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Short notice

Rezultatska uspješnost ronjenja na dah (apnea) u zavisnosti od uslova sredine

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Sažetak: Istraživanje je provedeno na uzorku od 21. ispitanika - studenta Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, upisanih u III godinu studija školske 2010/2011, muškog pola, starosti 23 godine ± 6 mjeseci. Slučajnim izborom podijeljeni u dvije grupe za vrijeme izvođenja nastave aktivnosti u prirodi u studentskom kampu na Tjentištu. Osnovni cilj istraživanja je da se utvrdi rezultatska uspješnost ronjenja apneom (u dužinu) u zavisnosti od prirodnih uslova sredine (temperatura vode i vazduha).
Uzorak varijabli predstavljali su: dužina ronjenja na dah (apneom) izražena u metrima, temperatura vode izražena u stepenima (º C) i temperatura vazduha izražena u stepenima (º C).
Testiranje svih ispitanika izvršeno je u dva vremenska termina, pri različitim temperaturama vode u bazenu koja je varirala od 17 do 22º C i vazduha koja je varirala od 22 do 26º C.
Za utvrđivanje rezultatske uspješnostu u ronjenju apneom u dužinu u zavisnosti od temperature vode u bazenu i temperature vazduha, izvršena je komparacija rezultata osnovnih centralnih i disperzionih parametara i analize rezultata t-testa.
Analizom dobijenih rezultata, može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom (u dužinu).
Ključne riječi: ronjenje, apnea, ispitanici,temperatura, t-test.

Uvod

Ronjenje na dah (apnea) u dužinu je ronilačka disciplina kojom se ljudi bave od davnina. Izvodi se sa privremenim zaustavljanjem spoljašnjeg disanja (apnea), kojoj prethodi duboki udah vazduha. U ovoj disciplini ronilac pokušava sa jednim udahom preplivati što veću udaljenost u horizontalnom položaju ispod površine

Resultative Success of Breath-Hold Diving (Apnea) Depending From Environment Conditions

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Summary: The research was conducted on the specimen of 21 examinees - students Physical education and sport Faculty Istocno Sarajevo University, enrolled in the IIIrd year of school year 2010/2011, males, age of 23=6 months. By random choice they were divided into two groups during lessons in nature within student camp Tjentiste based. The basic aim of the research is to establish the resultative success of diving by apnea(long distance) depending of natural conditions of the environment(air and water temperature). The specimen of variables represented: length of breath –hold diving (apnea) expressed in metres, water temperature expressed in degress(°C) and air temperature expressed in degrees(°C).
Testing of all examinees were carried out at two time intervals, and at different temperatures of water in pool varying from 17 to 22°C and air temperature varying from 22 to 26°C.
For establishing the resultative success in diving by apnea in length depending from temperature of pool water and air temperature, the comparisson was made of results of basic central and dispersion parameters and analyses of t-test results.
Through analyses of the obtained results, it can be concluded that pool water temperature and air temperature have significant impact on the apnea diving in length in such a way that the increase of pool water temperature for 3 to 5 °C and air temperature for 2 to 4°C contributed achieving better results in apnea diving in length.
Key words: diving, apnea, examinees,temperature, t-test.

Introduction

Breath – hold diving (apnea) in length is diving discipline people are dealing with since long ago. It is performed with temporary holding of external breathing(apnea), being preceeded by deep inhale of air. In this discipline diver attempts to swim with one breath the longest distance possible in horisontal position below

vode. Takmičenja se održavaju u bazenima, koji ne smiju biti manji od 25m. U realizaciji ove discipline najvažniju ulogu ima tehnika i fizička pripremljenost ronioca, jer se takmičar ne smije koristiti nikakvim pomagalima. Mogu se koristiti odijelo i tegovi koji se ne smiju odbacivati za vrijeme izvođenja discipline.

Zbog bezbjedenosti takmičara postoji fizičko obezbjeđenje ronilac-asistent, koji prati takmičara i ako primijeti bilo kakve poremećaje kod ronioca, odmah ga vadi iz vode.

Dakle, apnea u sportu podrazumijeva zadržavanje daha (nedisanje) i ronjenje u inspiratornoj apneji, čija dužina i dubina zavise od mnogo faktora: doba, pola, vitalnog kapaciteta, treninga, zamora, motivisanosti, straha, ambijentalnog pritiska i temperature okoline.

U početnim fazama razvoja ove discipline, ljudi koji su se bavili ovom aktivnosti smatrani su prirodnim fenomenima. Međutim, u posljednje vrijeme ova disciplina se snažno razvija, tako da su počela i ozbiljnija naučna istraživanja koja objašnjavaju sposobnosti ljudi da se pod vodom zadrže po nekoliko minuta i zaranjaju na dubine i do 200 metara.

Ronjenje na dah u dužinu sastoji se iz četiri faze, faza hiperventilacije, faza starta, faza podvodnog plivanja i faza finiša.

Faza hiperventilacije se provodi neposredno pred početak i ispred startne linije na sljedeći način: ronilac se sasvim opusti, olabavi sve mišiće tijela i napravi pet do deset dubokih udaha i izdaha. Broj udaha i izdaha zavisi od individualnih osobina i fizičke pripremljenosti svakog pojedinca. Ronilac mora da prestane s hipreventilacijom čim osjeti laganu vrtoglavicu, jer bi u suprotnom nastupila hipokapnija (pad u nesvjesno stanje zbog naglog pada parcijalnog pritiska CO2 u arterijskoj krvi).

Po završetku hiperventilacije, ronilac rukom daje znak sudijama da je spreman za start i odmah startuje (s mjesta ili iz pokreta). Kod starta u pokretu ronilac po završenoj hiperventilaciji zaroni pet do sedam metara ispred linije starta i to na sledeći način: napravi zadnji duboki udah, lijevu ruku ispruža naprijed po površini vode, glavu naglo pokreće na dole, tijelo se povija u pojasu i ronilac zaronjava. U fazi vraćanja desne ruke u ispruženi položaj, tijelo je već u vodi tako da odmah tpočinje s radom peraja i to stilom «delfin» što će ronioca odmah dovesti na potrebnu dubinu. Po zaronjavanju, ronilac prelazi na rad nogama tehnikom «kraul», trudeći se da ne gubi vrijeme i potisak kod prelaza s jednog stila na drugi. Startovanjem na ovakav način ronilac će kroz startnu liniju preći punom brzinom.

Brzina podvodnog plivanja zavisi od položaja tijela,

water surface. Competitons are held in swimming pools, that mustn't be smaller than 25m. In realisation of this discipline the most importan role has technique along with physical fitness of diver, because the competitior may not use any tools. A suit and weights can be used and they mustn't be disposed during the performance of the discipline. For the sake of competitor's safety there is physical security diver-assistant who monitors a competitior and in case of noticing any disturbances with a diver, he imediately pulls him out of water.

So, apnea in sport implies holding breath (non breathing) and diving in inspiratory apnea, the length of which and depth depend of many factors: age, gender, vital capacity, training, exhaustion, motivation, fear, ambiental pressure and environment temperature.

In initial developing phases of the discipline, people doing this activity were considered as natural phenomena. However, recently this discipline has strongly been developing, so that some serious scientific researches have started, explaining the capacity of people to hold under water for several minutes, diving on depths up to 200 metres.

Apnea diving on length consists of four phases, phase of hyperventilation, start phase, underwater swimming phase and finish phase.

Hyperventilation phase is conducted just before the beginning and in front of start line in the following way: a diver relaxes totally, relaxing all muscles and makes five to tendeep inhales and exhales. The number of inhales and exhales depends from individual features and physical fitness of each individual. The diver has to stop with hyperventilation as soon as he feels light dizziness, for in contrary, hypocapnia would occur (falling into uncosciencious state due to uprupt fall of partial pressure CO_2 in arterial blood). Upon completion of hyperventilation, a diver gives sign by hand to judges that he is ready for start and starts imediately. (from standing or moving). At starting from moving the diver dives five to seven times upon finished hyperventilation in front of starting line in the following way: making the last deep inhale, streching left arm on water surface, with head ubruptly pushed downwards, body bent in waist and diver dives. In returning of right arm into streched position, body is already in water, therefore he instantly begins with fins working with „dolphin" style which will bring the diver to necessary depth. After diving in, the diver starts with legs work „crawl" technique trying not to lose time and push at transfering from one style to another. By starting on such a way, the diver shall cross the start line with full speed. The speed of underwater swimming depends of body position, amplitude

amplitude i frekvencije rada nogu, forme i elastičnosti peraja, a u bazenima i od dubine na kojoj se pliva. Najbolji rezultati se postižu kada se pliva na dubini 1 do 1, 5 m. Ako je ronilac na manjoj dubini postoji opasnost da perajama ili dijelom tijela izroni na površinu i pokvari rezultat. Drugi nedostatak plitkog plivanja je što se javlja površinski kontra tok vode koji usporava kretanje ronioca. Povratno strujanje vode formira se i pri dnu bazena, pa će kontra strujanje vode usporavati njegovo kretanje.

Finiš treba da bude na dva do tri metra pred linijom cilja, kada ronilac pravi jak zaveslaj jednom rukom povlačeći je do kuka, dok druga ruka ostaje ispružena u očekivanju udara u liniju cilja ili ivicu bazena. Efekat finiša može se umanjiti ako ronilac podigne glavu da bi osmotrio liniju cilja.

Za vrijeme podvodnog plivanja, od starta do prolaska kroz cilj, ronilac treba da drži glavu između ispruženih ruku s pogledom okrenutim prema dnu bazena.

Istraživanja koja se bave proučavanjem problematike ronjenja na našim prostorima nema ili bar autorima takva istraživanja nisu poznata, te su i parcijalna istraživanja problematike ronjenja značajna za dobijanje validnih informacija o ronjenju.

Metod istraživanja

Uzorak ispitanika

Populacija iz koje je ekstrahovan uzorak ispitanika predstavlja 21 student Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, muškog pola, starosti 23 godine ± 6 mjeseci.

Uzorak varijabli

Uzorak varijabli odabran je tako da reprezentativno pokrije istraživano područje i pruži informaciju o uticaju uslova prirodne sredine na varijable ronjenja apneom u dužinu.

1. Dužina ronjenja na dah (apneom).....ADAJ
2. Temperatura vode .....TVOD
3. Temperatura vazduha.....TVAZ

Procedure mjerenja

Testiranje je izvršeno na bazenu studentskog kampa "Tjentište" na Tjentištu. Pored bazena je razvučena metalna pantljika sa koje se očitava dužina preronjene dionice sa tačnošću očit avanja od 0,1 m. Ispitanik stoji na ivici bazena i na znak mjerioca vremena (ispitivača) sunožnim odrazom ulazi u vodu i započinje ronjenje uz pomoć rada ruku i nogu. Mjerena je dužina preronjene dionice izražena u metrima.

and frequency of legs' work, form and elasticity of fins, and in swimming pools from depth on which swimming is done. The best results are being achieved when swimming on 1 to 1,5 m. depth. If the diver is on smaller depth, there is a risk to dive out on the surface with fins or a body part spoiling the result doing so. Another disadvantage of shallow swimming is appearance of surface counter water flow which slows down the diver's movement. Returning water flow has been formed at the pool's bottom, leading to slowing down of his movement by counter water flow. Finish should be two to three meters before starting line, when the diver makes strong stroke hand pulling it to hip, while the other hand remains streched expecting hit in start line or pool's edge. The effect of finish may be reduced if the diver raises his head in order to observe the start line. During underwater swimming, from a start to passing trhough finish line, the diver should keep his head between stretched arms with view turned to the pool's bottom.

There are no the researches dealing with research of diving issues in our area or at least they are not known to authors, therefore, partial researches of the diving issue are significant for obtaining valid information on diving.

Research method

The specimen of examinees

Population out of which the specimen of examinees was extracted is represented by 21 student Physical education and sport Faculty of Istocno Sarajevo University, males, age 23=6months.

The specimen of variables

The specimen of variables was selected so to representatively cover the researched field and provides information on the impact of environment conditions to variables of apnea diving in length.

1. The length of apnea diving.....ADAJ
2. Water temperature .....TVOD
3. Air temperature.....TVAZ

Measuring procedures

Testing was carried out on the pool of student camp „Tjentiste" in Tjentiste. By the pool the metal ribbon was spread which reads the length of dived line with punctuality of reading of 0,1 m. The examinee stands on the edge of pool and on sign of time measurer (examiner) with pedal reflection enters water starting diving by help of arm and leg working. The length of dived line was measured expressed in meters.

Prvo testiranje ispitanika prve grupe izvedeno je pri temperaturi vode od 17º C i temperaturi vazduha od 20º C, a drugo testiranje je izvedeno pri temperaturi vode od 18º C i temperaturi vazduha od 22º C.

Prvo testiranje ispitanika druge grupe izvedeno je kada je temperatura vode bila 20º C i temperatura vazduha 22º C, a drugo testiranje je izvedeno kada je temperatura vode iznosila 22º C, a temperatura vazduha 26º C.

Statistička obrada podataka

Za sve primijenjene varijable izračunati su osnovni centralni i disperzioni parametri:

- Aritmetička sredina.....(Mean),
- Minimalni rezultat mjerenja.....(Min),
- Maksimalni rezultat mjerenja.....(Max),
- Standardna devijacija.....(Std. Dev).

Za utvrđivanje statističke značajnosti razlika prvog u odnosu na drugo mjerenje na malim zavisnim uzorcima primijenjena je analiza rezultata t – testa.

Rezultati istraživanja i diskusija

Rezultati istraživanja obrađeni su na način da se dobiju informacije o centralnim i disperzionim parametrima za sve manifestne varijable i to: srednja vrijednost, minimalni i maksimalni (numerički) rezultat, standardna devijacija.

Tabela 1. Osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod prve grupe ispitanika - studenata

The first testing of the first group was done at water temperature of 17°C and air temperature of 20°C, and second testing was made at water temperature of 18°C and air temperatureof 22°C.

The first testing of the second group examinees was performed when water temperature was 20°C and air temperature 22°C, and the second testing was done at water temperature of 20°C and air temperature 26°C.

Statistical data processing

For all applied variables the basic central and dispersion parameters were calculated. For all applied variables the basic central and dispersion parameters were calculated:

- Arithmetic mean.....(Mean),
- Minmal result of measuring.....(Min),
- Maximum measuring result.....(Max),
- Standard deviation.....(Std. Dev).

For establishing of statistical significance of differences between first and second measuring on small dependable specimen analyses of results of t-test was applied.

Results of research and discussion

Results of research were processed in a way to get information on the central dispersion parameters for all manifesting variables, that is: middle value, minimum and maximum (numeric) result, standard deviation.

Table 1. Basic central and dispersion parameters of the applied variables at first and second measuring with the first group of examinees- students

	Valid N	Mean	Min	Max	Std. Dev
ADAJI	16	12.03	9.00	37.50	6.92
ADAJF	16	14.16	9.80	39.50	7.25
TVODI	16	17.00	17.00	17.00	0.00
TVODF	16	18.00	18.00	18.00	0.00
TVAZI	16	20.00	20.00	20.00	0.00
TVAZF	16	22.00	22.00	22.00	0.00

U tabeli 1 prikazani su osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod prve grupe ispitanika – studenata. Analizom rezultata prikazanih u tabeli 1 može se vidjeti sljedeće:

Na prvom mjerenju pri temperaturi vode od 17 º C i vazduha 20º C vrijednosti parametara su sledeći: srednja vrijednost (Mean=12.03), najslabiji rezultat (Min=9.00), a najbolji (Max=37,50), standardnu devijaciju (Std. Dev = 6.92).

In table 1 the basic central and dispersion parameters of applied variables at the first and second measuring with the first group of examinees - students are shown. Through analyses of results presented within table 1 the following can be seen:

On the first measuring at water temperature of 17°C air of 20°C parameters' values were the following: middle value (Mean=12.03), the weakest result (Min=9.00), and the best (Max=37,50), standard deviation(Std. Dev = 6.92).

Na drugom mjerenju iste grupe ispitanika pri temperaturi vode od 18º C i temperaturi vazduha od 22º C dobijene su sljedeće vrijednosti parametara: srednja vrijednost (Mean=14.16), najslabiji rezultat (Min=9.80), a najbolji (Max=39,50), standardna devijacija (Std. Dev = 7.25).

Komparacijom vrijednosti aritmetičkih sredina dobijenih u prvom i drugom mjerenju može se uočiti da su ispitanici prve grupe postigli bolje prosječne rezultate u drugom mjerenju kada su temperature vode i vazduha bile nešto veće (temperatura vode bila je veća za 1º C, a temperatura vazduha bila je veća za 2º C). Takođe, komparacijom vrijednosti minimalnih i maksimalnih rezultata postignutih u prvom i drugom mjerenju, može se uočiti da su njihove vrijednosti u drugom mjerenju veće u odnosu na prvo mjerenje, što ukazuje na činjenicu da su ispitanici postizali bolje rezultate pri većim vrijednostima temperature vode i vazduha. Vrijednosti standardne devijacije, kao mjere koja pokazuje realnu mjeru odstupanja pojedinih vrijednosti serije od aritmetičke sredine su veće u drugom mjerenju, što ukazuje na činjenicu da je prva grupa ispitanika postala heterogenija u drugom mjerenju, pa se može pretpostaviti da je temperatura vode i temperatura vazduha značajno uticali na dužinu ronjenja apneom.

On the seond measuring of the same group of examinees at water temperature of 18°C and air temperature of 22°C the following parameters values have been obtained: middle value (Mean=14.16), the weakest result (Min=9.80), and the best (Max=39,50), standard deviation (Std. Dev = 7.25).

Through comparisson of arithmetic means obtained in the first and second measuring it may be noticed that the examinees of the first group achieved better average results in the second measuring when temperature of water and air were higher (water temperature was higher for 1°C, while air temperature was higher for 2°C.) Likewise,through comparisson of minima and maximum results achieved in the first and second measuring, it is obvious that their values in the second measuring are higher as compared to the first measuring, which implies that the examinees achieved better results at higher values of water and air temperature. The value of standard deviation, as the measure showing the real measure of deviation of individual values of series from arithmetic mean are higher in the second measuring, which indicates to the fact that the first group of examinees became more heterogeneous in the second measuring, which leads to presumption that water and air temperature had significant influence on the length of apnea diving.

Tabela 2. Osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju druge grupe ispitanika - studenata

Table 2. The basic central and dispersion parameters of applied variables on the first and second measuring of the second group of examinees- students

	Valid N	Mean	Min	Max	Std. Dev
ADAJI	5	11.90	9.10	17.30	3.42
ADAJF	5	15.82	9.70	25.20	5.63
TVODI	5	20.00	20.00	20.00	0.00
TVODF	5	22.00	22.00	22.00	0.00
TVAZI	5	22.00	22.00	22.00	0.00
TVAZF	5	26.00	26.00	26.00	0.00

U tabeli 2 prikazani su osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod ispitanika druge grupe. Uvidom u tabelu 2, u kojoj su prikazani centralni i disperzioni parametri ronjenja apneom kod druge grupe ispitanika - studenata na prvom mjerenju pri temperaturi vode od 20º C i temperaturi vazduha od 22º C vrijednosti parametara su sljedeći: srednja vrijednost: (Mean=11.90), najslabiji rezultat (Min=9.10), a najbolji (Max=17,30), standardnu devijaciju (Std. Dev=3.42). Na drugom mjerenju druge grupe ispitanika pri temperaturi vode od 22º C i temperaturi vazduha od 26º C dobijene su sljedeće vrijednosti

In table 2 the basic central and dispersion parameters of the applied variables on the first and second measuring with second group examinees. Through the insight in table which shows the central and dispersion parameters of apnea diving with the second group of examinees – students on the first measuring at water temperature of 20°C and air temperature of 22°C the parameter values are the following: middle value: (Mean=11.90), the weakest result (Min=9.10), and the best (Max=17,30), standard deviation (Std. Dev=3.42). On the second measuring of the second group of examinees at water temperature of 22°C and air temperature of 26°C the following

parametara: srednja vrijednost: (Mean=15.82), najslabiji rezultat (Min=9.70), a najbolji (Max=25.20), standardnu devijaciju (Std. Dev=5.63).

Komparacijom rezultata dobijenih u prvom i drugom mjerenju može se uočiti da su ispitanici druge grupe postigli znatno bolje rezultate ronjenjem apneom na dužinu u drugom mjerenju kada je temperatura vode bila veća za dva stepena C, a temperatura vazduha za četiri stepena C, što se vidi iz vrijednosti aritmetičkih sredina prvog i drugog mjerenja. Ovakvi rezultati doprinijeli su i heterogenizaciji ispitanika druge grupe u drugom mjerenju, jer je vrijednost standardne devijacije u drugom mjerenju veća u odnosu na njenu vrijednost u prvom mjerenju.

Tabela 3. *Analiza rezultati t-testa ronjenja na apneu u dužinu kod prve grupe ispitanika - studenata*

	Mean	Std.Dv	N	Diff.	Std. Dv	t	df	p
ADAI	12.03	6.92						
ADAF	14.16	7.25	16	-2.13	1.87	-4.5	15	0.00

Analizom tabele 3 u kojoj su prikazani rezultati t-testa kojim se porede statističke serije i to na malim zavisnim uzorcima može se vidjeti da su rezultati aritmetičkih sredina (Mean) u drugom mjerenju bolji od rezultata u prvom mjerenju, kod ronjenja apneom kod prve grupe ispitanika – studenata. Na osnovu prikazanih rezultata aritmetičkih sredina (Mean) na prvom i na drugom mjerenju kao i na osnovu značajnosti promjena (p) testiranih (T-testom) može se uočiti da je povećanje temperature vode u bazenu za jedan stepen i temperature vazduha za dva stepena proizvelo parcijalne promjene kod varijable ronjenje na dah u daljinu, a vrijednosti t-testa bile su značajne na nivou p = 0,00.

Može se konstatovati da se rezultati prvog i drugog mjerenja kod prve grupe ispitanika statistički značajno razlikuju, a da je razlika nastala kao posljedica uticaja povećanih vrijednosti temperatura prirodne sredine.

Tabela 4. *Analiza rezultata t-testa ronjenja na apneu u dužinu kod druge druge ispitanika - studenata*

	Mean	Std.Dv	N	Diff.	Std. Dv	t	df	p
ADAI	11.90	3.42						
ADAF	15.82	5.68	5	-3.92	3.14	-2.78	15	0.04

Analizom tabele 4 u kojoj su prikazani rezultati t-testa kojim se porede statističke serije i to na malim zavisnim uzorcima može se vidjeti da su rezultati aritmetič-

parameter values have been obtained: (Mean=15.82), the weakest result (Min=9.70), and the best (Max=25.20), standard deviation (Std. Dev=5.63).

Through comparisson of the results obtained in the first and second measuring it may be obvious that the examinees of the second group achieved quite better results in apnea diving in length in the second measuring when the water temperature was higher for two degrees C, and air temperature for four degrees C higher, which can be seen from values of arithmetic means of the first and second measuring. Such results contributed heterogenization of the second group examinees in the second measuring, since the values of standard deviation in the second measuring is higher compared to its value in the first one.

Table 3. *Analysis of t-test results of apnea diving in length ronjenja at the first group of examinees -students*

By analysis of table 3 where t-test results are shown comparing static series on small dependable specimen it is obvious that results of arithmetic means (Mean) in the second measuring are better than the first measuring results, at apnea diving of the first examined group – students. On the base of the presented results of arithmetic means (Mean) on the first and second measuring and on the bas of significant changes (p) of tested (with T-test) it can be noticed that the water temperature increase for one degree and air temperature for two degrees resulted in partial changes at variable of breath-hold diving in length , and t-test values were important at level p=0,00.

It may be said that the results of the first and second measuring at the first examined group quite differ statistically, and the differene derives as a consequence of influences of increased natural environment temperature values.

Table 4. *The analysis of t-test results in apnea diving in length with the second group of examinees - students*

Through analysis of table 4 where t-test results are shown comparing statistical series on small dependable specimen it can be noticed that the results of arithmetic

kih sredina (Mean) u drugom mjerenju bolji od rezultata u prvom mjerenju, kod ronjenja apneom i kod druge grupe ispitanika – studenata. Na osnovu prikazanih rezultata aritmetičkih sredina (Mean) na prvom i na drugom mjerenju kao i na osnovu značajnosti promjena (p) testiranih (T-testom) može se uočiti da je povećanje temperature vode u bazenu za dva stepena i temperature vazduha za četiri stepena proizvelo parcijalne promjene kod varijable ronjenje na dah u daljinu, a vrijednosti t-testa bile su značajne na nivou p = 0,04.

Može se konstatovati da se rezultati prvog i drugog mjerenja statistički značajno razlikuju i kod druge grupe ispitanika, a da je razlika nastala kao posljedica različitih temperatura vode u bazenu i temperature vazduha (veće temperature) u kojima je izvedeno prvo, odnosno drugo mjerenje.

Na osnovu dobijenih rezultata može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom na dalj.

Zaključak

Istraživanje je izvedeno na uzorku od 21 ispitanika - studenta Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, upisanih u III godinu studija školske 2010/2011, muškog pola, starosti 23 godine ± 6 mjeseci, koji su slučajnim izborom podijeljeni u dvije grupe za vrijemme izvođenja nastave aktivnosti u prirodi u studentskom kampu „ Tjentište“ na Tjentištu. Uzorak varijabli predstavljali su: dužina ronjenja na dah izražena u metrima (apneom), temperatura vode izražena u stepenima (º C) i temperatura vazduha izražena u stepenima (º C).

Testiranje ispitanika obe grupe izvedeno je u dva vremenska termina, kada se temperature vode u bazenu kretala od 17 do 22º C, a temperatura vazduha od 22 do 26º C.

Prvo testiranje ispitanika prve grupe izvedeno je pri temperaturi vode u bazenu od 17º C i temperaturi vazduha od 20º C, a drugo testiranje je izvedeno pri temperaturi vode u bazenu od 18º C i temperaturi vazduha od 22º C.

Prvo testiranje ispitanika druge grupe izvedeno je kada je temperatura vode u bazenu bila 20º C, a temperatura vazduha 22º C, a drugo testiranje je izvedeno kada je temperatura vode u bazenu iznosila 22º C, a temperatura vazduha 26º C.

Osnovni cilj istraživanja bio je da se utvrdi rezultatska uspješnost u ronjenju na dah apneom u dužinu u

means (Mean) in the second measuring are better than those in the first one, with apnea diving and with the second examined group -students. On the base of the presented results of the arithmetic means (Mean) on the first and second measuring along with the significance of changes (p) of tested (by T-test) it can be noticed the increase of water temperature in pool for two degrees and air temperature for four degrees resulted in partial changes at variable of breath – hold diving in length, while t-test values were important on the level p=0,04.

It may be said that the results of the first and second measuring quite differ statistically with the second examined group too, and the difference derives as a consequence of different temperatures of pool water and air temperature (higher temperatures) at which the first and then the second measuring was done.

On the base of the obtained results it can be concluded that the pool water temperature and air temperature had significant influence on the length of apnea diving in such a way that the increase of pool water for 3 to 5°C and air temperature for 2 to 4°C contributed better results achievement in apnea diving in length.

Conclusion

The research was carried out on the specimen of 21 examinees – students of Faculty of physical education and sport, Istocno Sarajevo University, enrolled in IIIrd year of studies of school year 2010/2011, males, age 23 =6 months, who by random choice were divided into two groups during the lessons in nature within the student camp „Tjentiste“ in Tjentiste.

The specimen of variables was represented by: the length of breath-hold diving expressed in metres (by apnea), water temperature expressed in degrees (°C) and air temperature expressed in degrees (°C). Testing of both groups of examinees was done in two time intervals, when the pool water temperature was from 17 to 22°C and air temperature was from 22 to 26°C. The first testing of the first examined group was performed at pool water temperature of 17°and air temperature of 20°C, and the second testing was done at pool water temperature of 18°C and air temperature of 22°C

The first testing of the second group of examinees was conducted when pool water temperature was 20°C and air temperature 22°C, and the second testing was done when pool water temperature was 22°C and air temperature 26°C. The basic aim of the research was to establish the resultative success in breath-hold diving by apnea in length depending of water temperature and air temperature (natural conditions of environment).

zavisnosti od temperature vode i temperature vazduha (prirodnih uslova sredine).

Izvršena je komparacija rezultata osnovnih centralnih i disperzionih parametara i analize rezultata t-testa. Analizom rezultata osnovnih centralnih i disperzionih parametara i rezultata t-testa, može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom na dalj.

The comparisson of results have been made between basic central and dispersion parameters and analysis of t-test results.

Through analysis of the basic central and dispersion parameters results and t-test results it can be concluded that the pool water temperature and t-test results have significant influence on the length of apnea diving in such a way that the pool water temperature increase for 3 to 5°C and air temperaturefor 2 to 4°C has contributed better achievement of results in apnea diving in length.

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