of the Sochi-Giresun 320 km open water swimming event. Candidate swimmers were evaluated according to several criteria which are national and international competition experience, the ability to swim an average of 1 km in hour, experience in night swimming, and sports background. Selected from a total of 48 candidates from Turkey, Russia, and Germany, the group of 15 athletes comprises a balanced gender distribution, with 9 males and 3 females. Additionally, 3 reserve athletes were also identified. Participants were subjected of various assessments, including a personal information form, blood lactate sample, VAS scales and IZOF measurements. The research procedure involved VAS, IZOF and blood lactate measurements before swimming, transferring to the water according to their swimming order, commencing swimming upon the referee's command, recording time and distance with GPS location, transferring to the ship after swimming round, collecting after swim VAS, IZOF, and blood lactate samples. Research findings revealed some psychological differences between nighttime and daytime open-water swimming results. Male swimmers exhibited higher levels of perceived stress level and perceived difficulty level. Factors negatively affecting performance included post-swim blood lactate levels, perceived fatigue, the difficulty of the swimming round, and perceived stress levels. These results indicate that athletes' psychological states can vary individually and have complex effects on performance. The lower levels of stress and fatigue among athletes might be related with their participation in national and international competitions, relatively higher average age, and consequently elevated levels of performance and psychological maturity.

Keywords: Aerobic capacity, swimming, master swimmer, open water, marathon

320 km Sochi-Giresun açıksu elit master yüzme maraton etkinliğinin psikolojik ve fizyolojik etkilerinin incelenmesi

Öz

Bu çalışanın amacı Soçi-Giresun 320 km açık su yüzme etkinliğinde başlangıçtan bitişe kadar master yüzücülerinin psiko-fizyolojik tepkilerini incelemektir. Aday yüzücüler, ulusal ve uluslararası yarış deneyimi, ortalama 1 km'yi bir saatte yüzebilme yeteneği, gece yüzme deneyimi, spor geçmişine sahip olmak gibi kriterlere göre değerlendirildi. Türkiye, Rusya ve Almanya'dan 9'u erkek ve 3'ü kadın olmak üzere 15 sporcu yer almaktadır. Ayrıca, bu gruba ek olarak 3 yedek sporcu da belirlenmiştir. Katılımcılara kişisel bilgi formu, laktat ölçümleri, VAS ölçekleri ve IZOF ölçümleri uygulandı. Araştırma prosedürü, teknede VAS ve kan laktat örneklerinin alınması, yüzme sırasına göre transfer botuyla suya taşıma, hakemin komutuyla yüzmeye başlama, zaman ve mesafe için GPS konumu kaydetme, yüzme turunun bitiminde tekrar gemiye transfer ve yüzme sonrası VAS, İZOF ve laktat ölçümlerinin alınmasını içermiştir. Araştırma sonuçları, gece ve gündüz yüzme sonuçları arasında psikolojik faktörler açısından bazı farklılıklar olduğunu göstermiştir. Erkek yüzücülerde daha yüksek düzeyde algılanan stres seviyesi ve algılanan zorluk derecesi belirlendi. Bu sonuçlar, sporcuların psikolojik durumlarının bireysel olarak değişebileceğini ve performans üzerinde karmaşık etkilere sahip olabileceğini göstermektedir. Sporcuların stres ve yorgunluk seviyelerinin düşük çıkmasının nedeni, ulusal ve uluslararası düzeyde katıldıkları yarış deneyimleri, yaş ortalamalarının yüksek olması ve bu iki kritere olarak yüksek performansa ve psikolojik olgunluğa sahip olmaları ile açıklanmaktadır.

Anahtar Kelimeler: *Aerobik kapasite, yüzme, master yüzücü, açıksu, marathon.*

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Genişletilmiş Türkçe Özet, makalenin sonunda yer almaktadır.

INTRODUCTION

The Masters are defined as women and men 35 and upper ages (World Masters Athletics, 2023) in athletics, according to FINA, if athletes are equal or older than 25 years accepted as masters in swimming (FINA, 2023). In last years masters swimming is accepted as one of the fast-growing leisure activities (Knechtle et al., 2017). Open water swimming is a unique discipline that includes several internal and external performance-related factors such as waves, currents, night conditions, sea animals, wind, heat/coldness, distance, security, health risks, and others. FINA open water swimming guide (2018) mentioned boats and propellers, petrol fumes, hypothermia, hyperthermia, pain, sunburn, swallowed salt water, jellyfish stings, and other possible trauma sources to the risk list. In such conditions, open-water swimming becomes one of the most challenging sports events. Personal factors like physical condition, swimming technique, anthropometric features, swimming strokes (Vogt et al., 2013), sex differences (Eichenberger et al., 2013; Salihu et al., 2016), age, experience (Adalia et al., 2021), wearing of the wetsuit (Ulsamer et al., 2014) and physiological and psychological preparedness are all recognized as components influencing performance.

According to international swimming regulations, the regular race distance is between 5 to 25 km and since 2008, OWS has been an Olympic event (Tipton & Bradford, 2014). Ultra swimming is considered as one of the ultra-endurance events (Vogt et al., 2013) and distance extends up to 88k (Bradford & Cotter, 2019).

Under led by İstanbul Yıldızlar Swimming Club and supported by the Turkish Sports Ministry, Turkish Ministry of Foreign Affairs, Turkish Coastal Guard, Marmara University, Turkish Swimming Federation, Turkish Radio and Television, and Giresun City Municipality, a group of international swimmers (7 Turkish, 3 Russian, 2 Turkish- German) organized a 320k swimming event in the name of World Health Workers and Friendship. This event started from the Sochi coast (Russia) and finished on Giresun (Turkiye) coast on 14-20 June 2021. The formal permissions were taken from Turkish and Russian Foreign Ministries. All international open sea rules were followed during the event. One of the biggest coastal guard ships (TCG Dost, 93m long) hosted the event. TCG Dost's crew includes 85 Navy personnel. During the event, 3 medical personnel, 1 sport psychologist & researcher, 3 swimming official referees, 4 journalists, and 3 organization team members were on board the ship. TCG Dost contained two speedboats with jet turbine engines (without propellers) and a helicopter landing area was available for emergencies.

Recent studies reveal that environmental conditions play a redundant role in swimming performance (Tipton & Bradford 2014; Knechtle et al., 2017). In this study, because of the rotational swim plan, normally each swimmer performs two times a day (one daytime and one evening or nighttime), weather, water, and time differences are expected to play a role in athletes' psychological and physiological states. The study aimed to investigate swimmers' psycho-physiological responses under long-term open water swim experience from start to finish in the Sochi-Giresun 320k swimming event.

METHOD

Research group (population-sample)

Three months before the event, an open call is shared in various media environments to invite the candidate participants. candidate swimmers' applications are accepted for the evaluation process. The following conditions were evaluated for the competitive team's selection criteria:

- National and international competition experience,
- Ability to perform average 1k distance in one hour,
- Experience in night swimming,
- Absence of negative sport-related record,
- 30 years or older,
- 3 years of stable training regime retrospectively,
- A well-known social life and status.

At the end of the open announcement period, 48 candidates from Türkiye, Russia, and Germany participated in the list. Then according to the criteria above, the organizing committee was chosen 15 candidates (13 main, 2 substitute) and after the presentation of the project details, a consent form was signed by the participants. Just in the beginning of the organization one swimmer's participation is canceled due to health reasons and the ultimate team comprised 12 swimmers. Information given to the swimmers included security risks, the expected performance (1 hour swimming every 12 hours during 6 days), ship and sea-life conditions such as waves, stormy weather, and other details. One of the important detail was the value of achieving 320k distance in 6 days, because of the organizational goals.

In the Sochi-Giresun event, 9 males (average height 178.17; weight 80.5; age 45.42), 3 females (average height 175.44; weight 80.31; age 41.5) 12 swimmers participated. Every swimmer was monitored for their training regime 3 months before the event, weekly training

number was an average five times. Due to participants' elite level and selection criteria, a priori sample size calculation was not performed, convenience sample size was used.

One day before the ship boarding, team members and all officials joined a short preparation camp in a hotel at Giresun, organizing team meetings held, a health expert group examined all participants' health situation check, and collect blood samples, all team received COVID-19 PCR test and all results were marked as negative. A sport psychology expert gave a motivational speech and imagery-related exercises with athletes on the same day for mental preparation. The referee team holds a meeting with swimmers and the organizing team for the briefing about rules, schedules, and other important details.

Performance measures

According to the swimming plan of the group, every participant was expected to swim for one hour in a previously prepared order by official referees. The distance of the swimmer is recorded with smart swimming watches and the cruise GPS of the ship which cooperated with official swimming referees synchronizing. Besides swimming distance, blood plasma lactate concentration, and heart rate values were recorded. When the athletes prepared and conducted their warm-up just before the start command, lactate was taken using a portable lactate analyzer (Lactate Pro; FaCT Canada Consulting Ltd.), then before fatigue VAS scale was applied. After the swimming round, blood lactate samples were collected, and after swimming VAS scales were applied. IZOF measures are applied in the beginning round, middle rounds, and after the final rounds. After every round, smartwatch records are entered into a sheet.

Psychological measures

VAS scales: Visual Analog Scales were used to measure the swimmer's perceptions for each swim round. For this reason, before round fatigue, and during round fatigue, the difficulty of the round and perceived stress level during swim rounds were collected by using vertically designed visual analog scales. Those scales were developed by researchers and indicated 1 (very low) and 10 (very high) for all the variables. VAS scales were applied for perceived fatigue just before every swimming round, for other variables participants filled out the forms just after each swimming round.

Emotional State Profile -40: Instrument developed by Hanin (Hanin 2003; Ruiz& Hanin 2014) and based on the Individual Zones of Optimal Functioning (IZOF) methodology (Robazza et al. 2008). In IZOF applications, four emotion categories were derived (Ruiz, Raglin & Hanin 2015), and a list of positive and negative emotions indicated for functional emotions

and dysfunctional emotions were given to the participants, then asked to choose the proper ones before, during, or after the sportive performance. In this study, the ESP-40 form was used to indicate swimmers' emotional experiences from the beginning of the event until the end. ESP-40 consists of 40 emotional expressions for P+ (positive and functional, helpful), P- (positive and dysfunctional, harmful), N+ (negative and functional, helpful), and N- (negative and dysfunctional, harmful) categories. In the application form, every row of the form consisted of N-, N+, P+, and P- emotional expressions respectively, participants scored each expression of every row from 4 points (for the most dominant emotion) to 3 points for the next after 2 and 1 points for the less dominant emotions. Each dimension consisted of 10 emotional expressions, the maximum point can be 40 for each dimension and 10 for the minimum.

Procedure

According to the previously prepared swimming order, the first swimmer transferred to the water with transfer boat 1, then swam through the safe start area after by the referee's start command who positioned at the stern of the ship the swimmer started and time and GPS position are recorded. When the previous swimmer was near the finish of his/her turn, the next swimmer transferred with the same procedure and entered the water, and swam until the previous swimmer's endpoint. When the previous swimmer finishes his round by officials' command, the following athlete immediately starts his/her round. After finishing swimmer was taken to the speed boat and transferred to the main ship. Immediately after the swimmer was transferred to the ship, saliva samples, and psychological data collection procedures were conducted. This procedure is followed by the physician's routine examination of the athlete's health situation. After the swimmer went to the rest area until the next round start time.

FINDINGS

Table 1. Participants and average covered swimming distance per round

Swimmer (Gender)	Average Covered Distance (m)	Appearance
B.T (F)	3555.13	8
D.K (F)	3104.57	7
Z.Z (F)	3173.14	7
A.N (M)	4219.00	8
A.V (M)	3308.86	7
F.İ (M)	3041.00	8
H.B (M)	3150.43	7
K.Ç (M)	3468.75	8
K.T (M)	3274.50	8
N.Ü (M)	3499.86	7
P.K (M)	3529.83	6

Security precautions: Two speedboats accompanied the swimmers during every round continuously with four person rescue team, ship crew followed the swimmers with thermal

cameras during the event. Medical team members were all time been ready in the start area during all stages of the event.

Statistical analysis

Descriptive statistics were used for general distributions. Linear regression analyses were performed to analyze the effect of independent variables on perceived stress levels and the emotional situation of swimmers. Mahalanobis distance values controlled for the extreme values and Durbin-Watson coefficients were calculated to see auto-correlations between variables. One-way ANOVA was performed to explore the differences between the four stages of the event on the dependent variables. Post-hoc analyses were performed using Bonferonni statistics.

RESULTS

Table 2. Descriptive statistics of the study for daytime and nighttime performances

	Swimming Time				
	Daytime		Nighttime		
	Mean	**S.d.**	**Mean**	**S.d.**	**p<**
VAS Before swim fatigue	3.90	1.569	4,03	1.36	N. S
VAS During swim fatigue	5.78	1.548	5,80	1.79	N. S
VAS Difficulty	6.00	1.700	6,34	1.79	N. S
VAS Stress level	4.22	1.902	3,66	2.17	N. S
Distance (m)	3474.17	767.01	3305,54	797.23	N. S
BPM	145.12	13,71	142.29	13,66	N. S
Pace	147.20	44,68	155,19	60.83	N. S
Blood lactate before swim	3.21	29.32	1.82	12.58	P<0.05
Blood lactate after swim	3.80	24.98	3,52	17.96	N. S
IZOF Positive & functional emotions	33.75	2.74	31.9333	4.08	N. S
IZOF Positive & nonfunctional emotions	32.18	4,95	31.1333	3.97	N. S
IZOF Negative & nonfunctional emotions	14.44	2.89	15.2000	3.45	N. S
IZOF Negative & functional emotions	19.63	4.72	19.8667	4.05	N. S

**VAS: Visual Analog Scales, BPM: Beat Per Minute, IZOF: Individual Zones of Optimal Functioning.*

Examining the differences between daytime and nighttime swimming rounds, descriptive statistics were presented in Table 2 revealing that there are no significant differences found between variables for the daytime and nighttime measurements except before swim blood lactate level. There were slight differences between day and night in favor of daytime rounds for before fatigue, during fatigue, and difficulty of the round but those differences were not statistically significant. The perceived stress level was found higher in daytime rounds than in nighttime rounds. This result was opposite to expected. Also, a linear regression analyze conducted separately for the night rounds and the daytime rounds for the stress levels. No significant difference was found. This result showed night rounds were not created a big impact on swimmers than daytime rounds.

Table 3. Pearson correlations

	Covered Distance	VAS Scales				IZOF States				Before Blood Lactate	After Blood Lactate
		Before Fatigue	During Fatigue	Difficulty	Stress Level	P+	P-	N-	N+		
Before swim fatigue	-0,213										
During swim fatigue	0.015	0,283**									
Difficulty of round	-0.107	0.116	0.498**								
Stress Level	0.115	0,162	0.387**	0.367**							
Positive & functional emotions (P+)	0.217	-0.101	0.287	0.225	0.198						
Positive & nonfunctional emotions (P-)	0.291	-0.020	-0.068	-0.088	-0.021	0.044					
Negative & nonfunctional emotions (N-)	-0.347	0.167	-0.052	0.071	-0.220	-0.340	-0.379*				
Negative & functional emotions (N+)	-0.127	0.164	0.032	0.157	0.054	-0.079	-0.744**	-0.038			
Blood lactate before swim	0.127	-0.053	-0.081	-0.212	-0.019	0.208	0.368	-0.321	-0.181		
Blood lactate after swim	0.087	0.023	-0.311*	-0.253*	-0.368*	0.046	0.364	0.100	-0.313	0.166	
BPM	0.158	-0.154	-0.076	-0.108	0.232	-0.187	0.194	-0.301	-0.040	0.227	-0.049

VAS: Visual Analog Scales, BPM: Beat Per Minute, IZOF: Individual Zones of Optimal Functioning.

According to the Pearson correlations, objective performance parameters (distance, BPM), physiological parameters (before blood lactate, after blood lactate), and psychological IZOF states (P+, P-, N+, N-), and VAS scales (Before fatigue, during fatigue, the difficulty of the swimming round, perceived stress level) were included in the analysis. Objective performance parameters do not show any significant relationship with psychological parameters. In physiological parameters, before swim rounds blood lactic acid concentration level was found not significantly related to all other variables. Blood lactic acid concentration after swim round variable was found significantly related to perceived fatigue before swim rounds ($p<0.05$), perceived fatigue levels during swim rounds ($p<0.05$), and perceived stress level during swim rounds ($p<0.05$). All these correlations were negative. When perceived fatigue and perceived stress levels increased, blood lactate after swim rounds decreased. IZOF state parameters were not found statistically related to other variables. The only relationship found between N- and N+ and P+ states interrelated with each other negatively.

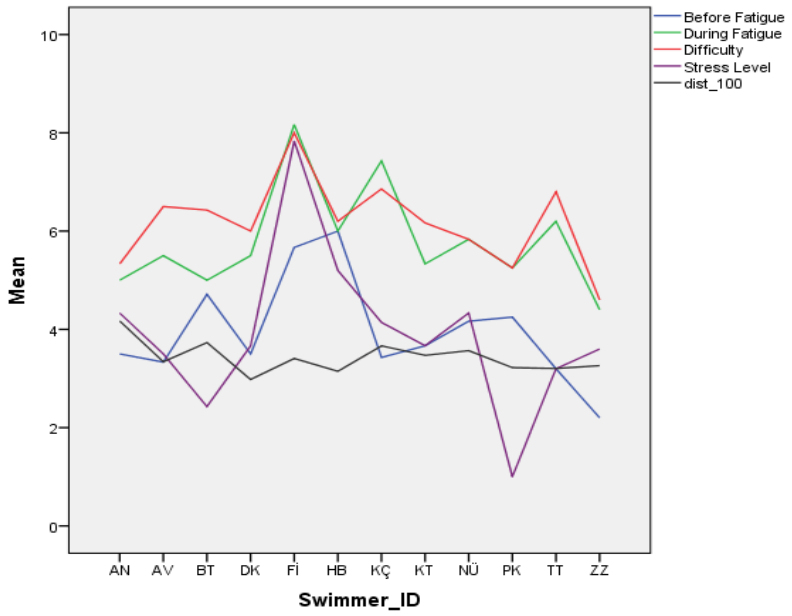

Figure 1. Perceived psychological VAS measurements and covered distance

When individual VAS performances were examined, each swimmer's perceptions were not consistent. When comparing with the covered distance, swimming distance was more consistent and similar for all swimmers (black line). Generally, fatigue scores and difficulty scores were higher than perceived stress and before fatigue scores. Despite the level of these two variables, stress level and before-swim fatigue levels were more unstable between each swimmer.

Visual Analog Scale (between 1 to 10) which indicates before round fatigue, during round fatigue, the difficulty of the round, and the perceived stress level during the round results were shown above. As seen in the graphic, each swimmer's psychological perceptions were quite different than others. Every swimmer experienced different emotions and perceptions during the stages of the marathon swim rounds.

Table 4. Linear regression analysis for perceived stress level

Predictors	Standardized Coefficients Beta	T	Sig.
(Constant)		1.900	0.063
During s. fatigue	0.345	2.412	0.020*
Difficulty	0.139	0.986	0.329
Lactate (after round)	-0.243	-1.973	0.054*
Daytime	-0.157	-1.339	0.186

A linear regression analyze conducted for examining the selected predictor variables' effect on the perceived stress level of swimmers during the rounds. In the model; during round fatigue and perceived difficulty and blood lactic acid levels and daytime (swimming under sunlight or night conditions) variables were entered as predictors. The model was significant

($p<0.001$) and according to the standardized Beta coefficients, the daytime variable which is entered dummy variable is affected other predictors. During swim fatigue was predicted the perceived stress level was linear and significant ($p<0.05$). After swimming round blood lactate levels also had an effect on stress levels but the Beta coefficient was negative ($p<0.05$). This means when the blood lactic acid concentration increased, perceived stress levels were decreased. This result might be related to the relative performance outcome of the swimmer.

DISCUSSION AND CONCLUSION

The originality of the study was to observe open-water swimmers during extraordinary conditions in a real challenge of 320k swimming performance in the Black Sea. Other studies were conducted in the pool or shore conditions, in this research, all measurements were collected during an open sea cruise with a 93m long TCG Dost Ship of Turkish Coastal Guard fillet. Another difference in this study was every swimmer performed 6 to 8 rounds of swim, and performances realized daytime and nighttime with shifts.

In this study, swimmers covered 21.178k to 33.752k (average 24.901k) distance during six days challenge. According to Adalia et al. (2021), the most common open-water races cover 5, 10, or 25k distances. If we compare with those distances, interruptedly our participants covered a maximum acceptable distance in day and night conditions. In the middle of the Black Sea, the event was suspended two times with the referee's decisions because of the extreme weather conditions. During this suspension time, TCG Dost was drawn circles in the sea until the next start command is given. Our study revealed a weak bond between the performance-related variables with psychological variables and physiological variables. This result is similar to Wang et al**.** (2023) study on collegiate swimmers. In this study, performed correlations level and all psychological measurements including energetic, tiredness, tension, calmness, and DALDA (Daily analysis of life demands of athletes) dimensions showed no significant relationship with blood lactate.

An observational result was the suspensions of the event possibly played a role and give a chance to recover swimmers, obviously, swimmers did not face the previously expected physical challenge level. In fact, to be on the ship for a long period in open sea conditions was already a stressful stimulant for unfamiliar bodies as well. Even in normal conditions, physiological problems for sea travelers such as seasickness, motion sickness and sopite syndrome, and other symptoms (Stevens & Parsons, 2002) are expected to be experienced.

Lactic acid metabolism results in the muscle that was transferred into the blood and causes a decrease in blood pH level (Rusdiawan et al., 2020). Generally, our measured blood lactate levels were lesser than other open-water swimming studies, but we have limitations in comparing our results with competition results. In this event, every swimmer performed one hour of swimming two rounds a day. In the literature, there are some experimental studies that measured blood lactate levels of open-water swimmers. Those studies acquired data in different settings than our study. VanHeest et al. (2004) conducted an experimental study on average age 18.6 (male) and 17.8 (female) swimmers. They organized a camp and after 5x200 m training loads, measured blood lactate in every 200 m distance completed. In this study, the male blood lactate average was 7.38 ± 1.40 mmol, and 7.88 ± 1.10 mmol for female swimmers. This study was similar to our study and every swimmer performed exercises twice a day for 6 to 7 days. Our findings showed lower lactate levels for both male (3.75±2.41 mmol) and female (3.44±1.39 mmol) swimmers. Another related study was conducted on female swimmers and a 14-week-long training program is applied (Santhiago et al., 2011). In this study, after a 5-15-minute warm-up, elite women Olympic and international-level swimmers performed 5x15-m front crawl maximum efforts with 1 minute of passive recovery in between, then blood lactate samples were taken from earlobes. According to the results, blood lactate concentration levels were similar in our study (between 3.39 mmol to 4.82 mmol range). Veiga et al. (2019) reported race-to-race and represented different swimming intensities for the lactate threshold velocities of elite freestyle swimmers. For this reason, blood lactate results need to compare with more similar cases e.g. competitive vs different challenging conditions such as marathon events. As an example, Holland and Acavedo (2000) conducted a qualitative study on English Channel swimmers and found that mental toughness and self-confidence as key factors for open-water swimmers.

Our other question was to compare daytime and nighttime effects on the psychological and physiological variables. Both daytime lactate levels were higher than nighttime swimming rounds, but this difference was not statistically significant. Another adverse result after rounds of swimming was lactate level negatively significantly correlated with during round swimming fatigue, the difficulty of the swimming round, and perceived stress at .05 level.

According to VAS and IZOF emotional state results, as a general observation, all athlete's scores were quite different from others. Generalization or average value analyses makes it harder to see individual differences. In Figure 1, the perceived VAS scale measures reveal the differences, compared to covered distance, psychological situation-specific perceptions vary

from one swimmer to another. Wang et al. (2023) results were parallel to ours, they mentioned psychological and physiological responses to training stimulus are mostly considered as an individual process. Our most volatile variable was found as perceived stress levels. After round stress level and other before swimming round VAS scores were unique for every swimmer. Clemente-Suares et al. (2021) found swimmer's recovery perception highly influences the anaerobic and aerobic performance on swimmers. Next studies may focus on swimmers' recovery during the breaks because some swimmers perceived fatigue levels were remarkably higher or lower than most of the group. This result shows idiosyncratic studies can help to interpret situations more than group-oriented comparisons for athletes. Generally, our psychological results are similar to Massey et al. (2020), progressive sea swimming sessions provide a longer-term reduction in negative mood states.

For open-water swimmers, endurance capability and mental toughness is a complementary factors for coping with the extreme conditions. On perceived stress levels, we performed a linear regression analysis to determine the predictors of the perceived stress level during the swimming rounds. According to the regression results, during fatigue is found to be a positive predictor ($p<0.05$), and after swimming blood lactate is a negative predictor ($p<0.05$) of perceived stress level. When athletes experience fatigue during the swim rounds, stress levels increase. Performance-related blood lactate level was expected to be positively related to perceived stress levels, the result was opposite to other findings such as Clemente-Suarez et al. (2021). One reason could be related to the characteristic of the event, more than a race, this event was an endurance challenge for six days, maximal performance was not the first aim, and could be as a result, average blood lactate levels found under the 4 mmol threshold. When lactate level is analyzed with brain functions, studies support our findings. Coco et al. (2020) reported that lactate works in the brain not just as an energy substrate or an angiogenetic factor, but also as a true neuromodulator, which can protect from stress. At this point, it is thought that this mechanism might be related to rewarding feedback on the performance action. In another study, Coco (2017) mentioned lactate as a protector agent from fatigue, so this could be related to the central nervous system protection mechanism in higher stress levels.

Regarding gender differences, our study comprised 3 female and 9 male swimmers. In physical parameters, just the BPM of women (average 151.56±11.96) swimmers were significantly higher than men (average 139.38±12.84). In all of the perceived psychological variables women swimmers perceived their swimming rounds as more comfortable than men, but just during fatigue score was statistically significant (women average=5.00±1.18; men

6.06±1.72). Our findings were parallel with Baldassarre et al. (2017) and Eichenberger (2017), open water swimming environment and also performance records of many competitions were reported in favor of woman swimmers, because long-distance water conditions were believed to be a good fit with woman's physiology and anatomy than men. This fact comes from some early studies "swimming economy is better in women than men" (Lavoie & Montpetit, 1986). Because of those reasons, in our study, men swimmers probably perceived more fatigue, stress, and difficulty in the same conditions than women. IZOF measures varied between women and men. Men swimmers' positive and functional states and negative and nonfunctional states were higher than women's but not statistically significant, other states were found almost similar.

According to the results, daytime and nighttime open water swimming results showed particular differences in favor of nighttime for perceived psychological factors (before and after swim fatigue, perceived difficulty) also daytime stress levels and blood lactate levels before swimming were higher than nighttime. Male swimmers' perceived stress and difficulty levels were higher than women's. After swimming blood lactate level is found a negative predictor of perceived stress levels during the swim.

Future research needs to study psychological factors including psychological recovery, stress levels, fatigue, and blood lactate levels according to gender and environmental parameters on open water swimmers.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Son yıllarda, masterlar yüzme, hızla büyüyen serbest zaman aktivitelerinden biri olarak kabul edilmektedir (Knechtle ve ark., 2017). Açık su yüzme, dalga, akıntı, gece koşulları, deniz hayvanları, rüzgâr, sıcaklık/soğukluk, mesafe, güvenlik, sağlık riskleri gibi birçok içsel ve dışsal performansla ilgili faktörü içeren benzersiz bir disiplindir. Bu tür koşullarda, açık su yüzme en zorlu spor etkinliklerinden biri haline gelmektedir. Fiziksel durum, yüzme tekniği, antropometrik özellikler, yüzme stili (Vogt et al., 2013), cinsiyet farklılıkları (Eichenberger ve ark., 2013; Salihu et al., 2016), yaş, deneyim (Adalia ve ark., 2021), dalış giysisi giyme (Ulsamer ve ark., 2014) ve fizyolojik ve psikolojik hazırlık gibi kişisel faktörler, performansı etkileyen bileşenler olarak kabul edilmektedir. Bu çalışmanın amacı, uzun süreli açık su yüzme deneyimine sahip yüzücülerin Soçi-Giresun 320 km yüzme etkinliğinde başlangıçtan bitişe kadar psiko-fizyolojik tepkilerini incelemektir.

YÖNTEM

Etkinlikten üç ay önce, aday katılımcıları davet etmek için çeşitli medya ortamlarında açık bir çağrı paylaşıldı. Aday yüzücülerin başvuruları değerlendirme sürecine alındı. Rekabetçi takımın seçimi için aşağıdaki koşullar değerlendirildi:

Ulusal ve uluslararası yarış deneyimi,
Ortalama 1 km mesafeyi bir saatte yüzebilme yeteneği,
Gece yüzme deneyimi,
Olumsuz sporla ilgili kayıt bulunmaması,
30 yaş ve üzeri olma,
Son üç yıl boyunca istikrarlı bir antrenman rejimine sahip olma,
Tanınmış sosyal yaşam ve statüye sahip olma.

Soçi-Giresun etkinliğinde, 9 erkek (ortalama boy 178,17; ağırlık 80,5; yaş 45,42), 3 kadın (ortalama boy 175,44; ağırlık 80,31; yaş 41,5) toplam 12 yüzücü yer aldı. Her yüzücünün etkinlikten 3 ay önceki antrenman düzeni takip edildi, haftada ortalama beş kez antrenman yapıldı. Gemiye binmeden bir gün önce, tüm katılımcıların sağlık durumu kontrol edildi, kan örnekleri alındı, Covıd-19 PCR testleri yapıldı ve sonuçlar negatif olarak belirlendi.

Performans ölçümleri: Yüzücünün mesafesi, akıllı yüzme saatleri ve resmi yüzme hakemleri ile senkronize olan geminin seyir GPS'i ile kaydedildi. Yüzme mesafesinin yanı sıra, kan plazma laktat konsantrasyonu ve kalp atış hızı değerleri kaydedildi.

Psikolojik ölçümler

VAS ölçekleri: Görsel Analog Ölçekler, yüzücülerin her yüzme turuna ilişkin algılarını ölçmek için kullanıldı. Tur öncesi yorgunluk ve tur sırasındaki yorgunluk, turun zorluğu ve yüzme turları sırasında algılanan stres seviyesi, dikey olarak tasarlanmış görsel analog ölçekler kullanılarak toplandı.

Prosedür: Önceden hazırlanmış yüzme sırasına göre, ilk yüzücü transfer teknesiyle suya taşındı, geminin kıç tarafına konumlandırılan hakemlerin başlama komutuyla güvenli başlama alanından yüzdü ve zaman ile GPS konumu kaydedildi. Önceki yüzücü döneminin sonuna yaklaştığında, bir sonraki yüzücü aynı prosedürle transfer edildi, suya girdi ve önceki yüzücünün son noktasına kadar yüzdü. Önceki yüzücü hakemlerin komutuyla turunu bitirdiğinde, hemen ardından takip eden sporcu turuna hemen başladı. Yüzücü, turunu bitirdikten hemen sonra hız teknesine alınmış ve ana gemiye transfer edilmiştir.

BULGULAR

Bireysel VAS performansları incelendiğinde, her yüzücünün algılarının tutarlı olmadığı görülmüştür. Yüzülen mesafe ile karşılaştırıldığında, yüzme mesafesi tüm yüzücüler için daha tutarlı ve benzerdi (siyah çizgi). Genel olarak, yüzme sırasındaki yorgunluk ve algılanan zorluk puanları, yüzme sırasında algılanan stres ve yüzme öncesi yorgunluk puanlarından daha yüksekti. Bu iki değişkenin

seviyesine rağmen, stres düzeyi ve yüzme öncesi yorgunluk düzeyleri yüzücüler arasında daha istikrarsızdı. Her yüzücü, maraton yüzme turunun aşamaları sırasında farklı duygular ve algılar deneyimledi. Algılanan stres düzeyinin yüzücülerin tur sırasındaki algılarına etkisini incelemek için lineer regresyon analizi yapıldı. Modelde; tur sırasındaki yorgunluk, algılanan zorluk ve kan laktik asit düzeyleri ve gündüz-gece (güneş altında veya gece koşullarında yüzme) değişkenleri yordayıcı olarak girildi. Model anlamlıydı ($p<0,001$) ve standartlaştırılmış Beta katsayılarına göre, dummy değişken olarak girilen gündüz değişkeni diğer yordayıcıları etkilemiştir. Yüzme sırasındaki yorgunluk, algılanan stres düzeyinin lineer ve anlamlı bir şekilde tahmin edicisi olarak belirlemiştir ($p<0,05$). Yüzme turu sonrası kan laktik asit düzeyleri de stres düzeyleri üzerinde bir etkiye sahipti, ancak Beta katsayısı negatif olarak bulunduğu için ilişkinin ters yönlü olduğu görülmüştür ($p<0,05$). Bu, kan laktik asit konsantrasyonu arttıkça, algılanan stres düzeylerinin azaldığı anlamına gelmektedir. Bu sonucun, yüzücünün göreli performans sonucu ile ilgili ödül etkisine bağlı olabileceği ön görülmüştür.

TARTIŞMA VE SONUÇ

Bu çalışmanın özgünlüğü, Karadeniz'deki olağanüstü koşullarda açıksu yüzücülerinin gözlemlenmesidir. Diğer çalışmalar genellikle havuz veya sahil koşullarında yapılmıştır, ancak bu araştırmada tüm ölçümler, 93 metre uzunluğundaki TCG Dost Gemisi ile gerçekleştirilen bir açıksu yüzme etkinliği sırasında toplanmıştır. Bu çalışmada her yüzücü, günde en az iki defa, gündüz ve gece vardiyalarıyla altı gün içerisinde toplam 6 ila 8 tur arasında yüzmüştür. Sonuç olarak, gündüz ve gece açıksu yüzme sonuçları, algılanan psikolojik faktörler (yüzme öncesi ve sonrası yorgunluk, algılanan zorluk) açısından gece lehine belirgin farklılıklar gösterdi; ayrıca gündüz stres düzeyleri ve yüzme öncesi kan laktat düzeyleri geceye göre daha yüksekti. Erkek yüzücülerin algılanan stres ve zorluk seviyeleri kadınlarınkinden daha yüksekti. Yüzme sonrası kan laktatı, yüzme sırasında algılanan stres düzeyinin negatif bir belirleyicisi olarak bulundu. Gelecekteki araştırmalar, açıksu yüzücülerinde cinsiyet ve çevresel parametrelere göre psikolojik faktörleri, psikolojik iyileşmeyi, stres düzeylerini, yorgunluğu ve kan laktat düzeylerini farklı açılardan inceleyebilir.

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Tasarım *Design*	Yöntem ve araştırma desenini tasarlamak *To design the method and research design.*	Cengiz KARAGÖZOĞLU
Literatür Tarama *Literature Review*	Çalışma için gerekli literatürü taramak *Review the literature required for the study*	Cengiz KARAGÖZOĞLU
Veri Toplama ve İşleme *Data Collecting and Processing*	Verileri toplamak, düzenlemek ve raporlaştırmak *Collecting, organizing and reporting data*	Kubilay ÇİMEN
Tartışma ve Yorum *Discussion and Commentary*	Elde edilen bulguların değerlendirilmesi *Evaluation of the obtained finding*	Kubilay ÇİMEN Cengiz KARAGÖZOĞLU

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