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ORIGINAL SCIENTIFIC PAPER

Differences in decreasing of swimming pace in elite swimmers in the 100 meter backstroke discipline

Isidora Trboljevac[1], Stefan Mijalković[1], Marko Đurović[1]

[1]Faculty of sport and physical education, University of Niš, Serbia

Abstract

The aim of this research was to determine the differences in swimming pace between the finalists and semi-finalists of the 2019 World Championships in the discipline of 100 m backstroke held in the South Korean city of Kwangju in 2019. The research was carried out on 16 swimmers (8 finalists and 8 semi-finalists), using 8 variables for evaluating swimming pace. Differences between groups were determined using the Student's T-test of independent samples. No statistically significant differences in swimming pace were found between the finalists and semi-finalists of the World Championships, but there was a statistically significant difference in passing times in favor of the finalists. The finalists were faster in the first and second passing times than the semi-finalists, while their pace drop is numerically smaller compared to the semi-finalists, but not statistically significant.

Keywords: *pace, backstroke, elite swimmers*

Introduction

Backstroke is the only competitive swimming technique where the swimmer starts in the water and it is similar to the crawl technique only in terms of certain technical characteristics. (Cornett 2011; Marković 2021). Swimmers, especially younger ones, often make and repeat identical mistakes due to the specific position of the body (on the back), starts, turns and strokes (Marković 2021; Okičić et al., 2007). Over time, the technique was upgraded and improved, acquiring today's characteristics that professional swimmers constantly supplement, adjust and modify, with the aim to make it more effective (Marković 2021). The pace of top swimmers can also be explained by physiological aspects. A swimming pace profile is usually characterized by measuring split times or speeds at each turn. The allocated times from the competition are easily accessible on the Internet through online results that allow insight into the elapsed time as well as the final result achieved by the swimmer at the turn and the finish of the race (Abbiss, Laursen & Describing, 2008).

It has been shown that shorter start and turn times have the greatest impact on swimming results (Veiga & Roig 2017; Šiljeg, Leko, & Mikulić, 2011). Also, Šiljeg, Leko, & Mikulić, (2011) suggest that there are smaller changes in the pace of the backstroke in the second section in older swimmers compared to younger ones. With regards toswimming pace, it can be established that females in younger age categories achieve higher speed in the discipline of 100 m backstroke (Kollarz, Knechtle, Rüst, Rosemann & Lepers, 2013), while Unterweger, Knechtle, Nikolaidis, Rosemann & Rust, (2016) concluded that changes in swimming pace exist in all age categories regardless of gender. Namely, Vasic, Djurovic, Madic, & Okicic, (2021) concluded that there was no statistically significant difference in split time between finalists and semi-finalists, but swimmers with better abilities were more dominant in the second part of the race.

Considering the fact that few studies have investigated the problem of decreasing in swimming pace in the discipline of 100 m backstroke, we aimed to test the differences in decreasing of swimming pace between finalists and semi-finalists of the World championship 2019 in the 100 m backstroke discipline.

Method

Sample of respondents

The sample of respondents consisted of 16 swimmers, 8 finalists and 8 semi-finalists, of the World Swimming Championship held in the South Korean city of Gwangju in 2019. All respondents swam the 100 m backstroke race and were ranked in the semi-final and final groups based on their swimming times. The average

Correspondence:

Montenegro Sport

S. Mijalković
University of Niš, Faculty of Sport and Physical Education, Čarnojevića 10A, 18000 Niš, Serbia
Email: stefimijalkovic@gmail.com

chronological age of the semi-finalists was 22±2.51 years, and the finalists' average chronological age was 26.13±5.17 years. The total swimming time of the semi-finalists was 53.82±0.23, and the finalists' total swimming time was 52.98±0.39.

Procedures

The World Swimming Championship in a 50 m pool was held in 2019 in South Korea. All results are taken from the official website (http://www.fina.org/event/18th-fina-world-championships/results-1).

The following variables were used to evaluate the scores in swimming: time of the first 50 m finalists in the 100m backstroke discipline (Pace1_finalist (s)), time of the second 50 m finalists in the 100 m backstroke discipline (Pace2_finalist (s)), the difference between the second and first times of the 50 m finalist in the 100m backstroke discipline (Dropoff_finalist (s)), total time of the finalists in the 100 m backstroke discipline (T100_finalist (s)), time of the first 50m semi-finalists in the 100 m backstroke discipline (Pace1_semifinalist (s)), time of the second 50 m semi-finalists in the 100 m backstroke discipline (Pace2_semifinalist (s)), the difference between the second and first times of the 50m semi-finalists in the 100m backstroke discipline (Dropoff_semifinalist (s)), total time of the semi-finalists in the 100m backstroke discipline (T100_semifinalist (s)).

Dropoff_finalist = Pace2_finalist – Pace1_finalist

Dropoff_semifinalist = Pace2_semifinalist – Pace1_semifinalist

The 100 m backstroke swimming race consisted of two 50 m sections connected by a somersault turn. Timing was electronic (Omega timing) at the World Championships and all passing times were recorded in the official results. The final score and passing times were taken from the official results.

Statistical data processing

All data obtained in this study were processed with the statistical program IBM SPSS Statistics 20. First, descriptive statistics of the variables were presented. The Kolmogorov-Smirnov test was used to examine the normality of the distribution, while the Student's T-test of independent samples was used to determine statistically significant differences in decreasing of swimming pace between finalists and semi-finalists in 2019 at the 100 m backstroke World Championship (Malacko & Popović, 2001).

Results

Table 1 presents the descriptive statistics and the differences in decreasing swimming pace in the 100 m backstroke of semi-finalist and finalist of the 2019 World Swimming Championship. Finalists' mean age was 26.13±5.17, while semi-finalists' mean age was 22.00±2.51.

Table 1. Descriptive statistics and Student's T-test results of monitored variables.

Variables	Mean	Std. Dev.	Min.	Max.	CV	T-test	
						t	p
Pace1_finalist	25.64	0.34	25.01	26.06	1.3%	5.534	0.034*
Pace1_semifinalist	26.02	0.31	25.43	26.25	1.2%		
Pace2_finalist	27.34	0.30	26.87	27.89	1.1%	9.978	0.007*
Pace2_semifinalist	27.80	0.28	27.47	28.28	1.0%		
T100_finalist	52.98	0.39	52.44	53.44	0.7%	27.098	<0.001*
T100_semifinalist	53.82	0.23	53.56	54.20	0.4%		
Dropoff_finalist	1.69	0.50	1.30	2.55	29.5%	0.090	0.768
Dropoff_semifinalist	1.77	0.55	1.23	2.85	31.0%		

Legend: * - statistical significance ($p < 0.05$); Pace1_finalist - time of the first 50 m finalists in the 100 m backstroke discipline; Pace1_semifinalist - time of the first 50 m semi-finalists in the 100 m backstroke discipline; Pace2_finalist - time of the second 50 m finalists in the 100 m backstroke discipline; Pace2_semifinalist - time of the second 50 m semi-finalists in the 100 m backstroke discipline; T100_finalist - total time of the finalists in the 100 m backstroke discipline; T100_semifinalist - total time of the semi-finalists in the 100m backstroke discipline; Dropoff_finalist - the difference between the second and first times of the 50 m finalists in the 100m backstroke discipline; Dropoff_semifinalist - the difference between the second and first times of the 50 m semi-finalists in the 100m backstroke discipline.

Results from Table 1 show that there was a statistically significant difference between finalists and semi-finalists in the first passing time (Pace1_finalist vs. Pace1_semifinalist: t = 5.534; p=0.034), second passing time (Pace2_finalist vs. Pace2_semifinalist: t= 9.978; p= 0.007) as well as in total time (T100_finalist vs. T100_semifinalist: t= 27.098; p=0.000, while there were no statistically significant differences between the finalists and semi-finalists between the second and first times in the 50 m in the 100 m backstroke (Dropoff_finalist vs. Dropoff_semifinalist: t= 0.090; p= 0.768).

Discussion

The aim of this study was to determine the differences in decreasing of swimming pace between finalists and semi-finalists of the World championship 2019 in the 100 m backstroke discipline. According to the results of our study, there was no statistically significant difference in swimming pace between finalists and semifinalists in the 100 m backstroke discipline. However, a statistically significant difference in favor of the finalists in passing times was observed. Consequently, finalists achieved a better time than the semi-finalists in the following variables: the difference between the second and first time in the 50 m in the 100 m backstroke, the time in the first 50 m in the 100 m backstroke and the time in the second 50 m in the 100 m backstroke. Also, it was observed that within the race itself, both finalists and semi-finalists had a better passing time in the first 50 m compared to the second one. Studies with similar objectives are scarce (Kollarz, et al., 2013; Unterweger, et al., 2016).

However, Cuenca-Fernández, et al., (2021) investigated differences in swimming parameters (swimming pace, stroke patterns and muscle power) between swimmers who participated in different races. They established that an ultra-short race-pace training (20x50 m) protocol in swimmers leads to replication of competitive swimming pace, less fatigue and faster recovery. On the other hand, the race-pace training (10x100 m) protocol in swimmers led to deterioration of stroke pattern, muscle power and swimming pace. Moreover, since it was observed in this study that the finalists had a better competative swimming pace than the semi-finalists. Ultra-short race-pace training can be recommended as a method of improving swimming pace for semi-finalists to progress in this integral part of the swim. The analysis of previous studies on the pace of backstroke showed smaller oscillations in the second half of the section in older swimmers compared to younger ones (Šiljeg, Leko, & Mikulić, 2011), and it was suggested that the score in swimming depended mostly on a shorter start and turn time. Veiga & Roig (2017) also achieved similar results.

Furthermore, previous study has found that hand coordination could be one of the key characteristics for increasing swimming speed. The Index of Coordination (IdC) (Chollet, Seifert, & Carter, 2008) quantifies the continuity of arm propulsive action. It was found that this index plays an important role in the analysis of an athlete's adaptation to different swimming distances (Schnitzler, Seifert, & Chollet, 2009), but also that they have a limited range of variation in backstroke (Seifert & Chollet 2009). It was observed that increasing speed and pace in elite swimmers leads to an increase in stroke rate, IdC and relative duration of the arm pull, and to a decrease in stroke distance (Chollet, Seifert, & Carter, 2008). Also, an increase in speed leads to a decrease in the time gaps that defines the beginning and end of the stroke phases, which leads to an increase in the continuity between the propulsive phases and to a decrease in the glide time (Seifert & Chollet 2009). Due to the above, it can be suggested that arm coordination during backstroke has a role in decreasing the swimming pace. Specifically, coordination has been shown to play a smaller role in backstroke than in crawl swimmers due to the limited shoulder flexibility, the alternating body-roll and a lag time with the hand at the thigh at the end of the push phase (Seifert & Chollet 2009).Dias (2022) reported that the duration of the pulling and pushing phases, swimming speed and stroke frequency, and trunk twisting on the undesirable side and elbow angle on the desirable side were significantly higher at the maximum pace of backstroke. Entry and exit phase duration, normalized stroke length, and hip roll were greater at submaximal backstroke pace, with no changes for shoulder rotation or other elbow joint angle variables (Dias, 2022). Faster swimmers had greater shoulder rotation and total shoulder rotation at maximal pace, while slower swimmers had greater maximal elbow angle at submaximal pace (Dias, 2022). Swimmers with higher hand velocity on the non-preferred side showed greater shoulder rotation (Dias, 2022). Therefore, to achieve higher swimming speed, swimmers should prolong the push phase and reduce elbow extension at the end of the push phase. Furthermore, slower swimmers had greater maximal elbow angle at submaximal pace, whereas faster swimmers exhibited greater shoulder roll and total shoulder roll at maximal pace. Therefore, it can be concluded that the appropriate swimming technique plays a role in the decrease of the swimming pace. In our study, it was observed that there was no statistically significant difference in the decreasing of swimming pace between finalists and semi-finalists. It is assumed that these results were obtained because the respondents were elite swimmers. However, it was established that the finalists were faster than the semi-finalists.

Conclusion

Based on the obtained study results, it could be concluded that there were no statistically significant differences in the swimming pace between the finalists and semi-finalists of the 2019 World Championships in the 100 m backstroke discipline. However, there was a statistically significant difference in passing times in favor of the finalists. It was observed that there were statistically significant differences between the semi-finalists and finalists in the variables: the time in the first 50m in the 100m backstroke, the time in the second 50 m in the 100 m backstroke and the difference between the second and first time in the 50 m in the 100 m backstroke. All observed statistically significant differences were in favor of the finalists. Furthermore, the finalists were faster in the first and second passing times than the semi-finalists. The result of the study was to complete the theoretical knowledge of swimmers and swimming coaches about the pace in backstroke swimming and it could be useful in training programs because it indicates that swimmers achieved faster times in the first 50 m of the race. Therefore, swimming coaches are advised to improve the second 50m pace of their swimmers in the 100 m backstroke.

Limitations

It is desirable to have a larger sample of respondents. In this way, future research which will analyze differences in decreasing of swimming pace will provide results that can be generalized.

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There are no acknowledgements.

Conflict of interest
The authors declare that there is no conflict of interest.

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ORIGINAL SCIENTIFIC PAPER

Associations between morphological dimensions and swimming time in different swimming styles

Vladan Markovic[1], Miloš Miloševic[1]

[1]Faculty of Physical Education and Sports Management, Singidunum University, Belgrade, Serbia

Abstract

The morphology of young athletes is an important selection factor when choosing sports and sports disciplines. In swimming, morphology has an influence on the choice of swimming style and is somewhat related to the improvement of results. In this research, 27 anthropometric dimensions were measured on a sample of 132 young swimmers. The swimmers were members of several Belgrade swimming clubs (aged 10-18), and were divided into three age-subsamples. The aim of this research is to determine the relationship between different age-groups morphology and the swimming time at 50m for different swimming styles. Descriptive indicators showed deviations from the measures of the general population, which describes the training adaptations of young swimmers' bodies. The results of correlation analysis show significant positive and negative correlations ($p<0.01$) of morphological dimensions and swimming results in all age groups and swimming styles. Strong positive correlations were obtained between swimming time in breaststroke style: with foot wide ($r=0.97$) in second and third age groups, as well as in butterfly style with thickness of skin fold of biceps ($r=0.80$), chest ($r=0.95$), stomach ($r=0.92$), upper leg ($r=0.88$) and back ($r=0.83$) in second age group. A strong significant negative correlation was observed between swimming time in butterfly style and shoulders width ($r=-0.85$) in third age group. This research can help professors of physical education and sports coaches to facilitate the process of selection and categorization of their students or athletes.

Keywords: *Swimmers, morphology, anthropometrics, swimming styles, swimming time*

Introduction

Achievements in sports show a constant improvement in results in all age categories of athletes and at all levels of competition. In Swimming as an Olympic sport, there is also a constant improvement in results from year to year (Markovic, 2017). Unlike group games where physical predispositions can be compensated by technical and tactical elements, in basic individual sports such as swimming, the variance of hereditary factors can hardly be compensated through training (Markovic & Milosevic, 2023). Body morphology is one of the main hereditary factors behind top results in swimming (Kumar & Solanki, 2019). In selection and early training process, by applying a system of anthropometric measurements, we obtain more precise data on the optimal physical development of the athlete (Leko et al., 2004). The ratio of muscle mass, limb length and joint mobility divides swimmers according to swimming styles (Damsgaard et al., 2001). Functional, motor and psychological components affect the duration of work (Rozi et al., 2019). That is why the selection should be based, on stable parameters, e.g., morphological parameters, and athletes should be selected based on them (Popo et al., 2010). In order to make this possible, it is necessary to systematically record and describe the morphological dimensions of young swimmers of different ages and swimming styles. Although there are numerous studies on this topic (Lima et al., 2022), a comprehensive and systematic measurement has so far been lacking.

Morphological analyses indirectly indicate that swimmers'anthropometric dimensions are related to their performance, results and the swimming style they compete in (Sekulic et al., 2007). In general, sprint free stylers are taller, with longer arms, heavier and more muscular than middle and long distance free stylers and other stroke specialists (Carte et al., 1994). It seems that greater body height is a performance-de-

Correspondence:

Montenegro Sport

Markovic Vladan
Faculty of Physical Education and Sports Management, SingidunumUniversity, Danijelova 32, 11000 Belgrade, Serbia
E-mail: vladanmarkovic@singidunum.ac.rs

termining factor for sprint, but that it is not so critical for long distance races (Kjendlie & Stallman, 2011). Body mass and BMI are lower in long-distance swimmers due to significant fat burning during swimming aerobic training (Vasileva et al., 2022). Body mass index is a poor predictor of performance and appears as a low-informative morphological feature in swimming (Pla et al., 2022).The results showed that older swimmers had higher body mass values compared to younger swimmers, and significant differences in upper limb strength indicators (Marinho et al., 2021).

When it comes to direct correlation observation, the results are inconsistent. Somatotype and body structure do not show a high correlation in swimming 100 meters at a younger age (Leko, et al., 2011). Junior group revealed a significant relationship between somatic traits (BM, BH, AS and BMI) and swimming speed for 50m crawl style (Strzala et al., 2019). However, the association of certain morphological dimensions in swimmers of different styles and ages, with young athletes, has not been observed in detail in previous studies.

The aim of this study is to examine anthropometric dimensions in three age categories of swimmers and their correlation with the results of swimming at 50 m in different swimming styles. We hypothesise that at different ages and with different styles, various morphological dimensions will correlate to the swimming result. Present findings should contribute to the efficiency of both, the selection process and the improved monitoring of the training process effects of the young swimmers.

Methods

Participants

The sample included in this research consists of N=132 male swimmers, aged 10 to 18, who are active competitors in four Belgrade swimming clubs. The entire sample was divided into three subsamples according to age: 10-12 years (n1=55), 13-16 years (n2=47) and 17-18 years (n3=30). Before the study, parents or guardians of the participants singed voluntary consent to participate. The study was carried out with the consent of the Ethics Commission of the Singidunum University (No. 123).

Morphological characteristics assessment

For the assessment of morphological characteristics, 27 anthropometric variables were applied according to the procedure established by the International Biological Program (IBP) (Stojanovic et al. 1975):

1. Longitudinal dimensionality of the body (body height-BH, arm length-AL, hand length-HL, leg length-LL and foot length-FL);
2. Transversal dimensionality of the body (shoulders width-SW, hand width-HW, pelvis width-PW, foot wide- FW, elbow diameter-ED, hand diameter-HD, knee diameter-ND, foot diameter-FD);
3. Body mass and volume (body mass-BM, chest circumference-CC, upper arm circumference-UAC.forearm circumference-FAC, upper leg circumference-ULC and lower leg circumference-LLC) and
4. Subcutaneous adipose tissue (thickness skin fold biceps-TSFBc, thickness skin fold triceps-TSFTc, thickness skin fold fore arm-TSFFA, thickness skin fold chest-TSFC, thickness skin fold back-TSFB, thickness skin fold stomach-TSFS, thickness skin fold upper leg-TSFUL and thickness skin fold lower leg-TSFLL).

Swimming time assessment

Swimming time for 50 m in all swimming styles was measured in groups of 6 in the semi-Olympic pool „Mirko Sandic"in the Belgrade municipality of Vracar.

Statistical analyses

The data obtained were processed in SPSS 22 using descriptive statistics and correlation analysis. Arithmetic mean and standard deviation were calculated for all age-groups. A bivariate Pearson's correlation analysis was applied to describe the relationships between anthropometric variables and swimming time in different groups.

Results

The results of descriptive statistical parameters of anthropometry by styles and ages are presented in Table 1.

The results of the correlation analysis between the anthropometric variables and the results at 50m by styles through different age periods are presented in Table 2.

Table 1. Descriptive analysis of the first (N=55), the second (N=47) and the third (N=30) subsample of swimmers.

	FREE			BACK			BREAST			FLY		
	M ± SD			M ± SD			M ± SD			M ± SD		
AGE	1	2	3	1	2	3	1	2	3	1	2	3
BM	45.29 ± 9.1	67.37 ± 5.52	69.48 ± 5.85	44.57 ± 9.91	65.37 ± 9.59	70.00 ± 9.65	41.81 ± 9.99	62.02 ± 10.26	74.88 ± 6.68	40.52 ± 12.87	72.86 ± 13.71	69.57 ± 6.05
BH	154.66 ± 9.16	179.1 ± 6.47	180.49 ± 3.69	152.6 ± 10.15	175.1 ± 10.82	184.9 ± 5.48	151.01 ± 7.91	172.84 ± 10.52	183.6 ± 7.46	146.8 ± 13.25	176.5 ± 6.77	176.9 ± 7.27
AL	66 ± 4.44	78.61 ± 3.92	78.09 ± 2.54	65.07 ± 5.77	75.61 ± 4.82	77.20 ± 4.37	64.84 ± 3.48	74.19 ± 5.43	79.92 ± 3.20	62.87 ± 6.24	75.54 ± 3.23	76.17 ± 3.34
HL	16.04 ± 1.12	18.80 ± 1.35	18.67 ± 0.52	15.84 ± 1.25	17.80 ± 1.39	19.10 ± 1.00	15.35 ± 0.98	18.54 ± 1.15	18.90 ±0.45	14.99 ± 1.5	18.44 ± 0.94	18.51 ± 0.54
LL	88.23 ± 5.36	102.7 ± 4.58	101.6 ± 2.85	87.83 ± 7.35	101.7 ± 5.38	102.76 ± 3.26	87.22 ± 5.15	99.09 ± 6.19	105.0 ± 5.49	84.25 ± 8.08	101.1 ± 4.50	100.1 ± 4.11
FL	25.22 ± 1.51	28.72 ± 1.72	27.95 ± 1.00	24.64 ± 1.65	27.72 ± 1.09	28.10 ± 0.65	24.38 ± 1.39	27.68 ± 1.31	29.00 ± .53	23.82 ± 2.21	27.80 ± 1.18	27.52 ± 0.84
SW	33.98 ± 2.31	40.15 ± 1.71	41.75 ± 1.72	33.54 ± 2.59	39.15 ± 2.87	43.10 ± 2.17	32.78 ± 1.72	38.26 ± 2.56	41.76 ± 2.95	33.34 ± 3.15	41.31 ± 1.81	41.52 ± 2.14
HW	7.16 ± 0.51	8.11 ± 0.38	8.13 ± 0.33	7.02 ± 0.4	7.71 ± 0.42	7.70 ± 0.26	6.79 ± 0.51	8.16 ± 0.45	8.20 ± 0.25	6.8 ± 0.6	8.14 ± 0.36	8.00 ± 0.38

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Table 1. Descriptive analysis of the first (N=55), the second (N=47) and the third (N=30) subsample of swimmers.

	FREE			BACK			BREAST			FLY		
	M ± SD			M ± SD			M ± SD			M ± SD		
AGE	1	2	3	1	2	3	1	2	3	1	2	3
PW	23.91 ± 2	27.71 ± 0.61	28.54 ± 0.98	23.63 ± 1.65	27.31 ± 2.33	29.10 ± 1.51	23.22 ± 1.82	27.05 ± 1.97	28.34 ± .56	22.86 ± 2.74	28.68 ± 1.62	27.83 ± 1.49
FW	8.29 ± 0.51	9.71 ± 0.58	9.34 ± 0.70	8.19 ± 0.68	9.51 ± 0.66	9.60 ± 0.40	7.92 ± 0.65	9.26 ± 0.50	9.42 ± 0.23	7.76 ± 0.74	9.74 ± 0.53	9.38 ± 0.47
ED	6.2 ± 0.41	7.18 ± 0.32	6.99 ± 0.19	6.23 ± 0.36	7.11 ± 0.44	7.23 ± 0.45	5.88 ± 0.48	7.01 ± 0.45	7.00 ± 0.12	6.08 ± 0.46	7.10 ± 0.42	7.03 ± 0.23
HD	5.16 ± 0.34	5.82 ± 0.33	5.69 ± 0.22	5.05 ± 0.28	5.62 ± 0.42	5.76 ± 0.28	4.95 ± 0.31	5.85 ± 0.32	5.60 ± 0.29	4.94 ± 0.47	5.74 ± 0.34	5.78 ± 0.28
ND	9.2 ± 0.43	9.90 ± 0.37	9.75 ± 0.43	8.93 ± 0.41	9.80 ± 0.36	9.96 ± 0.46	8.98 ± 0.72	9.80 ± 0.38	9.80 ± 0.45	8.83 ± 0.64	9.94 ± 0.50	9.61 ± 0.46
FD	7.1 ± 0.25	7.81 ± 0.30	7.63 ± 0.16	7.05 ± 0.26	7.71 ± 0.38	7.93 ± 0.41	7.03 ± 0.47	7.60 ± 0.32	7.56 ± 8.94	6.81 ± 0.5	7.67 ± 0.49	7.47 ± 0.36
CC	77.37 ± 6.72	93.11 ± 3.18	95.42 ± 4.38	76.78 ± 6.73	91.11 ± 7.36	94.56 ± 3.85	73.23 ± 5.47	88.52 ± 6.88	96.12 ± 4.95	75.13 ± 8.71	94.62 ± 8.20	95.07 ± 3.56
UAC	23.36 ± 2.8	27.84 ± 1.52	28.66 ± 1.98	23.94 ± 2.95	27.14 ± 1.93	27.20 ± 2.57	21.84 ± 3.26	26.48 ± 2.24	29.10 ± 1.67	22.28 ± 3.31	28.87 ± 3.60	28.93 ± 1.83
FAC	21.78 ± 1.59	25.50 ± 1.25	25.51 ± 0.99	21.72 ± 1.85	25.00 ± 1.34	25.30 ± 1.53	20.84 ± 2.04	24.74 ± 1.83	25.76 ± 0.85	20.8 ± 2.28	25.95 ± 1.83	25.70 ± 1.09
ULC	47.61 ± 4.73	53.41 ± 2.57	54.04 ± 3.22	47.38 ± 5.6	53.11 ± 3.64	51.76 ± 3.51	45.76 ± 6.26	52.27 ± 4.08	57.10 ± 3.78	45.32 ± 5.58	56.85 ± 5.89	54.15 ± 3.71
LLC	31.9 ± 2.62	35.72 ± 1.38	35.87 ± 1.89	31.31 ± 2.92	35.52 ± 2.02	35.83 ± 2.66	30.52 ± 3.7	34.90 ± 2.23	37.44 ± 1.46	29.77 ± 3.47	37.60 ± 3.50	36.36 ± 2.11
TSFBc	5.81 ± 2.15	4.05 ± 1.01	4.06 ± 1.18	6.33 ± 2.33	4.00 ± .70	3.56 ± 0.11	6.1 ± 3.95	4.45 ± 1.39	4.64 ± 1.05	5.5 ± 0.94	5.22 ± 2.02	4.41 ± 1.65
TSFTc	12.13 ± 4.15	8.31 ± 2.59	8.72 ± 3.40	18.04 ± 20.49	8.11 ± 2.28	6.36 ± 0.35	11.76 ± 6.78	8.96 ± 2.38	10.52 ± 3.90	12.02 ± 3.54	11.83 ± 5.61	8.91 ± 5.27
TSFFA	6.33 ± 1.87	4.17 ± .88	4.11 ± 1.09	6.31 ± 2.07	4.07 ± .89	4.13 ± 0.70	6.03 ± 2.67	4.79 ± 1.20	4.70 ± 1.01	5.87 ± 1.72	5.49 ± 2.05	4.61 ± 1.30
TSFS	15.28 ± 12.3	10.05 ± 2.80	10.99 ± 5.92	15.13 ± 12.54	9.85 ± 2.57	5.93 ± 1.00	11.84 ± 12.71	11.98 ± 6.68	16.56 ± 7.75	12.19 ± 11.84	20.81 ± 20.70	12.66 ± 11.19
TSFC	8.21 ± 5.29	4.72 ± .73	5.25 ± 1.37	8.02 ± 4.98	4.52 ± .49	4.60 ± 0.36	7.26 ± 7.06	5.42 ± 1.53	6.54 ± 1.89	7.17 ± 4.34	8.56 ± 6.93	5.65 ± 2.39
TSFB	6.99 ± 2.45	6.88 ± 1.70	7.67 ± 1.51	7.23 ± 2.31	6.68 ± 1.69	5.60 ± 1.30	7.01 ± 5.54	7.16 ± 1.29	9.44 ± 2.72	6.08 ± 1.54	9.33 ± 5.69	8.11 ± 1.81
TSFUL	18.2 ± 7.81	9.94 ± 1.85	12.23 ± 4.21	18.64 ± 6.87	9.74 ± 3.02	8.26 ± 0.64	16.87 ± 8.99	12.02 ± 4.04	15.22 ± 3.25	16.29 ± 6.26	16.50 ± 6.35	12.51 ± 7.96
TSFLL	12.78 ± 4.23	7.35 ± 1.14	9.15 ± 3.71	14.08 ± 5.1	7.25 ± 2.75	7.33 ± 0.98	12.52 ± 7	10.13 ± 3.38	10.66 ± 3.28	11.55 ± 3.68	11.26 ± 3.99	9.23 ± 6.17

Table 2. Correlations of parameters in the first, second and third subsample of swimmers

AGE	50m FREE			50 m BACK			50 m BREAST			50 m FLY		
	1	2	3	1	2	3	1	2	3	1	2	3
BM	-0.358 0.132	-0.313 0.495	-0.709 **0.010**	-0.446 0.095	-0.222 0.566	-0.363 0.173	-0.108 0.661	-0.348 0.204	0.163 0.794	-0.549 0.100	0.760 **0.011**	-0.359 0.383
BH	-0.393 0.096	0.223 0.631	-0.063 0.845	-0.614 **0.015**	-0.025 0.949	-0.669 0.534	-0.286 0.236	-0.488 0.065	0.383 0.525	-0.522 0.122	0.192 0.595	-0.494 0.214
LL	-0.442 0.058	0.269 0.559	-0.152 0.638	-0.647 **0.009**	0.175 0.652	-0.801 0.409	-0.274 0.256	-0.464 0.082	0.704 0.185	-0.483 0.157	0.021 0.954	-0.032 0.940
SW	-0.305 0.204	-0.156 0.738	-0.468 0.125	-0.537 **0.039**	-0.187 0.631	-0.991 0.086	-0.211 0.386	-0.520 **0.047**	-0.564 0.322	-0.521 0.122	0.337 0.341	-0.852 **0.007**

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Table 2. Correlations of parameters in the first, second and third subsample of swimmers

AGE	50m FREE			50 m BACK			50 m BREAST			50 m FLY		
	1	2	3	1	2	3	1	2	3	1	2	3
PW	-0.444	-0.172	-0.600*	-0.588	-0.218	-0.926	0.064	-0.543*	0.023	-0.571	0.230	-0.774
	0.057	0.712	**0.039**	**0.021**	0.574	0.247	0.796	**0.036**	0.971	0.085	0.523	**0.024**
ED	-0.367	-0.369	0.085	-0.377	-0.278	-0.043	-0.108	-0.434	-0.273	-0.574	0.225	-0.095
	0.122	0.416	0.792	0.166	0.469	0.972	0.660	0.106	0.656	0.082	0.531	0.823
HD	-0.270	-0.328	0.071	-0.555	-0.446	-0.518	-0.374	-0.396	-0.394	-0.484	0.103	-0.097
	0.264	0.472	0.826	**0.032**	0.228	0.653	0.115	0.143	0.512	0.156	0.777	0.820
HL	-0.201	-0.515	-0.375	-0.540	-0.391	0.876	-0.134	-0.634	0.121	-0.424	-0.097	-0.429
	0.409	0.237	0.229	**0.038**	0.298	0.320	0.584	**0.011**	0.846	0.222	0.791	0.289
HW	-0.304	-0.817	-0.011	-0.502	-0.024	-0.670	-0.174	-0.522	0.269	-0.505	0.516	-0.031
	0.206	**0.025**	0.974	0.057	0.950	0.532	0.477	**0.046**	0.662	0.137	0.127	0.942
CC	-0.433	-0.160	-0.621	-0.570	-0.395	-0.944	-0.112	-0.666	-0.179	-0.623	0.758	-0.438
	0.064	0.732	**0.031**	**0.026**	0.293	0.215	0.648	**0.007**	0.773	0.054	**0.011**	0.278
UAC	-0.214	-0.625	-0.622	-0.301	-0.221	-0.972	-0.142	-0.436	-0.486	-0.570	0.702	0.040
	0.380	0.133	**0.031**	0.276	0.568	0.151	0.562	0.105	0.407	0.085	**0.024**	0.926
FAC	-0.327	-0.566	-0.540	-0.370	-0.303	-0.950	-0.194	-0.381	-0.417	-0.556	0.539	-0.271
	0.172	0.185	0.070	0.174	0.429	0.202	0.427	0.161	0.485	0.095	0.108	0.516
ULC	-0.136	-0.757	-0.566	-0.271	-0.305	-0.972	-0.188	-0.088	0.341	-0.590	0.669	0.158
	0.578	0.049	0.055	0.329	0.424	0.150	0.440	0.755	0.574	0.073	**0.034**	0.709
LLC	-0.134	0.058	-0.656	-0.323	-0.268	-0.982	-0.180	0.027	-0.641	-0.625	0.717	-0.399
	0.585	0.902	**0.021**	0.240	0.486	0.121	0.460	0.924	0.244	0.053	**0.020**	0.327
TSFBc	-0.039	-0.555	-0.020	-0.256	0.224	-0.482	0.104	0.409	0.631	-0.515	0.804	0.642
	0.874	0.196	0.952	0.357	0.562	0.680	0.671	0.130	0.254	0.128	**0.005**	0.086
TSFFA	0.124	-0.472	-0.316	-0.054	-0.558	0.428	0.186	0.502	0.229	-0.165	0.798	0.654
	0.614	0.285	0.317	0.849	0.119	0.243	0.446	0.056	0.712	0.648	**0.006**	0.078
TSFC	0.194	-0.473	0.040	-0.105	-0.213	-0.220	0.152	0.508	0.918	-0.586	0.954	0.534
	0.427	0.283	0.901	0.711	0.581	0.859	0.536	0.053	**0.028**	0.075	**<0.001**	0.173
TSFS	0.170	-0.613	-0.064	-0.060	-0.153	-0.094	0.012	0.377	0.825	-0.354	0.928	0.522
	0.486	0.143	0.844	0.831	0.695	0.940	0.960	0.166	0.086	0.315	**<0.001**	0.184
TSFUL	0.236	-0.501	0.475	-0.019	0.231	-0.340	-0.010	0.619	0.170	-0.551	0.880	0.520
	0.332	0.252	0.624	0.947	0.549	0.779	0.968	**0.014**	0.785	0.099	**0.001**	0.186
TSFLL	0.152	-0.314	-0.029	0.065	0.146	0.482	0.046	0.693	0.492	-0.556	0.492	0.585
	0.533	0.493	0.928	0.819	0.707	0.680	0.850	**0.004**	0.400	0.095	0.148	0.128
TSFTc	0.088	0.358	-0.172	-0.254	0.384	0.810	0.037	0.432	0.279	-0.360	0.663	0.605
	0.719	0.430	0.594	0.361	0.308	0.399	0.879	0.108	0.650	0.308	**0.037**	0.112
TSFB	0.239	0.376	-0.131	-0.194	-0.552	-0.021	0.338	-0.068	0.546	-0.461	0.833	0.231
	0.324	0.406	0.686	0.488	0.123	0.987	0.158	0.809	0.341	0.179	**0.003**	0.581
ND	-0.165	-0.021	0.044	-0.484	-0.103	-0.482	-0.273	-0.110	0.724	-0.521	0.518	-0.005
	0.499	0.964	0.892	0.067	0.791	0.680	0.259	0.695	0.166	0.122	0.125	0.990
FD	-0.044	-0.053	0.324	-0.335	-0.355	-0.678	-0.441	-0.475	0.082	-0.472	0.484	-0.274
	0.857	0.910	0.304	0.223	0.348	0.526	0.059	0.073	0.896	0.169	0.156	0.511
FW	-0.248	-0.045	-0.343	-0.255	-0.407	-0.855	-0.162	-0.372	0.972	-0.489	0.357	0.187
	0.305	0.924	0.275	0.359	0.277	0.347	0.507	0.172	**0.006**	0.151	0.311	0.658
FL	-0.336	0.054	-0.132	-0.706	-0.001	-0.780	-0.025	-0.422	0.224	-0.607	0.217	0.207
	0.159	0.908	0.683	**0.003**	0.997	0.431	0.918	0.117	0.717	0.063	0.547	0.622
AL	-0.355	0.184	-0.190	-0.608	0.075	0.078	-0.295	-0.440	0.551	-0.470	0.128	-0.548
	0.136	0.694	0.555	**0.016**	0.849	0.950	0.220	0.100	0.336	0.171	0.724	0.160

Note: Significant values are marked in bold.

Discussion

This study aimed to describe and analyse the relationship of morphological dimensions with the swimming time of young swimmers in different swimming styles. Detailed description of morphological dimensions considering the three age groups as well as the four main swimming styles was provided. Also, numerous correlations of morphological dimensions and swimming time were obtained in all age groups and swimming styles.

In the first age group, freestyle swimmers showed a significant correlation with the 50m result in the variables: BH, LL, PV and CC, which shows that total body height and especially long legs follow fast crawl swimming. Similarly to these findings, body height, arm length and hand length showed earlier to be related to the result in 50m crawl and back stroke styles (Dimitric, et al., 2010).

In the case of back technique, the most significant correlations with the result are with the longitudinal and transfer dimensions (BM, BH, LL, SV, HD, HV, CC, PV, FL and AL).These results are also in line with the earlier findings that suggest that developed arm musculature improved the efficiency of backstroke swimmers (Sammound et al., 2018).

Breaststroke swimmers showed the weakest correlation of anthropometric variables and swimming time with the youngest age group, probably due to the marked difference in the development of swimmers. The only significant correlation with the 50 m result is with FD, which indicates the importance of foot shape in leg propulsion. The flexibility of ankle joint is important in the leg work of breaststrokers (Jagomagi & Jurimate, 2005). Butterfly technique swimmers have a correlation of results with anthropometric variables with PW, CC, UAC, FAC, ULC and LLC. These correlations may suggest that effective swimming for butterfly swimmers entails strong chest, arms and legs (Leko et al.,2004), due to strong arm propulsion and leg kicking (Grcic-Zupcevicet al., 2004).

In the second age period that included freestyle swimmers, the correlation of results is only with HW and ULC. This shows that larger hand dimensions and stronger quadriceps contribute to better efficiency in arm propulsion (S-stroke), and the efficiency of leg work. No correlation between variables was observed with backstroke swimmers at this age, so the result must be influenced by additional factors such as the training process.

With breaststroke swimmers in second age group, ten variables have a good correlation with the result at 50 m. The variables BH LL, SW PW, HL, HW, FD, CC, TSFUL and TSFLL record good correlations with the result. This finding is in accordance with previous studies which showed that overall body height and particularly length of the legs as well as wide shoulders are characteristics of good breaststroke swimmers (Nevill et al., 2018), (Trivun et al., 2011). This shows that the longitudinal and transversal dimensions of the feet and hands have role in improving the propulsion of arms and legs, leading to better results. When it comes to butterfly, body mass, circumferences and TSF show a significant relationship with the result. This indicates that the chest muscles, the back and arms have significant role in the propulsion of the arms, and the leg muscles are important for a more efficient kick. This is in line with previous study in which the swimming time in 100 m butterfly was correlated with muscles mass (Bouguezzi et al., 2018).

With the third age, the connection between variables was the weakest, partly due to the small sample. Freestyle swimmers showed a good correlation of swimming time with BM, PW, CC, UAC, FAC, ULC and LLC. This indicates that large and massive swimmers are needed for a better result of a 50m crawl swimmer. Volumes of body change drastically under the influence of training at a younger age, but later they stabilize (Gualdi&Graziani, 1993).

With backstroke swimmers the only significant correlation of the results is with SW, which helps the body move better in the water. The results of these swimmers correlated with TSFC and TSFTc (stronger arm stroke) and with FW (more efficient leg push). Butterfly swimmers also have a smaller number of significant connections than the other age groups, which means that the development of butterfly swimmers has stabilized. The results correlate only with four variables: CW and PW contributes to a better body position and TSFBc and TSFFA contribute to a stronger arms stroke (Sammoud et al., 2018).

Conclusion

The findings of this study provide a detailed description of the morphological dimensions of the three age groups of swimmers who employed four swimming styles. Obtained correlation with swimming time in first age group are highest for the backstroke technique with longitudinal and transverse dimensionality indicators. In the second age group, the swimmers of butterfly styles showed significant correlation of swimming time with body volume and mass. The breaststroke swimmers showed significant correlations of swimming time with transfer, girth and TSF of the legs. In the third group, the body mass and volumes of freestyle swimmers were correlated with swimming time.

The results obtained in this research provide insight into possible influences of morphological characteristics on swimming time with different swimming styles. A more detailed conclusion to this topic requires further experimental studies. Nevertheless, the results of this research provide a guideline for the swimming clubs and all swimming workers of the Swimming Federation of Serbia to carry out an adequate selection of young swimmers and to categorize them in different swimming styles based on their morphological characteristics.

Conflict of interest
The authors declare that there is no conflict of interest.

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ORIGINAL SCIENTIFIC PAPER

Co-occurance of aggression and frustration and its relationship with handball players' sports performance

Lator Chukwuma Sunday[1]

[1]Department of Human Kinetics and Sports Science, Faculty of Education, University of Benin, Benin City Edo State

Abstract

This study investigates the co-occurrence of aggression and frustration and its relationship with handball players' sports performance. Five research questions were raised, tested at 0.05alpha level. The descriptive survey research design was adopted for the study. The population of the study was the registered 99 handball players in Delta State Sports Commission. The research instrument for the study was a self-constructed questionnaire. The instrument's validity was exposed to scrutiny and the cronbach alpha statistics was used to ascertain its reliability. The correlation coefficient was 0.73 indicating that the instrument was reliable. The data were analyzed with Pearson correlation and multiple regression. Results revealed that there was no significant relationship between aggression and sport performance; there was a significant relationship between frustration and sport performance; there was a significant relationship between aggression and frustration in sports among handball players; there was no significant relationship between aggression and gender on sports performance; and there was a significant relationship between frustration and gender on sports performance among handball players. In conclusion, proper training, good tolerance levels among the athletes, coaches and sports organizers, would go a long way in reducing aggression and frustration in sports, thus, enhancing sports performance.

Keywords: *aggression, frustration, sports performance, handball players, sports*

Introduction

Aggression in sport is an unprovoked physical or verbal assault and aggressiveness as the purpose is to commit such an assault (Singh & Singh, 2016). Aggression is an open vocal or physical act which can emotionally or physically injure another athlete or oneself (Krishnaveni & Shahin, 2014). Sometimes, sports players or athletes display aggressive behaviour towards their opponents in a bid to instill fear in them, so as to be in a vantage position as to defeating/winning them. According to Krishnaveni and Shahin (2014) sports aggression involve harm-causing behaviour having no association to the competitive goals of sports, and connect, thus, to incidents of uncontrolled aggression outside the rules and regulations of sports, rather than highly competitive behaviour within the rule boundaries. Aggressive and violent actions are criminal and illegal in certain sports such as, basketball, football and cricket.

Simpson (2001) found evidence about the role of testosterone and its effect on aggression. Alterations in hormone concentration can have impact on individual mood and behaviours. It is a well known fact that aggressive behaviour on the part of an athlete will create a disruption and end in a low performance. This act would likely be distracting to the teams also as a whole. Studies have shown, for instance, that the poorer a team is in performance, the more likely it would engage in aggression (Krishnaveni & Shahin, 2014). They also found out more aggressiveness occur as there is a huge difference between scores or points. However, with the cooperation of all concerned parties, sports aggression can be minimized. Angry feelings and behaviour, being a precursor to aggressions can be modified through proper anger management training and role play.

Apart from aggression, frustration also impacts or influences

Correspondence:

Montenegro Sport

LATOR, Chukwuma Sunday (Ph.D)
Department of Human Kinetics and Sports Science, Faculty of Education, University of Benin, Benin City Edo State
E-mail: chukwuma.lator@uniben.edu

sports performance. Thus, the frustration-aggression hypothesis states that aggression is a result of frustration. This aligns with the instinct theory which suggests that aggression occurs as a result of an inherent drive like hunger, taste, frustration, anger, and so on (Sarah Mae Sincero, 2012). In suggesting a reformulation of the frustration–aggression hypothesis, Berkowitz (1989) claimed that the involvement of vexation, frustration or aversive stimuli tends to cause adverse effects that the individual interpret as anger leading to aggression. Frustration, though does not necessary culminates in aggressive behaviour, create an inclination for aggression through resentment, hostility, or other undesirable feelings (Mentovich & Jost, 2017). Anger has the tendency to affect performance by either unsettling or improving the focus of devotion, information-processing and decision-making, execution and control of action (Jones, 2003). For instance, dysfunctional anger can be provoked in a rugby player as a result of a rival's unlawful and deliberate act. The upset player may then sidetrack the concentration of his attention from the mission at hand to the offender for revenge with the drive of inflicting harm. Anger is therefore dysfunctional as it culminates in wasted energy, reduced accomplishments, and unlawful acts of violence. On the other hand, the player may use his anger instrumentally to direct more energy towards the legitimate, functional, and assertive behaviours of tackling and shoving in order to block the opponent's attack. Hence, anger can disorganise and ruin performance or, contrariwise, energise and consolidate behaviour towards the accomplishment of a task.

Ruiz and Hanin (2004a, b) and Ruiz (2004) also scrutinized the content of anger conditions using a multiplicity of procedures, comprising metaphoric reports, sensation profiling and open-ended questions. The observed functional impact of anger on performance specified that athletes can use anger in training for or during competition. The facilitative impacts of anger were linked to positive feelings of increased inspiration, confidence and powerful skill execution, while the debilitative impacts were related with pressure, low self-esteem and perceived failure to manage the condition. According to the Individual Zones of Optimal Functioning (IZOF) concepts of energy mobilisation and utilisation (Hanin, 2000), the experience of the facilitative or debilitative effect of anger, fretfulness or other adversely toned feelings would depend on an individual's opinion of the energising or de-energising impacts of these feelings, and the right use or misuse of these energies. Hanin (2004) has lately suggested the concept of meta-emotion, or meta-experience, to account for knowledge, attitudes, beliefs and inclinations for (or rejection of) a feeling that athletes develop through a range of successful and less than successful performances. For example, an athlete who observes that anger indicators are typically related with feeling powerful, vigorous and alert, can deduce this state as a pointer of eagerness to achieve a task. Meta-experiences are also influenced by culturally resolute principles of performers concerning the expected outcome of specific emotions on performance and the guidelines of expression or suppression of emotions in a specific context (Hanin, 2004).

Sport performance is the mode in which sports participation is measured. Sports performance is an intricate fusion of biochemical function, emotional factors and training methods. Performance in an athletic perspective has a common meaning of signifying the quest of distinction or achievement (Encyclopedia.com, 2019). Sports performance has six distinct aspects: neuromuscular factors, musculoskeletal system, mental control, psychological factors, environmental conditions, coaching and external support for athletes. With definite penalties used as a degree of aggression, two groups of male college ice hockey players were matched for differences in goals and assists (McCarthy et al, 1978). Those rated high in aggression scored significantly more goals than those low in aggression. The bearing of differences in assist was same but did not reach significance. When the same groups were matched for shots on goals, significant differences were established, favoring the high aggressive group (McCarthy et al, 1978). Meanwhile, aggression and frustration are seen as abnormal behavior in sports, although not in all cases.

Statement of the Problem

Aggressive behavior is displayed at different level of sports. Aggression and frustration in sports has been made to the public on regular basis by the mass media. Serious efforts are being made to minimize negative use of aggression in sports, ranging from setting up of committee to checkmate the disposition on the field of play, as well as enactment of tiles and policies to guide the sporting events.

Athletes who are unable to manage the feeling of anger or aggression and frustration in contact sports attract to themselves various sanctions such as paying fines, match bans and so on. While those who are unable to utilize the anger feeling, aggressive feeling of frustrating feelings can earn themselves prizes or rewards that are worthwhile such as medals and social recognition. However, most athletes do not seem to know this. Therefore, this study aimed to investigate the co-occurence of aggression and frustration on sport performance among handball players.

Research Questions

1. What is the relationship between aggression and sport performance among handball players in Delta State?
2. What is the relationship between frustration and sport performance among handball players in Delta State?
3. What is the relationship between aggression and frustration in sport among handball players in Delta State?
4. What is the relationship between aggression and sport performance based on gender?
5. What is the relationship between frustration and sport performance based on gender?

Methodology

The population of the study was made up of 99 registered handball players making up the handball team in the Delta State Sports Commission who have been duly screened, cleared and consistent in the sport. The test instrument (See Appendix I) used for the study was a self-constructed questionnaire used to measure the psychological variables as well as sports performance. The test instrument was validated by three (3) experts in Human Kinetics and Sports Science, University of Benin, Benin City.

Data Analysis

The data analysis for the research questions were carried out using Pearson correlations and multiple regression.

Research Question 1: Is there a relationship between aggression and sport performance among handball players in Delta State?

Table 1: Descriptive characteristics and correlation between aggression and sports performance

	N	Mean	SD	R	p-value
Aggression	99	12.76	2.330	0.108	0.288
Performance	99	15.12	2.309		

The data in Table 1 showed that there is no significant association between aggression and sports performance (r=0.108, p=0.288).

Research Question 2: Is there a relationship between frustration and sport performance among handball players in Delta State?

Table 2: Descriptive characteristics and correlation between frustration and sports performance

	N	Mean	SD	R	p-value
Performance	99	15.12	2.309	0.251	0.012
Frustration	99	12.55	1.593		

The data in Table 2 showed that there is a significant association between frustration and sports performance (r=0.251, p=0.012).

Research Question 3: Is there a relationship between aggression and frustration on sport performance among handball players in Delta State?

Table 3: Descriptive characteristics and correlation between frustration and aggression

	N	Mean	SD	R	p-value
Frustration	99	12.55	1.593	0.426	<0.0001
aggression	99	12.76	2.330		

The data in table 3 showed that there is a significant association between frustration and aggression (r=0.426, p=0.000).

Research Question 4: Is there a relationship between aggression and sport performance based on gender?

Table 4: Multiple regression statistics on relationship between aggression and sports performance based on gender among handball players

Model Summary								
				Change Statistics				
R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df 1	df 2	Sig. F Change
0.111	0.012	-0.008	2.319	0.012	0.601	2	96	0.550

Analysis of Variance (Anova^b)						
	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Regression	6.459	2	3.229	0.601	**0.550**	Ho is accepted
Residual	516.087	96	5.376			
Total	522.545	98				

The R value is 0.111 meaning that there is a weak relationship between aggression and gender on sports performance. The R square value of 0.012 showed that both aggression and gender contribute 1.2% (0.012) to the variance of sport performance.

The data in the ANOVA table showed df=2, 96; F=0.601, p=0.550. Hence, with a p-value that is greater than the alpha level of 0.05, there is no significant relationship between aggression and gender on sports performance.

Research Question 5: Is there a relationship between frustration and sport performance based on gender?

Table 5: Multiple regression statistics on relationship between frustration and sports performance based on gender among handball players

Model Summary								
				Change Statistics				
R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df 1	df 2	Sig. F Change
0.256	0.065	0.046	2.256	0.065	3.356	2	96	**0.039**

Analysis of Variance (Anovab)						
	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Regression	34.144	2	17.072	3.356	**0.039**	Ho is rejected
Residual	488.402	96	5.088			
Total	522.545	98				

The R value is 0.256 which meant that there is a weak relationship between frustration and gender on sports performance. The R square value of 0.065 showed that both frustration and gender contribute 6.5% (0.065) to the variance of sport performance.

The data in the ANOVA table showed the F value is 3.356, df is 2, 96. The p-value is 0.039 which is less than 0.05, meaning that there is a significant relationship between frustration and gender on sports performance among handball players.

Discussion

The findings of research question 1 showed that there is no relationship between aggression and sports performance. However, this is not in line with the findings of Krishnaveni (2014) who found that the poorer a team is in performance, the more likelihood it will engage in aggression. This is because as the game gets more intense, hostility levels after the game are significantly higher.

The findings of research question 2 showed that there is a positive weak relationship between frustration and sports performance. This aligns with the assertion of Tripathy (2019) who reported that in sporting sense when injury occurs to a sports person, he can get frustrated.

The findings of research question 3 showed that there was a positive moderate relationship between frustration and aggression in sports among handball players. This follows the finding of Dollard, Miller, Doob, Mowrer and Sears (1939) and Freud (1950), Breuer and Elson (2017) who theorized that a player becomes aggressive when the goal is blocked thus leading to frustration in the player and ultimately aggression. They stated that frustration will continuously lead to aggression and aggression is at all times caused by frustration.

Findings in research question 4 revealed no significant association between aggression and gender on sports performance. In line with this finding, White and Kowalski (1994) stated that if women played the same collision sports as men, they would display same aggression intensities due to the same sport socialization processes. In fact, given same circumstances, women have presented to be just as aggressive as men. Nonetheless, women and men have been shown to differ on their acceptance of sport aggression in relation to sport type participation (Gardner & Janelle, 2002).

Findings of research question 5 showed that there is no significant relationship between frustration and gender on sports performance. However, Tripathy (2019) suggested that it seems that participation in sport, such as handball can serve as a good device for enhancing the psychological characteristics such as frustration tolerance. Moreover, this can be beneficial for male and female players.

Conclusion

Proper training, good tolerance levels on the part of athletes, coaches, sports organizers would go a long way in reducing aggression and frustration in sports, thus, enhancing sports performance.

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ORIGINAL SCIENTIFIC PAPER

The effect of mini-basketball on physical development and motor skills in 8 year old children

Mariana Aleksieva Borukova[1]

[1]National Sports Academy"Vassil Levski", Sofia, Bulgaria

Abstract

A person's physical development is a complex concept, which can be considered as a dynamically changing state from the moment of birth till the person's death. The beginning of sports education in school is set for children through the game. The study aims to determine the dynamics of physical development and motor skills in 8-year-old students under the influence of mini-basketball activities within one school year. Ninety-five primary school students were studied. The applied methods are an overview study of specialized literature and sports-pedagogical testing on 18 indicators, carrying information about physical development and some motor skills. The data were processed mathematically and statistically using a variation, comparative, and correlation analyses. The obtained results indicate that for 8-year-old children, organized mini-basketball activities raise the level of physical development and favor the development of motor skills.

Keywords: *physical development, mini-basketball, school*

Introduction

With the implementation of various games in the educational and training process, the PE teacher tries to develop motor abilities and skills. For instance, the reaction time and frequency of movements are abilities that can be developed from early childhood (Tsarov, 2008). The coach should not only implement the numerous exercises and games but also be able to classify and apply them in the appropriate context and change the type of the exercises and games according to children's abilities (Maaßmann, Mayer, 2020).

There are two methods for implementing mini-basketball – a game and a competitive method. This requires the inclusion of many movement activities and competitive and relay games. The parts of the lesson should flow smoothly into each other, and the main goal is not to disturb the density of the activity. In order to be able to keep the children's interest and at the same time carry out the educational process, the teacher should show creative thinking while teaching basic technical skills. Lessons need to be dynamic and full of games (Borukova, 2018).

This study aims to determine the dynamics of physical development and motor skills of 8-year-old students under the influence of organized mini-basketball activities for one school year.

Material & Methods

This study was conducted in September 2021 and June 2022.

Participants

Ninety five children, students in the 2nd grade in a primary school, were studied.

Intervention

Within a school year, students have two compulsory physical education and sports lessons (PES) and one additional lesson in which the teacher can choose which sport to conduct. In our case, the sport is mini-basketball. The additional lessons planned for one school year are 32 of 35 minutes each, which occur once a week. The same teacher conducts the lessons with all students, and the same methods and means of teaching mini-basketball are applied according to the thematic curriculum. Thirty-two mini-basketball sessions were conducted with the 2nd-grade students. Students' attendance in this additional class was 90%, and no one missed more than one lesson.

Anthropoemtric abilities, motor abilities and skills assessment

Anthropometric measurements, motor abilities and skilss were conducted at the beginning and the end of the school year, as

Correspondence:

Montenegro Sport

Mariana A. Borukova
National Sports Academy"Vassil Levski", Faculty of Pedagogy, Department of Basketball, Volleyball, Handball, 1700 Sofia, Bulgaria
E-mail: marianaborukova@gmail.com

one lesson for each was required (Aleksieva, 2009). The children's anonymity is guaranteed; each was registered under a different number known only to the teacher. All participated in the study voluntarily, provided informed consent, and received no money or financial compensation for their contribution.

Data analysis

All statistical operations were carried out by mathematical-statistical processing with SPSS for Windows, Release 23.0.; depending on the research tasks, the following statistical methods were applied: variation analysis – for defining the average values, normality of distribution, and variety of the indicators under study; comparative analysis using Student's t-test for dependent samples and Mann-Whitney U test.

Results

Table 2 presents the descriptive statistical parameters and the results of the applied variation analysis of the initial data.

Table 1. Description of the test battery

№	Indexes	Measurement units	Exact. of measurem.	Direction of increase
1.	Height – H(cm)	Cm	1,0	+
2.	Weight - W(kg)	Kg	0,5	
3.	Body Mass Index – BMI ($_{kg/m^2}$)	kg/m²	1,0	
4.	Chest measurement – Pause – ChMP ($_{cm}$)	Cm	1,0	+
5.	Chest measurement - respiratory difference – ChMD ($_{cm}$)	Cm	1,0	+
6.	Horizontal extension – HE($_{cm}$)	Cm	1,0	+
7.	Vertical extension – VE ($_{cm}$)	Cm	1,0	+
8.	Squat jump - SJ($_{cm}$)	Cm	1,0	+
9.	Vertical jump 2 legs - VJ($_{cm}$)	Cm	1,0	+
10.	Vertical jump 1 leg - VJ($_{cm}$)	Cm	1,0	+
11.	Sprint 10 m - S 10m ($_{s}$)	S	0,01	-
12.	Throwing a solid ball from a standing position – Tb ($_{cm}$)	Cm	1,0	+
13.	Flexibility - F($_{cm}$)	Cm	1,0	+
14.	Pass with two hands from chest to wall – PW($_{n}$)	N	1	+
15.	Running between cones – Rc($_{s}$)	S	0,01	-
16.	Dribble between cones - Dc($_{s}$)	S	0,01	-
17.	Abdominal presses – A ($_{n}$)	N	1	+
18.	Index for leading the ball – Ib($_{s}$)	S	0,01	-

Table 2. Descriptive characteristics of the physical and motor abilities development in II grade students (8 years old)

N	Indicators	n	min	max	R	X	S	V	As	Ex
1.	Height	95	116.00	143.00	27.00	132.00	0,062	4.69	-0.654	-0.276
2.	Weight	95	20.00	50.00	30.00	29.15	0,595	20.42	2.939	1.453
3.	BMI	95	12.43	25.51	13.08	16.71	2,704	16.19	2.223	1.383
4.	Chest measurement – Pause	95	50.00	90.00	40.00	65.26	6,357	9.74	2.315	0.929
5.	Chest measurement - respiratory difference	95	0.00	11.00	11.00	5.94	1,956	32.94	0.462	-0.093
6.	Horizontal extension	95	116.00	150.00	34.00	133.04	7,015	5.27	-0.029	0.031
7.	Vertical extension	95	145.00	184.00	39.00	167.26	7,896	4.72	-0.244	-0.022
8.	Standing long jump - SLJ(cm)	95	80.00	170.00	90.00	129.24	19,149	14.82	0,535	-0,048
9.	Vertical jump 2 legs	95	3.00	27.00	24.00	16.37	4.747	29.00	-0.284	-0.324
10.	Vertical jump 1 leg	95	2.00	25.00	23.00	10.98	5.147	46.88	0.357	-0.516
11.	Sprint 10 m	95	2.09	3.83	1.74	2.83	0.431	15.24	0.258	-0.818
12.	Throwing a solid ball from a standing position	95	200.00	600.00	400.00	348.63	72.002	20.65	0.623	1.155*
13.	Flexibility - F(cm)	95	70.00	110.00	40.00	96.06	8.884	9.25	-0.738	0.265
14.	Pass with two hands from chest to wall	95	6.00	34.00	28.00	18.96	5.422	28.60	0.295	0.327
15.	Running between cones	95	6.05	12.82	6.77	8.61	1.187	13.79	0.892	2.519*
16.	Dribble between cones	95	10.63	37.45	26.82	20.92	6.765	32.34	0.718	-0.329
17.	Abdominal presses	95	3.00	48.00	45.00	26.69	7.913	29.64	-0.163	0.538
18.	Index for leading the ball	95	2.91	30.65	27.74	12.38	6.866	55.44	0.776	-0.173

The results show that the study population has a higher growth rate than the national average since 2012 according to the Bulgarian Academy of Sciences (2012).The coefficient of variation presented in Table 2 shows that the studied group is homogeneous in four indicators, which are mainly related to body lengths: height (V_1=4.69%), chest measurement - Pause (V_4=9.74%), horizontal (V_6=5.27%) and vertical extension (V_6=4.72). According to the other two indicators, the group is relatively homogeneous. According to the indicator 'chest measurement – respiratory difference,' in the group of 8-year-old students, the high value of the coefficient of variation indicates that the group appears to be (V_5=32.94%) heterogeneous.

The analysis of Table 2 shows that the average achievement in the 'Standing long jump' is 129.24 cm, in the 'Vertical jump - 1 leg' it is X_8=16.37 cm, and in the 'Vertical jump – 2 legs' X_8=10.98 cm. A one-leg vertical jump requires good coordination, developing with growing up, and improving technique. The indicators 'Passing with two hands from chest to a wall,' 'Running between cones', and 'Dribble between cones' do not require special skills but accuracy and coordination, as well as the ability to move along a set route using dribble.

For most of the indicators, the distribution of the values is average, but there are also those where it is different from the normal one. These are the indicators related to the explosive power of the lower and upper limbs, in which the values of As are ≥ 1.00. We consider this normal because the sample size is large (n≥30), and in the studied group, there are children of both genders (boys and girls) - a prerequisite for an asymmetric distribution of the values for some indicators. This is also confirmed by the values of the coefficient of variation 'V', which are above 10% and above 30% for all indicators. According to sports statistics, this proves that the population we studied is relatively homogeneous and heterogeneous regarding these indicators. The group is highly homogeneous only regarding flexibility 'Depth of bent' (V_{13}=9.25 %). Although the group is highly homogeneous, the mean values show (X_{13}= 96.06 cm) that the children are not flexible enough because the value is below 100 cm.

Our research aims to determine the impact of organized mini-basketball activities on the level of physical and motor development of 2nd-grade students. For this purpose, it is necessary to establish whether a statistically significant difference has been obtained between anthropometric characteristics, motor abilities and skills after the intervention applied during the academic school year. A second test was conducted at the end of the school year to establish the impact of mini-basketball activities on the physical ability of 2nd-grade students.

Table 3 presents a comparative analysis and the significant differences after applying the Student's t-test for dependent samples.

Table 3. Comparison between physical and motor development indicators in 2nd-grade students after the end of the intervention

Indicator	n	I measurement		II measurement		Increase in results		Significant difference	
		X_1	S_1	X_2	S_2	d	d%	t/U	p≤0.05
1. Height	95	132,00	6,00	136,00	7,00	4,00	30,30	4,53	p<0.05
2. Weight	95	29,15	0,60	33,99	6,76	4,84	16,60	5,51	p<0.05
3. BMI	95	16,71	2,70	18,27	2,89	1,56	9,34	4,23	p<0.05
4. Chest measurement –Pause	95	65,26	6,36	66,18	6,39	0,92	1,41	1,17	p<0.05
5. Chest measurement - respiratory difference	95	5,94	1,96	5,48	1,90	-0,46	-7,74	1,62	p<0.05
6. Horizontal extension	95	133,04	7,02	136,55	7,34	3,51	2,64	3,37	p<0.05
7. Vertical extension	95	167,26	7,90	172,39	7,98	5,13	3,07	4,45	p<0.05
8. Standing long jump - SLJ(cm)	95	129,24	19,15	138,16	16,98	8,92	6,90	3,40	p<0.05
9. Vertical jump 2 legs - VJ(cm)	95	16,37	4,75	17,73	4,71	1,36	8,29	1,98	p<0.05
10. Vertical jump 1 leg	95	10,98	5,15	13,03	4,99	2,05	18,68	2,79	p<0.05
11. Sprint 10 m	95	2,83	0,43	2,73	0,37	-0,10	-3,38	1,60	p<0.05
12. Throwing a solid ball from a standing position	95	348,63	72,00	393,68	74,49	45,05	12,92	4,24	p<0.05
13. Flexibility - F(cm)	95	96,06	8,88	98,92	7,32	2,86	2,97	2,42	p<0.05
14. Pass with two hands from chest to wall	95	18,96	5,422	23,13	4,99	4,17	21,97	5,51	p<0.05
15. Running between cones	95	8,61	1,19	8,13	0,99	-0,48	-5,53	2,99	p<0.05
16. Dribble between cones	95	20,92	6,77	16,76	4,36	-4,16	-19,88	5,04	p<0.05
17. Abdominal presses	95	26,69	7,91	28,47	7,75	1,78	6,68	1,57	p<0.05
18. Index for leading the ball	95	12,38	6,87	8,56	4,47	-3,82	-30,84	4,39	p<0.05

After the second measurement, a statistically significant positive increase was observed for all the investigated indicators (Table 3. Regarding the indicators that provide information about the students' anthropometric data, there is an increase in the average height by 3.5 cm. In the horizontal extension, the value is approximately the same. As expected, body weight increased slightly, as did body mass index. The limits for a normal degree of obesity for children in this age group remained the same. Only for chest measurement – Pause, no statistically significant difference was observed.

The presented values show that the results have improved for all the examined indicators. In the standing long jump, the children jump nearly 10 cm farther; in the two-leg vertical jump, the results have improved by 1.5 cm and the one-leg vertical jump by 2 cm. The strength in the upper limbs has increased by nearly 50 cm, as have the abdominal muscles; the children are now 0.10s faster in the 10 m sprint, run faster between cones, and dribble better.

The high values of the t-test show that statistically significant differences exist for nine characteristics; only for the characteristics related to speed abilities t11=1.60 and abdominal muscle strength t17=1.57, no such differences are observed. We can summarize that mini-basketball activities positively impact second-grade students' motor abilities.

Discussion

The results of the present study indicate that 32 organized mini-basketball sesions in 8-year-old children, positively impacted the physical and motor development of the children, as well as the level of ball handling skills. No statistically significant differences in chest circumference and speed abilities was observed after the mini-basketball sesssions.

The results of the present study corroborate with the findings of the study of Akbari (2009), which showed a positive influence of the selected motor program on the progress of fundamental movements, and that gross motor skills can be influenced by an appropriate motor program. Furthermore, Aleksieva and Petkova (2015) found that under the influence of normal biological development, as well as under the influence of physical exercises specific to minibasketball, occur significant positive changes in anthropometric signs in 8 year old children. Comparing the results of this study with a similar study conducted by Fotrousi, Bagherly and Ghasemi (2012), we find that the implementation of a minibasketball training program has a positive impact on motor abilities in children aged 7-10 years.

During the school-age period, significant and dynamic changes occur in the biological development and ability, mental maturation, and intellectual and social development of the personality (Tsarov, 2008). Children at this age can perform complicated actions regarding coordination, combining the movements of the arms and legs. The educational content in the mini-basketball programs envisages precisely this assimilation of knowledge and skills at a basic level. With the creation of mini-basketball in 1948, Jay Archer defined the goal of the game, namely that not winning is important, but the fact that children learn to love the sport and respect the rules of the game, the referees, and the opposing team players. Mini-basketball allows working in mixed groups during training, and competitions are like festivals. It is not the victory that is important, but the participation and attraction of children to sports and popularizing sports, especially basketball. The motto of mini-basketball is 'Come and try with us!'.

The content of mini-basketball is very similar to that of movement activities and games, allowing it to be combined with them or studied separately. Thus, the basketball lessons can include a continuous learning process for mini-basketball. The regular participation of students in mini-basketball activities would help them to increase the level of their physical ability. In addition to applying numerous exercises and games, the teacher should be able to classify exercises, apply them in the appropriate context, and change the type of exercises and games according to the children's abilities (Maaßmann, Mayer, 2020). From the age of 7-8, children have the anatomical and physiological prerequisites to cope with the requirements of the mini-basketball game, thus exercises to develop coordination abilities, flexibility, and conditioning abilities are emphasized. Practicing and developing basic motor skills (technique improvement) continues so that they can gradually be transformed into specific motor skills. Children of this age group learn to play together by dribbling, passing, shooting, and defending. The sports pedagogue must provide them with all these actions in a standard form to gain experience for the diverse game situations typical for basketball (Aleksieva, 2012).

Conclusions

As found in our research, mini-basketball activities have a positive effect on some indicators of physical and motor development. More precisely, height and horizontal extension, improved strength of the upper limbs and abdominal muscles, flexibility, speed of movement along a set route, dribbling at maximum speed, as well as coordination while passing.

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ORIGINAL SCIENTIFIC PAPER

Exploring associations between psychosocial parameters and quality of life in patients with spinal cord injury

Kubeyinje Oluwaseun Susan[1], Nwodo Chinedu[1], Inegbenejie Sylvester Bamidele[1], Ugwu Esther[1], Ede Stephen[1], Olubayode Temitope[1], Abugu Ezinne[1], Ogualaji Precious[1], Onyebueke Perpetua[1], Okorie Joshua[1], Ibekaku Michael Chigozie[1], Ejele Perpetua[1], Christopher Raphael[1]

[1]University of Benin Teaching Hospital, Benin City, Edo State, Nigeria

Abstract

Spinal Cord Injury (SCI) is a devastating condition causing profound life changes for millions of people around the world as it typically causes paralysis, and permanent disability. The aim of this study was to ascertain the quality of life (QoL) of the patients with SCI and to correlate it with psychosocial variables (age, sex, source of income, level of education, independence level, ambulatory status and depression). A cross-sectional survey design was employed with 22 SCI patients constituting the sample size. World Health Organization Quality of Life Questionnaire–BREF and Patient's Health Questionnaire (PHQ) were the instruments used for data collection. The instruments were administered directly and data was analyzed using descriptive statistics of frequency counts, percentage, mean, standard deviation and Spearman rho correlation statistics. The findings of this study showed that majority of the respondents were male (68.2%) and they were mostly dependent in ambulation (68.2%) with the use of wheelchair as the most common assistive device (85.7%). Their QoL ranged from very poor to average (72.7%) and most of them found it very difficult to move around (59.1%). The physical health domain also had the least score on PHQ (38.36±19.52) and most of them were minimally depressed. There was no significant correlation between QoL and physical function, but there was significant negative correlation between depression and physical function. Conclusively, the findings of this study have shown that recovery of physical function in SCI patients is inversely related with the level of depression experienced.

Keywords: *Quality of life, Depression, Physical function*

Introduction

Spinal Cord Injury (SCI) is a condition resulting in devastating alterations in the life of several people worldwide (Wyndaele & Wyndaele, 2006). In the United States alone, an estimated 262,000 are living with SCI. Over 80% are male, with an average age of about 40 years and most frequent causes of injuries include motor vehicle accidents, violence, falls and recreational accidents (Mcdonald & Sadowsky, 2002).

A retrospective hospital-based study done in the South-East, Nigeria showed that over 80% are males while just 11% are females, and the incidence of traumatic spinal cord injury are relatively low in the children and adolescent population (Chima, Anthony, Chibuzo, Ngozi, Robinson & Ebere, 2014). SCI results in diminished mobility, reduced functional independence, difficulties with socialization and employment (Craig, Tran & Middleton, 2009). Many individuals will also experience serious complications including decubitus ulcers, pneumonia, deep venous thrombosis, spasticity and pain (Johnson, Gerhart, Mcgray, Menconi & Whiteneek, 1998). Some patients also experience serious psychosocial and neurobehavioral issues and are at increased risk of developing anxiety disorders, substance abuse problems, feelings of helplessness, poor coping skills, low self -esteem and depression (Craig, Tran & Middleton, 2009). Acute SCI is typically marked by weight loss, disruptions in appetite, sleep cycles, physical sensations, energy levels and mobility

Correspondence:

Montenegro Sport

O.S. Kubeyinje
Department of Physiotherapy, University of Benin Teaching Hospital, P.M.B. 1111, Benin City, Edo State, Nigeria
Email: efanu101@gmail.com

problems. These symptoms are also symptomatic of depressive conditions (Frank, Elliot, Corcoran & Wonderlich, 1987).

Depression is the most common psychological issue associated with SCI (Craig, Tran & Middleton, 2009). It reportedly affects 30% of patients and is generally characterized by depressed mood and diminished pleasure over a two-week span accompanied by issues including energy loss, concentration difficulties and sleep or appetite disturbances (American Psychiatric Association, 1994). Depression severity ranges from minor depression to adjustment disorders, and major depressive episodes. The type, duration, pervasiveness of symptoms and effect on functions varies (Judd, Paulus, Wells & Rapaport, 1996).

Quality of life (QoL) has been defined in many ways. As a dynamic concept, it has been defined as different things to different people at different times in their lives and these definitions reflect both the dynamic nature and multidimensionality of QoL and its inherent subjectivity as a self-report concept (Tate, Kalpakjian, & Forchheimer, 2002). QoL refers to the physical, social, psychologic, and existential aspects of well-being that might be affected by disease, disability and its treatments (Schumaker, Anderson, & Czajikowski, 1990). The heightened stress levels in individuals with SCI further decrease QoL (Ditor, Latimer, Ginis, Arbour, MCcartney & Hicks, 2003). The changes in resilience as a result of the SCI are believed to have correlation with satisfaction of life, onset of depression and functional independence during inpatients rehabilitation after an SCI (White, Driver & Warren, 2010). Whalley (2006) showed that QoL was found to be diminished by problems associated with the impaired body and by a sense of loss. SCI usually results in loss of motor function, faecal and urinary incontinence, impaired skin sensation as well as sexual challenges. These symptoms impact these individuals and their families mentally, physically emotionally and financially resulting in a negative effect on their QoL. However, there is limited work in the literature on the relation between psycho social parameters and QoL in patients with SCI. Hence, the objective of this study was to evaluate if QoL and level of depression are related to the psycho social parameters of the patients with spinal cord injury.

Methodology

This study utilized a cross-sectional research design and it was carried out in the University of Benin Teaching Hospital (UBTH), Benin City, Edo State. The research population included all patients with spinal cord injury that were receiving care (in-patients and out-patients) at UBTH. A sample of 22 respondents (18-65 years) participated in the study using convenience non–probability sampling technique. Participants were admitted patients who were willing to participate in this study and were at least 3 weeks post-injury during the period of this study. Ethical approval was sought and obtained from the Research and Ethics committee of UBTH (ADM/E 22/A/VOL.II/14830976). Informed consent of each respondent was also obtained before commencement.

The research instruments for this study are: World Health Organization Quality of Life Questionnaire –BREF (WHOQOL-BREF) and Patient's Health Questionnaire (PHQ – 9). The WHOQOL-BREF was developed in the context of the four domains defining the QoL, physical, social and environmental which has 26 questions. Higher scores implied better life satisfaction. The PHQ -9 measures the level of depression and it comprises of 9 questions. Lower scores were interpreted to mean lower level of depression.

All the participants were given routine physical and neurological examination by the research team using International Standard for Neurological Classification of Spinal Cord Injury developed by the American Spinal Cord Injury Association (ASIA). The questionnaires were administered to the respondents and a guide on how to fill was provided (in English and Bini language). Those who were unable to fill the questionnaire due to poor motor control were assisted by the researchers. The questionnaires were returned to the researchers.

Descriptive statistics of frequency and percentage were used to analyze the participants' demographic data. The relationship between quality of life and psychosocial variables (age, sex, source of income, highest level of education, self-ambulant and depression) of patients with spinal cord injury was analyzed using Spearman's correlation coefficient with the significance level set at $p \leq 0.05$. The statistical analysis was done using Statistical Package for Science (SPSS) version 23.0.

Results

Table 1 summarized the demographic details of study respondents; which shows that a total of 22 respondents completed the survey, and they were mainly males (n=15). Those aged 35-54 years constituted the majority (n=12, 54.5%). They were predominantly married (n=16). Over 50% of the respondents (n=13) had

Table 1. Demographic and Clinical Characteristics of Respondents

Variable	Frequency	Percentage
Age (years)		
15-34	4	18.2
35-54	12	54.5
55-64	4	18.2
65 and above	2	9.1
Gender		
Male	15	68.2
Female	6	27.3
Marital Status		
Single	5	22.7
Married	16	72.7
Widowed	1	4.5
Change of occupation after injury		
Yes	7	33.3
No	14	66.7

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Variable	Frequency	Percentage
Highest level of education received		
Primary	2	9.1
Secondary	7	31.8
Tertiary	13	59.1
Source of income		
Family	3	14.3
Self	14	66.7
Government	4	19.0
Onset of Injury		
0-6 weeks	15	71.4
7-12 weeks	1	4.8
13-36 weeks	2	9.5
Above 36 weeks	3	14.3
Level of Spinal cord injury affectation		
C4	4	25
C5	1	6.3
T2	1	6.3
T6	1	6.3
T7	1	6.3
T10	1	6.3
L2	4	25.0
L3	3	18.8
Self-ambulant		
Yes	7	31.8
No	15	68.2
Assistive devices		
Wheelchair	18	85.7
Walking frame	2	9.5
Walking sticks	1	4.8

tertiary education and the major source of income was self-generated. The onset of injury was mostly between 0-6 weeks (n=15, 71.4%), three of the respondents have had their injury for over 36 weeks. The level of spinal cord injury affectation was mainly in the lumber region (n=7), followed by cervical region (n=5), and then the thoracic region (n=4). Only 7 (31.8%) of the respondents

Table 2. Quality of life of respondents

Variable	Frequency	Percentage (%)
How would you rate your quality of life?		
Very poor	3	13.6
Poor	5	22.7
Neither poor nor good	8	36.4
Good	6	27.3
Very good	-	-
How well are you able to get around?		
Very poor	13	59.1
Poor	5	22.7
Neither poor nor good	4	18.2
Good	-	-
Very good	-	-

are self-ambulant, wheelchair was the major ambulatory device (n=18, 85.7%). Walking frames and sticks were used only by two and one respondents, respectively. After their injury, 33.3% (n=7) has changed their occupation.

Table 2 shows that Quality of life of respondents which was assessed using the WHOQOL_BREF revealed 13.6% (n=3) of them rated their quality of life as very poor, 22.7% (n=5) as poor, 36.4% (n=8) was neither poor nor good, and 27.3% rated as good. None of the respondents rated their quality of life as very good. On how they are able to get around, majority of the respondents (n=13, 59.1%) indicated very poor, 22.7% (n=5) indicated poor while the rest indicated neither poor nor good.

Table 3 shows that among the four domains of quality of life, the mean score for social domain was the highest (56.82±22.66), followed by the psychological health domain (50.09±15.67), and the environmental health domain (42.45±13.93). The physical health domain had the least mean score (38.36±19.52).

Table 3. WHOQOL-BREF score of respondents

Variable	Mean	SD	Min	Max
Qol	2.77	1.02	1	4
Getting around	1.59	0.80	1	3
Physical pain	2.91	1.38	1	5
Medical treatment	2.27	0.77	1	3
Energy	2.91	1.38	1	5
Health satisfaction	2.59	1.01	1	4
Sleep	2.73	1.42	1	1
Activity	2.27	1.16	1	5
Working skills	2.00	1.11	1	5
Physical health domain	38.36	19.52	0	69
Enjoy life	2.59	1.10	1	5
Meaning	3.09	1.02	1	5
Concentration	2.86	1.39	1	5
Body aspect	2.64	1.53	1	5
Self-satisfaction	3.23	1.11	1	5
Blue feelings	3.68	0.89	2	5
Psychological health domain	50.09	15.67	19	75
Daily life safety	3.05	1.13	1	5
Environment safety	2.86	1.21	1	5
Money	2.27	1.45	1	5
Information	2.27	1.12	1	5
Leisure	1.91	1.02	1	4
Place	2.91	1.19	1	5
Health services	3.36	1.00	1	5
Transports	2.36	1.05	1	4
Environmental domain	42.45	13.93	13	63
Personal relationship	3.36	1.18	1	5
Sexual life	3.14	1.24	1	5
Friendship	3.27	1.55	1	5
Social domain	56.82	22.66	19	100

Table 4. Respondents' Depression Severity

Variable	Frequency	Percentages (%)
Depression Severity		
Minimal depression	9	40.9
Mild depression	5	22.7
Moderate depression	7	31.8
Moderately severe depression	1	4.5
Severe depression	-	-

Table 4 shows that out of the 22 respondents that completed the survey, 40% were minimally depressed, 22.7% mildly depressed, 31.8% were moderately depressed, 4.5% were moderately severely depressed. There was no severe depression among the study sample.

The result presented in table 5 shows that there was no significant correlation between the QoL and the levels of depression; quality of life and physical function. However, there was a significant negative correlation between the levels of depression and physical function.

Table 5. Relationship between QoL, level of depression, and physical function of respondents (Pearson Correlation [r] analysis)

Variable	Quality of life	Level of depression	Physical function
Quality of life	1	-0.27	0.40
Level of depression	-0.27	1	-0.46*
Physical function	0.40	-0.46*	1

*= p-value is less or equal to 0.05

Discussion

The study carried out assessed the relations between physical function and quality of life and depression, in patients with spinal cord injury in University of Benin Teaching Hospital. Main findings indicate that QoL was not significantly related to the levels of depression and physical function. However, there was a significant negative correlation between the levels of depression and physical function. Findings from the study also indicate that men were more prone to SCI. This could be attributed to the fact that they are more involved in violence, motorcycle usage, dangerous driving and reckless decisions when compared to their female counterpart (Saunders, 2021). This is also in line with the findings of O'Connor (2005) which showed a higher prevalence in men's susceptibility to SCI than women. The study by Kang et al. (2018) also revealed that men are more likely to be involved in SCI. Further findings from the study revealed that cervical spine is the most susceptible to injury and this could be due to its anatomy and flexibility (Torhincasi & Waseem, 2021). This finding backs up the study carried out by Miyakoshi et al. (2020) which showed a higher prevalence in cervical injury when compared to other spines. The study of Kang et al. (2018) and Dahlberg et al. (2005) also revealed a higher prevalence in cervical injury.

Quality of life of patients with spinal cord injury

The result from this study reviewed that amongst the four domains of WHOQOL-BREF (Physical Health, psychological Health, Social Health and Environmental Health Domain), Social health ranked the highest with 56.82 + 22.66 followed by psychological health domain which is 50.09+15.67. This finding supports the study carried out by Jang et al. (2004) which also showed that social health ranks the highest. Chang et al (2012) also reported a higher percentage in social health as compared to other domains. This finding could be attributed to the fact that recovery of SCI patients is based on social support. According to Müller et al. (2012), social support in SCI patients can help to overcome discomfort and stigmatization and as well enhance integration into the social environment. Furthermore, in a study carried out by Kreuter et al. (2005) in Australia and Sweden, it was reported that social aspects received lowest average score which was attributed to SCI patient's dissatisfaction because they consider themselves at a social disadvantage.

Depression severity among patients with spinal cord injury

Literature relating depression and SCI shows that psychological mobility is not an inevitable consequence of SCI. However, much of this research is characterized by methodological inadequacies and the conclusions are therefore tenuous (Hancock et al., 1993). The result of this study showed that 90% of the participants had significant depression level. On account of the severity of depression, 40% indicated minimal depression, 22% were mildly depressed, while moderate depression indicated a score of 31.8%, and finally 4.5% were moderately severely depressed. In comparison with the result of this study, a similar questionnaire-based survey study by Shin et al. (2012), measured depression in SCI patients on admission using Beck Depression Inventory (BDI). Shin et al. (2012) used the cut-scores according to Kendall et al. (2010) with 0-9 indicating normal, 10-19 indicating mild depression, 20-30 indicating moderate depression, and 31-63 indicating severe depression. Of the 36 participants who participated in the survey, the average BDI score was 13.8±8.4. The study showed that there was a higher rate of depression with patient suffering from SCI (63.9%) as seen also in this study, though the study did not give specific severity scores.

Relationship between QoL, level of depression, and physical functioning of respondents.

This study shows that the QoL when correlated with the levels of depression and physical function has no significant correlation among them. However, there was a significant negative correlation between the levels of depression and physical function. Contrary to this work's finding, a study by Polat et al (2018) demonstrated that depression was associated with lower QoL in patients with SCI and the same study also concluded that depression correlates with gender, pain, sleep deprivation and type of caregiver. This variation in findings could be attributed to the use of different instruments in the assessment of QoL as well as a larger sample size, though the population in both studies was quite similar in terms of age distribution and gender.

Conclusion

In conclusion, the participants who were predominantly on admission at the study setting rated their quality of life mainly as poor or neither poor nor good. The participants posted the highest mean scores in the social domain of the WHOQOL-BREF questionnaire while the least mean scores were obtained for the physical health domain. The participants did not have major problem with depression, and none recorded severe depression. Analysis of the relationship between variables showed that quality of life did not significantly correlate with depression severity and physical function. However, there was a negative correlation between depression severity and physical function.

It is therefore recommended that rehabilitation for spinal cord injured patients should focus on the physical healthcare needs of the patients as this might be significant to their overall psychological well-being. Also, further studies should further explore the association between QoL, depression severity, and physical functioning of patients with spinal cord injury using a larger sample.

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Guidelines for Authors

Revised October 2017

*** Please use the bookmark function to navigate within the guidelines. ***

When preparing the final version of the manuscripts, either NEW or REVISED authors should strictly follow the guidelines. Manuscripts departing substantially from the guidelines will be returned to the authors for revision or, rejected.

1. UNIFORM REQUIREMENTS

1.1. Overview

The *Journal of Anthropology of Sport and Physical Education* (JASPE) applies the Creative Commons Attribution (CC BY) license to articles and other works it publishes.

There is no charge for submissions and no page charge for accepted manuscripts. However, if the manuscript contains graphics in color, note that printing in color is charged.

JASPE adopts a double-blind approach for peer reviewing in which the reviewer's name is always concealed from the submitting authors as well as the author(s)'s name from the selected reviewers.

JASPE honors six-weeks for an initial decision of manuscript submission.

Authors should submit the manuscripts as one Microsoft Word (.doc) file.

Manuscripts must be provided either in standard UK or US English or Montenegrin language. Chosen language standards should be consistent throughout the manuscripts.

Format the manuscript in A4 paper size; margins are 1 inch or 2.5 cm all around.

Type the whole manuscript double-spaced, justified alignment.

Use Times New Roman font, size eleven (11) point.

Number (Arabic numerals) the pages consecutively (centering at the bottom of each page), beginning with the title page as page 1 and ending with the Figure legend page.

Include line numbers (continuous) for the convenience of the reviewers.

Apart from chapter headings and sub-headings avoid any kind of formatting in the main text of the manuscripts.

1.2. Type & Length

JASPE publishes following types of papers:

Original scientific papers are the results of empirically- or theoretically-based scientific research, which employ scientific methods, and which report experimental or observational aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical. Descriptive analyses or data inferences should include rigorous methodological structure as well as sound theory. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Original scientific papers should be:
- Up to 3000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 30;
- Maximum combined total of 6 Tables/Figures.

Review papers should provide concise in-depth reviews of both established and new areas, based on a critical examination of the literature, analyzing the various approaches to a specific topic in all aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical.

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Review papers should be:
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Editorials are written or commissioned by the editors, but suggestions for possible topics and authors are welcome. It could be peer reviewed by two reviewers who may be external or by the Editorial Board.

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Editorials should be:
- Up to 1000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
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- Maximum number of references is 10.

Short reports of experimental work, new methods, or a preliminary report can be accepted as two page papers. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

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- Up to 1500 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
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Peer review - fair review provides authors who feel their paper has been unfairly rejected (at any journal) the opportunity to share reviewer comments, explain their concerns, and have their paper reviewed for possible publication in JASPE.

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- Maximum number of references is 15.

Invited papers and award papers include invited papers from authors with outstanding scientific credentials. Nomination of invited authors is at the discretion of the JASPE editorial board. JASPE also publishes award papers selected by the scientific committee of the publisher's conferences.

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- Maximum number of references is 30;
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- The author signs a formal statement that the submitted manuscript complies with the directions and guidelines of JASPE.

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1.7. Code of Conduct Ethics Committee of Publications

C O P E COMMITTEE ON PUBLICATION ETHICS

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2. MANUSCRIPT STRUCTURE

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Analysis of Dietary Intake and Body Composition of Female Athletes over a Competitive Season

Original Scientific Paper

Diet and Body Composition of Female Athletes

Svetlana Nepocatych[1], Gytis Balilionis[1], Eric K. O'Neal[2]

[1]Elon University, Department of Exercise Science1, Elon, NC 27215
[2]University of North Alabama, Department of Health, Physical Education and Recreation, Florence, AL 35632

Corresponding author:

S. Nepocatych

Elon University

Department of Exercise Science

100 Campus Dr.

2525 CB

Elon, NC 27244

United States

E-mail: snepocatych@elon.edu

Word count: 2,946

Word count: 4259

Abstract word count: 211

Number of Tables: 3

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Title should be short and informative and the recommended length is no more than 20 words. The title should be in Title Case, written in uppercase and lowercase letters (initial uppercase for all words except articles, conjunctions, short prepositions no longer than four letters etc.) so that first letters of the words in the title are capitalized. Exceptions are words like: "and", "or", "between" etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

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Affiliation consists of the name of an institution, department, city, country/territory (in this order) to which the author(s) belong and to which the presented / submitted work should be attributed. List all affiliations (each in a separate line) in the order corresponding to the list of authors. Affiliations must be written in English, so carefully check the official English translation of the names of institutions and departments.

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If an author belongs to more than one institution, all corresponding superscript digits, separated with a comma with no space in between, should be present behind the family name of this author.

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Whenever possible expand your authors' affiliations with departments, or some other, specific and lower levels of organization.

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Corresponding author's name with full postal address in English and e-mail address should appear, after the affiliations. It is preferred that submitted address is institutional and not private. Corresponding author's name should include only initials of the first and middle names separated by a full stop (and a space) and the last name. Postal address should be written in the following line in sentence case. Parts of the address should be separated by a comma instead of a line break. E-mail (if possible) should be placed in the line following the postal address. Author should clearly state whether or not the e-mail should be published.

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The second page of the manuscripts should be the abstract and key words. It should be placed on second page of the manuscripts after the standard title written in upper and lower case letters, bold.

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Authors should provide up to six key words that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus are recommended to be used.

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Abstract

Results of the analysis of

Key words: *spatial memory, blind, transfer of learning, feedback*

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- ✓ **Methods**

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- ✓ *Table position of the research football team*

2.3.2 Ethics

When reporting experiments on human subjects, there must be a declaration of Ethics compliance. Inclusion of a statement such as follow in Methods section will be understood by the Editor as authors' affirmation of compliance: "This study was approved in advance by [name of committee and/or its institutional sponsor]. Each participant voluntarily provided written informed consent before participating." Authors that fail to submit an Ethics statement will be asked to resubmit the manuscripts, which may delay publication.

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JASPE encourages authors to report precise p-values. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Use normal text (i.e., non-capitalized, non-italic) for statistical term "p".

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All contributors who do not meet the criteria for authorship should be listed in the 'Acknowledgements' section. If applicable, in 'Conflict of Interest' section, authors must clearly disclose any grants, financial or material supports, or any sort of technical assistances from an institution, organization, group or an individual that might be perceived as leading to a conflict of interest.

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All information needed for each type of must be present as specified in guidelines. Authors are solely responsible for accuracy of each reference. Use authoritative source for information such as Web of Science, Medline, or PubMed to check the validity of citations.

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2.4.2. Examples for Reference citations

One work by one author
- ✓ In one study (Reilly, 1997), soccer players
- ✓ In the study by Reilly (1997), soccer players
- ✓ In 1997, Reilly's study of soccer players

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- ✓ Duffield and Marino (2007) studied
- ✓ In one study (Duffield & Marino, 2007), soccer players
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Works by three to five authors: cite all the author names the first time the reference occurs and then subsequently include only the first author followed by et al.
- ✓ First citation: Bangsbo, Iaia, and Krustrup (2008) stated that
- ✓ Subséquent citation: Bangsbo et al. (2008) stated that

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Two or more works in the same parenthetical citation: Citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically, then chronologically)
- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that

2.4.3. Examples for Reference list

Journal article (print):

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine, 6*(2), 57-65. doi: 10.26773/mjssm.2017.09.008

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology, 100*(6), 727-735. doi: 10.1007/s00421-007-0468-x

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise, 35*(4), 697-705. doi: 10.1249/01.MSS.0000058441.94520.32

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Journal article (online; electronic only):

Chantavanich, S. (2003, October). Recent research on human trafficking. *Kyoto Review of Southeast Asia, 4*. Retrieved November 15, 2005, from http://kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/index.html

Conference paper:

Pasadilla, G. O., & Milo, M. (2005, June 27). *Effect of liberalization on banking competition*. Paper presented at the conference on Policies to Strengthen Productivity in the Philippines, Manila, Philippines. Retrieved August 23, 2006, from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/Pasadilla.pdf

Encyclopedia entry (print, with author):

Pittau, J. (1983). Meiji constitution. In *Kodansha encyclopedia of Japan* (Vol. 2, pp. 1-3). Tokyo: Kodansha.

Encyclopedia entry (online, no author):

Ethnology. (2005, July). In *The Columbia encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved November 21, 2005, from http://www.bartleby.com/65/et/ethnolog.html

Thesis and dissertation:

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport.* Unpublished Doctoral Dissertation. Tallahassee, FL: The Florida State University.

Book:
Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human kinetics.

Chapter of a book:
Kellmann, M. (2012). Chapter 31-Overtraining and recovery: Chapter taken from Routledge Handbook of Applied Sport Psychology ISBN: 978-0-203-85104-3 *Routledge Online Studies on the Olympic and Paralympic Games* (Vol. 1, pp. 292-302).

Reference to an internet source:
Agency. (2007). Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare. Retrieved 10/29, 2013, from www.rcn.org.uk/newsevents/hydration

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All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard must be explained in a footnote of that table. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

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Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. *See* example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

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Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word *Note* (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. [a, b, c]), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript [a].

- ✓ [a]One participant was diagnosed with heat illness and n = 19.[b]n =20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || etc.

- ✓ *P<0.05,†p<0.01.

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- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

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Figures and figure legends should be completely intelligible without reference to the text.

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Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written bellow the figure, in sentence case. *See* example:
- ✓ **Figure 1.** Changes in accuracy of instep football kick measured before and after fatigued. SR – resting state, SF – state of fatigue, *p>0.01, †p>0.05.

2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. *See* example:
- ✓ Figure 1
  - × figure 1
  - × Figure 1.
  - ✓ ….exhibit greater variance than the year before (Figure 2). Therefore…
  - ✓ ….as shown in Figures 1 and 3. (citing more figures at once)
  - ✓ ….result has shown (Figures 1-3) that... (citing more figures at once)
  - ✓ ….in our results (Figures 1, 2 and 5)... (citing more figures at once)

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If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. *See* example:
- ✓ Figure 1a
- ✓ …in Figures 1a and b we can…
- ✓ …data represent (Figures 1a-d)…

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All units of measures should conform to the International System of Units (SI).

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Decimal places in English language are separated with a full stop and not with a comma. Thousands are separated with a comma.

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10º	✓ 10 kg	✓ 12:2	✓ 0.056
× 10 %	× 10 º	× 10kg	× 12 : 2	× .056

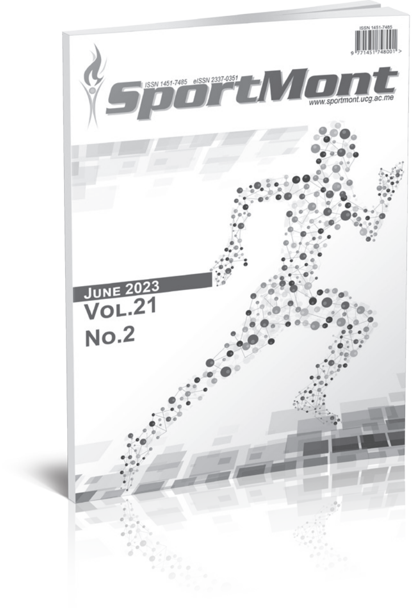
Signs should be placed immediately preceding the relevant number.		
✓ 45±3.4	✓ p<0.01	✓ males >30 years of age
× 45 ± 3.4	× p < 0.01	× males > 30 years of age

2.8. Latin Names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non-italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations. *See* example:

- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*



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SMJ covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

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Borko KATANIC, Managing Editor – borkokatanic@gmail.com
Nedim COVIC, Managing Editor – nedimcovic@gmail.com

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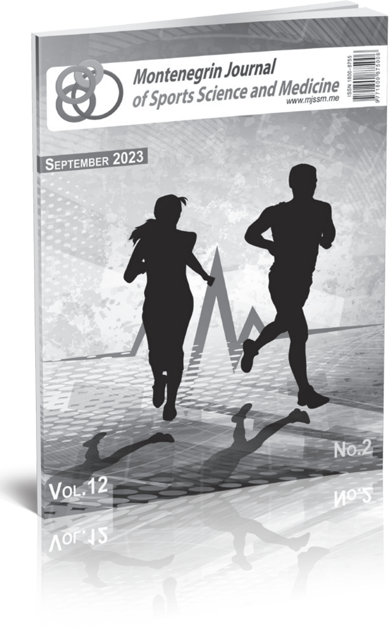
Montenegrin Journal of Sports Science and Medicine



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Dusko BJELICA, Editor-in Chief – sportmont@t-com.me
Damir SEKULIC, Editor-in Chief – damirsekulic.mjssm@gmail.com

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Autumn issue – September 2024

MONTENEGRIN SPORTS ACADEMY

Founded in 2003 in Podgorica (Montenegro), the Montenegrin Sports Academy (MSA) is a sports scientific society dedicated to the collection, generation and dissemination of scientific knowledge at the Montenegrin level and beyond.

The Montenegrin Sports Academy (MSA) is the leading association of sports scientists at the Montenegrin level, which maintains extensive co-operation with the corresponding associations from abroad. The purpose of the MSA is the promotion of science and research, with special attention to sports science across Montenegro and beyond. Its topics include motivation, attitudes, values and responses, adaptation, performance and health aspects of people engaged in physical activity and the relation of physical activity and lifestyle to health, prevention and aging. These topics are investigated on an interdisciplinary basis and they bring together scientists from all areas of sports science, such as adapted physical activity, biochemistry, biomechanics, chronic disease and exercise, coaching and performance, doping, education, engineering and technology, environmental physiology, ethics, exercise and health, exercise, lifestyle and fitness, gender in sports, growth and development, human performance and aging, management and sports law, molecular biology and genetics, motor control and learning, muscle mechanics and neuromuscular control, muscle metabolism and hemodynamics, nutrition and exercise, overtraining, physiology, physiotherapy, rehabilitation, sports history, sports medicine, sports pedagogy, sports philosophy, sports psychology, sports sociology, training and testing.

The MSA is a non-profit organization. It supports Montenegrin institutions, such as the Ministry of Education and Sports, the Ministry of Science and the Montenegrin Olympic Committee, by offering scientific advice and assistance for carrying out coordinated national and European research projects defined by these bodies. In addition, the MSA serves as the most important Montenegrin and regional network of sports scientists from all relevant subdisciplines.

The main scientific event organized by the Montenegrin Sports Academy (MSA) is the annual conference held in the first week of April.

Annual conferences have been organized since the inauguration of the MSA in 2003. Today the MSA conference ranks among the leading sports scientific congresses in the Western Balkans. The conference comprises a range of invited lecturers, oral and poster presentations from multi- and mono-disciplinary areas, as well as various types of workshops. The MSA conference is attended by national, regional and international sports scientists with academic careers. The MSA conference now welcomes up to 200 participants from all over the world.

It is our great pleasure to announce the upcoming 21th Annual Scientific Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives" to be held in Dubrovnik, Croatia, from 18 to 21 April, 2024. It is planned to be once again organized by the Montenegrin Sports Academy, in cooperation with the Faculty of Sport and Physical Education, University of Montenegro and other international partner institutions (specified in the partner section).

The conference is focused on very current topics from all areas of sports science and sports medicine including physiology and sports medicine, social sciences and humanities, biomechanics and neuromuscular (see Abstract Submission page for more information).

We do believe that the topics offered to our conference participants will serve as a useful forum for the presentation of the latest research, as well as both for the theoretical and applied insight into the field of sports science and sports medicine disciplines.

USEFUL CONTACTS

Editorial enquiries and journal proposals:
Dusko Bjelica
Damir Sekulic
Editors-in-Chief
Email: **damirsekulic.mjssm@gmail.com**

Selcuk Akpinar
Executive Editor
Email: **office@mjssm.me**

Marketing enquiries:
Fidanka Vasileva
Marketing Manager
Email: **damirsekulic.mjssm@gmail.com**

Sports Science and Medicine Journals

from Montenegrin Sports Academy

We have expanded the quality of our journals considerably over the past years and can now claim to be the market leader in terms of breadth of coverage.

As we continue to increase the quality of our publications across the field, we hope that you will continue to regard MSA journals as authoritative and stimulating sources for your research. We would be delighted to receive your comments and suggestions, mostly due to the reason your proposals are always welcome.

Look Inside!

Sport Mont Journal

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Managing Editor: **Borko Katanic**, Montenegro; **Nedim Covic**, Bosnia and Herzegovina

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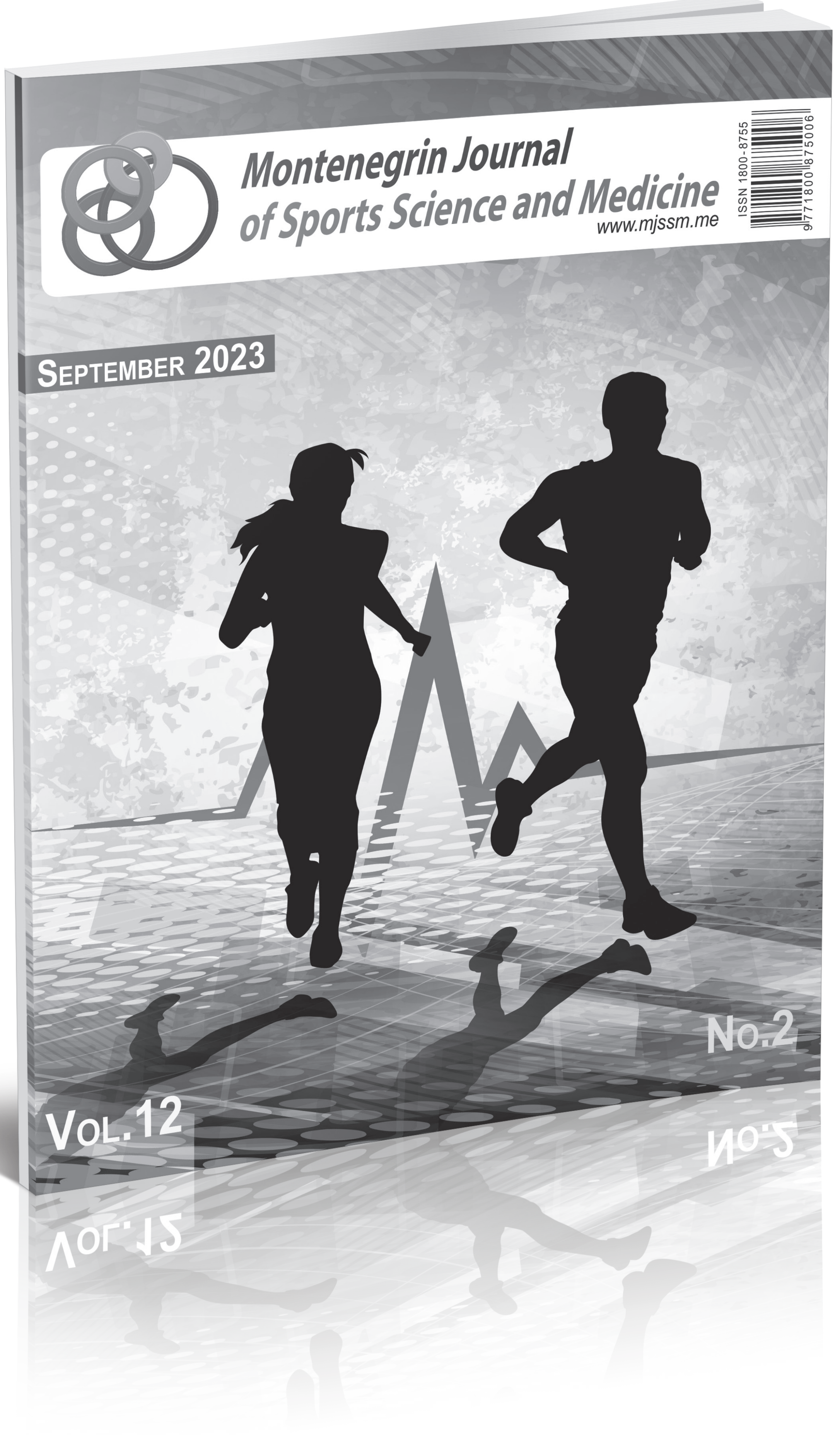
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