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Bulevar Vojvode Petra Bojovića 1A
78000 Banja Luka, Bosna i Hercegovina
Phone/Fax: 00387 (0)51 31 22 80
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COMPARING POSSESSION CHARACTERISTICS BETWEEN 12, 15, AND 18 a SIDE GAMES IN JUNIOR AUSTRALIAN FOOTBALLERS

USPOREDBA KARAKTERISTIKA IGRAČKIH POZICIJA IZMEĐU 12, 15 I 18 STRATEŠKE IGRE KOD JUNIORSKIH AUSTRALIJSKIH FUDBALERA

**Zac Cross¹, Shane Pill¹, Kym
Williams¹**

¹*Flinders University College of
Education, Psychology and Social
Work*

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Corresponding Author:
Dr Shane Pill
Flinders University, South
Australia
GPO Box 2100
Adelaide, South Australia, 5001
shane.pill@flinders.edu.au

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Abstract

The purpose of this investigation was to compare the effects of altering the number of players during ‘small sided games’ on the possession characteristics within a youth under 10 football setting. Two modified ‘small sided game’ versions of 12 a side and 15 a side in accordance to the Australian Football League (AFL) junior match policy were used to compare against the 18 a side game used in a junior football association. Possession characteristics were coded using IPad installed with the application Dartfish Easy Tag across 4 game periods of 24 minutes for each game format. It was found that the additional players in the 18 a side version led to more tagged events on average, however, there was a decrease in the number of tagged actions per player compared to 12 a/side and 15 a/side. It was also observed that there were more possession characteristics for kicking and handballing per player during the 12 a/side and 15 a/side versions. The findings suggested that the 12 a side game version of Australian Football is more appropriate for under 10 than the 18 a side format, as it provides players with greater involvement and therefore potentially greater enjoyment, engagement, and technical game-based development. This uniquely aids player development, skill acquisition and participation levels in junior Australian footballers.

Key words: football, small sided, juniors, participation, player engagement.

INTRODUCTION

Australian Football (AF) is a high intensity and fast paced invasion game with a unique mixture of various multi-dimensional movement requirements. Despite different positional characteristics, players require elements of speed, agility, aerobic and anaerobic fitness, strength and power to perform the demands of the game (Wisbey, Montgomery, Pyne, & Rattray, 2010). A match is played between two teams consisting of 18 players on each team, split up into positions with six defenders, six midfielders, six forwards, and four interchange players. The game is played over 20 minute quarters plus ‘time on’ added for stoppages in play (Gray & Jenkins, 2010). The primary objective of the game is to kick more total points than the other team. This is achieved by holding onto possession while creating and exploiting space in order to kick goals (6 points) or score ‘behinds’ or ‘points’.

AF provides one of the most popular early engagement in sport programs for children, called the AusKick program (AFL, 2016a), and while its participation numbers continue to grow, this initial interest is not sustained throughout adolescence when compared to other (more popular) invasion sports. This has resulted in a growing concern about retention in AF (Agnew, Pill & Drummond, 2016). It has been identified that fun and enjoyment are two of the most important aspects of youth participation in sports (Drummond, Agnew, Pill & Dollman, 2013). Enjoyment is defined as a positive affective response that reflects general feelings such as fun, pleasure and liking (Crane & Temple, 2015; McCarthy, Jones & Clark-Carter, 2008), and has been recognised as a strong motivator to participate and a continued desire to stay involved in sport (Agnew, Pill & Drummond, 2016; Crane & Temple, 2015; McCarthy, Jones & Clark-Carter, 2008).

The Sport Commitment Model (Scanlan, Simons, Carpenter, Schmidt & Keeler, 1993) proposes enjoyment, involvement opportunities, and the attractiveness of other involvement alternatives promote participant retention in team sports. Small sided game (SSG) and scaled versions of AF have been suggested as a means of addressing retention concern, while also improving skill acquisition through greater player engagement (Elliott & Pill, 2016). However, the junior football association recommends playing with 18 per side, while the Australian Football League Match Day Policy (AFL, 2017) promotes small sided games of 12 and 15 a/side. Nonetheless, the majority of SSGs research has been drawn from football/soccer, with limited research towards AF (Pill & Elliot, 2015), despite the AFL Match Policy recommendation of SSG scaled versions of AF at junior levels. Consequently, further research in AF has been recommended to build the case for SSG modified and scaled forms of AF at both practice and for game day competition (Elliott & Pill, 2016; Phillips & Wehner, 2012). Therefore, this study aimed to compare game events in 12 a/side and 15 a/side to 18 a/side in under 10s AF. Informed by a previous study in U14 AF by Pill and Elliott (2015), it was hypothesized that 12 and 15 a/side would generate a greater number of game engagement per player compared to traditional approach of 18 a/side.

METHODS

The research involved a quantitative approach to compare game statistics - kicks, handballs, marks, ground ball pickups and goal attempts, in 12 a side and 15 a side game formats to the 18 a side format used by the junior association in weekend competition. A positivist perspective was adopted as the epistemological stance within this study, as a natural environment (a football club) where observed behaviours (possession characteristics) can be directly measured (Gratton & Jones, 2010). The study involved the control of possession characteristics to determine the influence that field size and player numbers on player engagement. The project design is similar to that employed by Pill and Elliott (2015).

Quantitative data was collected using real-time tagging using Apple IPad and the application DartFish EasyTag. Dartfish Easy Tag enables a coding panel to be created that helps capture, record and tag live information during a game to derive game-based statistics (Dartfish, 2017). This method of data tagging has been used before by Pill & Elliot (2015) to record modified junior AF SSGs, with the possession characteristics in this study coded using the Dartfish Easy Tag application. Real-time tagging is also considered by sports teams and sports data companies to be a reliable method to collect sports statistics for sport performance analysis (Bradley, O'Donoghue, Wooster & Tordoff, 2007; Liu, Hopkins, Gomez & Molinuevo, 2013; O'Shaughnessy, 2006; Robertson, Gupta & McIntosh, 2016). An intra-operator reliability test was also completed prior to data collection to help provide the researcher with the necessary practice and understanding of the application before observation commenced. An observation of an Under 18's game between two state league teams was the chosen. The game events, kicks, handballs, marks and goal attempts were tagged for one team across all four quarters of the game. This competition was chosen as the games are tagged by Champion Data and the tagging tallies are publically available from the league. The difference between the intra-operator test results and those of Champion Data was found to be insignificant.

The recruitment of the football club was by convenience sampling (Patton, 2015). The club was then contacted via their publicly available details on their club website. The project was discussed with club, with the club agreed to be a part of the research.

The data collection was not individually identifiable from player to player and was solely focused on the game events (kicks, marks, handballs, ground ball pickups, goal attempts). The five possession characteristics were chosen as they are common in AF game tagging analysis (i.e., Champion Data). The possession characteristics definition is provided in Table 1.

Table 1. Australian Football possession characteristics definitions (AFL, 2016b)

Kick: An act of disposing of the football, when a player contacts the football with any part of the player's leg below the knee.
Handball: A player holds the football in one hand and disposes of the football by hitting it with the clenched fist of the other hand.
Mark: A mark to the body is taken if a player catches or takes control of the football within the playing surface, after it has been kicked by another player, and which has not touched the ground or been touched by another player during the period when the football was kicked until it was caught or controlled by the player to the body.
Ground ball pickup: A player taking possession of the ball while in dispute, off the ground.
Goal attempts: Recording of either 1 or 6 points, under any of the following conditions: (1) when the football is kicked completely over the goal line by a player of the attacking team without being touched by any other player, even if the ball first touches the ground; (2) the football passes completely over the behind line; (3) a player of the attacking team kicks the football over the goal line but before passing over the goal line, the ball is touched by another player; or (4) the football passes touches or passes over the goal post or touches the padding or any other attachment to the goal post

The playing area was consistent with the AFL match policy of 140m x 80m; the surface area per player was 698m² in the 18 a/side format compared to 1,047m² during the 12 a/side games. The AFL Match Policy thus provides greater space per player in the 12 a side format.

Data was compared between the four game periods of 24 minutes for each game format, with descriptive statistics (mean, standard deviation and frequency counts) calculated holistically per game period (Table 4 and 5), and per player (Table 6 and 7). Cohen's d magnitude-based inferences were employed to further understand the level of statistical importance between selected possession and match characteristics between the three game formats (<0.2 trivial, 0.2 – 0.5 small, 0.5 – 0.8 moderate, 0.8>Large (Cohen, 1988). Effects with 95% confidence limits (CL) overlapping the thresholds for small positive and negative effects (exceeding 0.2 standard deviations either side of the null hypothesis) were defined as unclear, with clear small, moderate and large effect sizes defined as substantial.

RESULTS

The analysis of total possession and match characteristics showed that there was a small increase in kicks achieved for the 12 a/side ($d = 0.39$, CL -0.36 – 1.11), 15/side ($d = 0.33$, CL -0.37 – 1.01) compared to the 18 a/side. In addition, there was a small increase between marks achieved for the 12 a side ($d = 0.34$, CL -0.41 – 1.07) compared to the 18 a/side. Conversely, 12 and 15 a/side demonstrated a small to large decrease for handballs, groundball pick-ups, goal attempts and total tagged events compared to the 18 a side game format. In a secondary comparison, 12 a/side demonstrated a small increase in handballs ($d = 0.42$, CL -0.36 – 1.18) and goal attempts ($d = 0.34$, CL -0.43 – 1.10) achieved compared to 15 a/side game format, while differences in marks, groundball pick-ups and total tagged events were trivial.

Table 2. Summary of tagged events for 12, 15 and 18 a/side games

12 a/side								
Possession Characteristic	Game 1	Period Game 2	Period Game 3	Period Game 4	Period	Totals Game Ave	Per/player	
Kicks	66	65	47	57		235	58.8	4.90
Handballs	10	15	32	17		74	18.5	1.54
Marks	20	20	9	13		62	15.5	1.29
Groundball Pickups	38	46	46	50		180	45.0	3.75
Goal Attempts	8	14	6	9		37	9.25	0.77
Total Tagged Events	144	162	143	146		595	148.75	12.4
15 a/side								
Possession Characteristic	Game 1	Period Game 2	Period Game 3	Period Game 4	Period	Totals Game Ave	Per/player	
Kicks	49	65	64	55		233	58.25	3.88
Handballs	21	8	13	19		61	15.25	1.02
Marks	9	9	23	17		58	14.50	0.97
Groundball Pickups	51	48	52	56		207	51.75	3.45
Goal Attempts	5	9	13	5		32	8.00	0.53
Total Tagged Events	135	139	165	152		591	147.75	9.85
18 a/side								
Possession Characteristic	Game 1	Period Game 2	Period Game 3	Period Game 4	Period	Totals Game Ave	Per/player	
Kicks	66	65	47	57		235	58.8	4.90
Handballs	10	15	32	17		74	18.5	1.54
Marks	20	20	9	13		62	15.5	1.29
Groundball Pickups	38	46	46	50		180	45.0	3.75
Goal Attempts	8	14	6	9		37	9.25	0.77
Total Tagged Events	144	162	143	146		595	148.75	12.4

Possession Characteristic	Game 1	Period Game 2	Period Game 3	Period Game 4	Period	Totals Game Ave	Per/player
Kicks	63	54	55	53	225	56.25	3.13
Handballs	20	18	25	13	76	19.00	1.06
Marks	14	15	13	13	55	13.75	0.76
Groundball Pickups	56	53	55	46	213	52.50	2.92
Goal Attempts	15	15	10	6	46	11.50	0.64
Total Tagged Events	170	157	162	130	619	154.75	8.60

Table 3. Analysis of total possession and match characteristics during the games

	12/side	12 → 15 ES (LB and UB)	15/side	12 → 18 ES (LB and UB)	18/side	15 → 18 ES (LB and UB)
Kicks	58.8 ± 8.1	0.07 (-0.69 – 0.82)	58.3 ± 7.6	0.39 (-0.36 – 1.11)	56.25 ± 4.6	0.33 (-0.37 – 1.01)
Handballs	18.5 ± 9.5	0.42 (-0.36 – 1.18)	15.3 ± 5.9	-0.07 (-0.80 – 0.66)	19 ± 5.0	-0.69 (-1.38 – 0.03)
Marks	15.5 ± 5.4	0.15 (-0.62 – 0.90)	14.5 ± 7.6	0.34 (-0.41 – 1.07)	13.75 ± 5.0	0.12 (-0.57 – 0.80)
Groundball pick-ups	45.0 ± 5.4	-1.18 (-1.96 – 0.33)	51.8 ± 5.9	-1.53 (-2.31 – 0.67)	52.5 ± 4.5	-0.14 (-0.83 – 0.55)
Goal attempts	9.3 ± 3.4	0.34 (-0.43 – 1.10)	8.0 ± 3.8	-0.56 (-1.29 – 0.20)	11.5 ± 4.4	-0.85 (-1.54 – 0.11)
Total tagged events	149.0 ± 8.92	0.08 (-0.68 – 0.84)	147.8 ± 13.6	-0.41 (-1.14 – 0.34)	154.75 ± 17.3	-0.44 (-1.13 – 0.26)

In secondary analysis, there was a considerable large increase in kicks achieved for the 12/a side ($d = 3.53$, CL 2.30 – 4.57), 15/side ($d = 1.92$, CL 1.06 – 2.70), compared to the 18 a/side, and between 12 a/side ($d = 1.65$, CL 0.73 – 2.47) and 15 a side game formats. In addition, 12 a/side displayed a large increase in handballs achieved compared to both 15 a side ($d = 0.95$, CL 0.15 – 1.69) and 18 a/side ($d = 0.95$, CL 0.15 – 1.69). A similar large increase was also observed between goal attempts in the 12 a side ($d = 0.90$, CL 0.08 – 1.66) compared to 15 a/ side. Finally, a large increase in total tagged events was also observed for 12 a/side ($d = 4.46$, CL 3.02 – 5.65) and 15/side ($d = 1.33$, CL 0.55 – 2.05), compared to 18 a side game format.

Table 4. Summary of tagged events

12 a/side						
Possession Characteristic	Game Period 1	Game Period 2	Game Period 3	Game Period 4	Totals	Ave per/player
Kicks	5.50	5.42	3.92	4.75	19.58	4.9
Handballs	0.83	1.25	2.67	1.42	6.17	1.54
Marks	1.67	1.67	0.75	1.08	5.17	1.29
Groundball Pickups	3.17	3.83	3.83	4.17	15.00	3.75
Goal Attempts	0.67	1.17	0.50	0.75	3.08	0.77
Total Tagged Events	12.00	13.50	11.92	12.17	49.58	12.4

15 a/s ide						
Possession Characteristic	Game Period 1	Game Period 2	Game Period 3	Game Period 4	Totals	Ave per/player
Kicks	3.27	4.33	4.27	3.67	15.53	3.88
Handballs	1.40	0.53	0.87	1.27	4.07	1.02
Marks	0.60	0.60	1.53	1.13	3.87	0.97
Groundball Pickups	3.40	3.20	3.47	3.73	13.80	3.45
Goal Attempts	0.33	0.60	0.87	0.33	2.13	0.53
Total Tagged Events	9.00	9.27	11.00	10.13	39.40	9.85

18 a/s ide						
Possession Characteristic	Game Period 1	Game Period 2	Game Period 3	Game Period 4	Totals	Ave per/player
Kicks	3.50	3.00	3.06	2.94	12.50	3.13
Handballs	1.11	1.00	1.39	0.72	4.22	1.06
Marks	0.78	0.83	0.72	0.72	3.06	0.76
Groundball Pickups	3.11	2.94	3.06	2.56	11.67	2.92
Goal Attempts	0.83	0.83	0.56	0.33	2.56	0.64
Total Tagged Events	9.44	8.72	9.00	7.22	34.39	8.60

Table 5. Possession and match characteristics per player during the 12, 15, and 18 a/side games. Descriptive statistics are displayed as mean (\bar{x}) and standard deviations (SD). ES refers to Cohen's d effect size, with the LB and UB referring to the lower and upper bound 95% confidence limits.

	12/side	12 → 15 ES (LB and UB)	15/side	12 → 18 ES (LB and UB)	18/side	15 → 18 ES (LB and UB)
Kicks	4.90 ± 0.73	1.65 ($0.73 - 2.47$)	3.88 ± 0.51	3.53 ($2.30 - 4.57$)	3.13 ± 0.25	1.92 ($1.06 - 2.70$)
Handballs	1.54 ± 0.73	0.91 ($0.09 - 1.68$)	1.02 ± 0.39	0.95 ($0.15 - 1.69$)	1.06 ± 0.28	-0.13 ($-0.81 - 0.56$)
Marks	1.29 ± 0.45	0.71 ($-0.10 - 1.47$)	0.97 ± 0.45	1.85 ($0.94 - 2.66$)	0.76 ± 0.05	0.67 ($-0.05 - 1.36$)
Groundball pick-ups	3.75 ± 0.42	0.93 ($0.10 - 1.70$)	3.45 ± 0.22	2.54 ($1.51 - 3.43$)	2.92 ± 0.25	2.24 ($1.32 - 3.05$)
Goal attempts	0.77 ± 0.28	0.90 ($0.08 - 1.66$)	0.53 ± 0.26	0.17 ($-0.57 - 0.90$)	0.64 ± 0.96	-0.15 ($-0.83 - 0.54$)
Total tagged events	12.4 ± 0.64	3.18 ($1.96 - 4.20$)	9.85 ± 0.91	4.46 ($3.02 - 5.65$)	8.6 ± 0.96	1.33 ($0.55 - 2.05$)

DISCUSSION

It was hypothesised that 12 and 15 a/side would generate a greater number of game engagement per player compared to traditional approach of 18 a/side. This hypothesis has been found to be correct. The findings in this study suggest that by competitively engineering (Burton, Gillham & Hammermeister, 2011; Elliot & Pill, 2016) AF for Under 10's, characterized by altering the number of players on the field, specific player development aspects can be significantly improved or constrained. Consistent with previous studies (Katis & Kellis, 2009; Owen, Twist & Ford, 2004; Pill & Elliot, 2015; Small, 2006), the total number of tagged possession characteristics per player was greater in the 12 a/side games compared to the 15 a/side and 18 a/side games. There was a 30.6% increase of possession characteristics per player during the 12 a side SSGs with 12.4 per person per 24 minutes compared to the 8.60 per person per 24 minutes achieved during the 18 a/side game. This indicates that SSGs (where playing numbers are reduced) increases the number of participation per player, therefore allowing players to perform skills at a greater rate, which in turn accelerates their skill development compared to traditional 18 a/side format.

Kicking and handballing were found to have no significant difference between the total number of kicks and handballs within the 12, 15 and 18 a/side games. However, consistent with previous findings from Pill and Elliot (2015), the average number of possessions per player shows that 12 a/side AF elicits significantly more kicks (4.9 per player) and handballs (1.54 per player) than the 15 and 18 a/side format. This result

demonstrate that players are provided with more opportunities in the SSGs versions to obtain and distribute the ball, therefore allowing an increased level of engagement per player.

The results from this study also suggest that by decreasing the number of players on the field, the amount of marks per player may be more frequent. Players recorded 41% more marks per player in the 12 a/side modification compared to the 18 a/side games. This may be because the 12 a/side game constraints of keeping the playing area constant and reducing playing numbers resulted in increasing the playing space per person compared to the 18 a side format. Players have a larger proximity to each other in 12 a/side games which may result in more uncontested marking attempts and therefore greater opportunity to develop marking ability.

The finding also demonstrated that there was a decrease in the number of groundball pick-ups during 12 a side version compared to the larger numbered 15 and 18 a/side games. The efficiency of possessions, the amount of kicks kicked towards a contested situation and the increased congestion in the 18 a side games had a direct impact towards the higher number of groundball pick-ups in this game format. Pill and Elliott (2015) observed a similar finding and suggested that the high amount of groundball pick-ups was somewhat due to the player's inability to kick at the correct trajectory so that the ball would make the distance and accuracy to the intended target to be able to mark the ball when playing on the larger fields. Participants in the Pill and Elliott (2015) study were under 14's. At U10 level, the age level of participants in this study, this (in) ability to get a kick to the intended player when playing in the larger space, and thus with potentially greater distance between players, can reasonably be suggested and account for the differential in ground ball pick-ups between the game versions.

An unexpected finding of this study was the decrease in goal attempts during the smaller scaled 12 and 15 a/side games compared to the 18 a/side game. In contrast to previous studies involving AF and soccer (Katis & Kellis, 2009; Owen, Twist & Ford, 2004; Pill & Elliott, 2015; Small, 2006) that suggested decreasing the numbers in SSGs increased the amount of scoring attempts and goals, this study had the opposite finding. In this study, reducing the number of players resulted in the amount of goal attempts decreasing.

CONCLUSION

The AFL Match Policy emphasises that at U10s level and below, AF training and matches should focus on 'fundamental' game skills such as kicking, handballing, marking and gathering the ball. The findings in this study suggests that competitively engineering the game form in AF for reduced player numbers and smaller fields may enhance player development as each player has the potential for greater game engagement than in game forms with more players and on larger fields. Further research is still required to further develop our understanding of how SSGs can affect player development and participation in AF, specifically junior AF. Determining what task and player constraint for game formats that elicits the optimal number technical demands and ball contacts for player development and engagement and how SSGs can be used as an education tool is two important areas that should be further investigated. To date, there is only one previous study (Pill & Elliott, 2015) that investigated the effects of player constraints (number of players) and environment constraints (dimensions of the playing area) on player possession characteristics in junior AF.

As fun, enjoyment and perceived competence are key factors in youth retention in sports, it is recommended for future research to investigate the levels of enjoyment and perceived competence in children participating in AF SSG formats in training and match day. This will allow for further understanding of the benefit of scaled game forms in junior AF competitions and allows for player experiences to be a focus when competition engineering is

being investigated. We recommend that longitudinal case study that tracks possession characteristics, players' development, participation and experiences of competition engineering for a whole season is required to further advance the field of knowledge.

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SAŽETAK

Cilj ovog istraživanja bio je usporediti učinke mijenjanja broja igrača tokom ‘small sided games’ na igračku poziciju kod mlađih fudbalera (ispod 10 godina). Dvije modifikovane verzije strateške igre od 12 i 15 igrača koje su u skladu sa pravilima Australijske fudbalske lige (AFL) za juniore korištene su za upoređivanje sa uobičajenom formacijom od 18 igrača. Igračke pozicije su utvrđene upotrebom IPAD-a uz korištenje aplikacije Dartfish Easy Tag tokom 4 perioda igre od 24 minute za svaki format igre. Utvrđeno je da su dodatni igrači u formaciji od 18 u prosjeku učestvovali u više akcija, međutim, došlo je do smanjenja broja akcija po igraču u usporedbi sa formacijom od 12 i 15 igrača. Također je uočeno da su se igrači nalazili u boljim pozicijama za udaranje i bacanje po igraču tokom formacija sa 12 i 15 igrača. Rezultati sugerisu da je strateški formacija od 12 igrača prikladnija za djecu uzrasta do 10 godina od formacije sa 18 igrača, jer pruža igračima veću angažovanost, a time i potencijalno veći užitak, angažman i tehnički razvoj igre. Ovo jedinstveno pomaže napredovanju igrača, sticanju vještina i njihovom sudjelovanju u australskom fudbalu.

Ključne riječi: fudbal, strateška igra, juniori, sudjelovanje, angažman igrača

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Corresponding Author:

Dr Shane Pill

Flinders University, South Australia

GPO Box 2100

Adelaide, South Australia, 5001

shane.pill@flinders.edu.au

DEVELOPMENT OF SPORTS MANAGEMENT IN SERBIA AND MONTENEGRO THROUGH THE HISTORY OF THE OLYMPIC COMMITTEES OF THEIR COUNTRIES

RAZVOJ SPORTSKOG MENADŽMENTA U SRBIJI I CRNOJ GORI KROZ ISTORIJU OLIMPIJSKIH KOMITETA NJIHOVIH DRŽAVA

ABSTRACT

The subject of this research refers to development of management in sport throughout history of the Olympic Committee of Serbia and the Montenegrin Olympic Committee. Analysis of the work of the Olympic Committee of Serbia and the Montenegrin Olympic Committee and presentation of their structures, cooperation with international and national sports organisations, ways of encouragement of the world-class professional sport development, different in their duration but with common interweaving activities, definitely represented a research challenge. A very specific challenge is a common political past hence social patterns that are characteristic for both states. These patterns are still very present in everyday political life which indirectly influences the work of majority of national bodies including Olympic committees thus their organization and proper functioning. A very specific challenge is a common political past hence social patterns that are characteristic for both states. These patterns are still very present in everyday political life which indirectly influences the work of majority of national bodies including Olympic committees thus their organization and proper functioning. The aim of this research was to determine the importance of work of the Olympic Committee of Serbia and the Montenegrin Olympic Committee from the aspect of management. Development of management in sports throughout history on examples of the Olympic Committee of Serbia and the Montenegrin Olympic Committee was

**Violeta Šiljak¹, Dejan
Đurović², Rade Stefanović³
& Branimir Mekić³**

¹ Faculty of Sport and Physical Education, University of Belgrade, Serbia

² Faculty for Management in Sport, Alfa BK University, Belgrade, Serbia

³ Faculty of Sport and Physical Education, Leposavić, Serbia

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Corespondent:
Violeta Šiljak

Fakultet sporta i fizičkog vaspitanja,
Univerzitet u Beogradu
Blagoja Parovića 156
11030 Beograd, Srbija
violeta.siljak@fsfv.bg.ac.rs
vsiljak@yahoo.com

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defined by this scientific research. Its results point to the fact that degree of development of management in sports of the Olympic Committee of Serbia and the Montenegrin Olympic Committee was conditioned by length of their membership in the International Olympic Committee. Besides this, it was confirmed that the influence of technological, economic and political challenges for management of the Olympic Committee of Serbia and the Montenegrin Olympic Committee were the same; that carrying out the Olympic movement projects of different scopes as well as propagation of the Olympic values were equally present in the Olympic Committee of Serbia and the Montenegrin Olympic Committee. Importance of the research is reflected in academic and scientific perspective of work of the Olympic Committee of Serbia and the Montenegrin Olympic Committee. This survey will help future experts in sports organizations to apply their management in sport models successfully in their sports organizations.

Key words: history/ management/ National Olympic Committees /Serbia/ Montenegro

INTRODUCTION

In order to get reliable and valid results in this complex survey, it was necessary to analyse and get an overview, besides the previously mentioned activities of the two national committees, of the whole Olympic movement since its beginning to present days. Interweaving of historic facts and their influence on development of the Olympic movement and management of its umbrella organization are undeniable (Ilić & Mijatović, 2006). In order to fulfill the above mention research goals it was necessary to consult a very wide literature spectre including primarily the literature concerning the historical phenomena and as well management literature, specifically those focussing on the management of sport organizations¹.

Each sports organization is defined by its vision, mission, strategy, as well as by other development documents complied with European and the world development documents. The International Olympic Committee (IOC), as part of its mission and its role has the task to encourage cooperation, organization and development of sport and sports competitions. It was created with a clear goal to “.... encompasses organizations, athletes and other persons who agree to be guided by the principles of the Olympic Charter. Its composition and general organization are governed by Chapter 1 of the Charter” (<https://www.olympic.org/about-ioc-institution>). It is also very important to highlight the legal status of IOC which is defined within the Olympic charter as it follows “The IOC is an international non-governmental not-for-profit organization, of unlimited duration, in the form of an association with the status of a legal

¹ For more details, please see: Aćimović, D. (2007). *Menadžment u sportu*. Niš: Serbona; Gašović, M. (2009). *Marketing sportskih organizacija*. Beograd: Intermanet; Kastratović, E. (2004). *Osnove menadžmenta sa menadžmentom u sportu*. Beograd: Institut za razvoj malih i srednjih preduzeća doo; Kostadinović, S., Kostadinović, I. (2007). *Pravo i sport*. Beograd: Univerzitet Braća Karić; Tomić, M. (2007). *Sportski menadžment*. Beograd: Data Status i Živković, S. (2009). *Liderstvo u sportu*. Beograd: Fakultet za trgovinu i bankarstvo "Janićije i Danica Karić".

person, recognized by the Swiss Federal Council in accordance with an agreement entered into on 1 November 2000 In order to fulfill its mission and carry out its role, the IOC may establish, acquire or otherwise control other legal entities such as foundations or corporations” (Olympic charter, 2017).

Also, when speaking of national Olympic committees, the aforesaid Charter regulates their work along with the regulative of the state where the NOC is established and where it works. The mission of these bodies is to develop, promote and protect the Olympic movement (Olympic charter, 2017) along with other stipulations. It is important to mention the stipulation concerning exclusivity of NOC regarding the cooperation with IOC,².

However having in mind the turbulent history of the region and inter-state overlapping between the two states that once were federative republics in mutual SFRJ³, then equal partners in state federation of Serbia and Montenegro until the formation of separate political entities, also represents a significant factor in development of society at whole and development of sport in particular. Political legacy of former systems and regimes have changed from (semi)autoritary regime through transitional and post-transitional movement towards democracy that still, owing to still existing cultural patterns, cannot be comparable to Western democracies. This political legacy is even now directly impacting decision making, HR affairs and generally speaking, public policies. Politicl systems of Serbia and Montenegro that are aspiring toward modernization in compliance with EU standars, are still deeply founded in traditional political manners of political will and functioning. In other words, the democratic and professional maturity is yet to be achived and this is directly reflected upon managing national Olympic committees.

Throughout the whole period of IOC existence, whenever problems overgrew the existing organization which could not handle and solve them, there was a crisis of the organization and the total management; therefore, the International Olympic Committee was forced to find solutions to these problems.

Development of the International Olympic Committee led to more proportional representation and larger constitutional power of its members. Starting with 15 members who founded it in 1894 to 115 members only in the IOC Assembly and other numerous members of other IOC bodies and commissions, IOC has grown into the biggest sports organization in the world (Olympic charter, 2017). Successful IOC activities on realization of its projects related to the world peace and UN activities at whole having a status of permanent observer, education of young population, equal participation of women in each segment of the movement, founding of numerous commissions are facts which point to the significant influence which IOC has on global sport and global scenery in general (Van Luijk, 2018).

² For more details, please see Olympic charter, 2017.

³ Socialistic Federate Republic of Yugoslavia

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Human resources management through discovering and development of human potentials in organization of the Olympic Games, as well as managing changes originating from economic, political, social and technological factors, can be realized successfully due to high standards based on contemporary principles of management which IOC applies. Motivation for the leading position on the world stage of sports organizations is realized through team work where processes of control and measuring results of realization of activities are constant.

Geographic particularities, cultural and other aspects influence diversity in functional approach national Olympic committees have and which are different from one country to another. Serbia was admitted to the IOC in 1912 during the Fifth Olympic Games held in Stockholm. All activities of the world Olympic movement were stopped because of the First World War. Activities of the Serbian Olympic Committee were also slowed down because most of its members were Serbian army officers. The Sixth Olympic Games planned for Berlin in 1916 were not held and only after the end of the WW I Olympic activity was continued in all countries of the world.

In the Olympic Games held in Antwerp in 1920, Serbia participated as part of the newly formed Kingdom of Serbs, Croats and Slovenes. Montenegro joined Serbia before that by recognition of the Karađorđević dynasty instead of the Petrović dynasty for their sovereigns. Serbia and Montenegro were together in various forms of the common state from 1918 to 2006.

Methods of work of a sports organization is often conditioned by insufficient resources which asks for pragmatism in its modeling and management. Analysis of work and presentation of the organizational structure of the Olympic Committee of Serbia and the Montenegrin Olympic Committee, cooperation with international and national sports organization, ways of encouragement of the world-class sport are very important for perceiving them comprehensively.

METHODS

Historical method, causal-descriptive method and dialectical method were applied in this research survey. Historical analysis applied in this study was very important during conduction of the research in order to determine the course of work of the Olympic Committee of Serbia and the Montenegrin Olympic Committee.

DISCUSSION

In order to obtain appropriate interpretation of particular decisions made by management of the International Olympic Committee, it was necessary to research the ancient Games and then contemporary Olympic movement from its restoration/creation till present days, since contemporary Olympic movement is based on the principles of the Ancient Olympic Games.

The Ancient Olympic Games left their ethical principles as their legacy to be followed to some extent and the Olympic movement to be managed. In the time of globalization, it is not appropriate or scientifically justified to make literal or direct comparison between work of the

International Olympic Committee and the Olympic movement itself with the Ancient Olympic Games. Apart from competing for glory and not for material prizes, wars being stopped during the Games and establishing Panhellenic unity, women were not allowed to participate in the Ancient Olympic Games, the reason why Pierre de Coubertin was often criticized in scientific disputes since his idea was to establish modern Olympic Games on the same principle (Simonović, 2007).

Since its beginnings till today, the Olympic movement has had to follow and respond to a lot of political, economic, sociological, technological and other types of challenges and changes (Ilić, 2006). Successful work of the IOC on realisation of its projects related to the world peace, education of the young population, equal participation of women in every segment of the movement, founding of Commision for women, Commission for Sport for All, Sport and the Environment are facts which point to the significant influence IOC has on values of the Olympic movement (Šiljak and Đurović, 2017). Today, besides all athletes participating with equal rights, the Olympic movement has provided programmes of the Olympic solidarity, education, etc (Trkulja, 2008; Škaro, 2012). Boycotts of the Olympic Games, prohibition of participation of women and professional athletes are the problems which were overcome long time ago. Results of the research show that management of IOC as a sports organization which is in charge of this Movement aimed at realization of the goal of contribution to building-up of more peaceful and better world of education for young people through doing sports in accordance with the Olympic values (Binder, 2007). IOC has founded what we know today as the Olympic movement, through the revitalisation of Olympic games. During decades that have passed, this very idea was developing in every aspect, especially in organizational aspect becoming one of the greatest international sport organizations. It is likely that in the earliest period one cannot speak of management as we know it today but more of set of principles and rules that led to management procedures and processes. Proper management of the IOC improved sports and grew into an organization at the head of the Olympic movement, thus representing a model to all national Olympic committees.

A fact that then a twenty-year-old Serbian king was in Athens in 1896 played a very significant role in informing the public about sports competitions at the Olympic Games, which definitely would not have been described in the same way and in the same scope if young Serbian king had not attended. Newspaper articles following King Aleksandar's mission had a significant influence on introducing and accepting the idea of the Olympics and in that way on the emrgence of the Olympic movement in the Kingdom of Serbia, because they informed, introduced, made young people interested in the movement and in that way encouraged young people in Serbia to accept and further develop the Olympic idea (Šiljak, 2013). After change of dynasties, the Kingdom of Serbia dedicated itself to spreading the Olympic ideas more seriously and numerous competitions, with the adjective "Olympic" in their names, were organised. Svetomir Đukić, who is considered to be the founder of the Serbian Olympic movement, and his followers were dedicated to committed work on spreading the Olympic ideas through organization of

competitions and engagement of a large number of young people in sports. Serbia was admitted in the IOC in 1912 and Svetomir Đukić was admitted as a member of the IOC. Serbian membership in the IOC also enabled membership of the states later admitted in a newly-formed state of Yugoslavia, which they kept after breakup of Yugoslavia.

Formation of the Yugoslav Olympic Committee (council) in 1919 and its international recognition happened automatically by inheriting the Serbian Olympic Committee without separate procedure of election into membership of the International Olympic Committee. The Yugoslav Olympic Committee (YOC) worked until 2003 when it became the Olympic Committee of Serbia and Montenegro due to the breakup of the state. It became only National Olympic Committee of Serbia after disunion of Serbia and Montenegro in 2006 and now it is called the Olympic Committee of Serbia - OCS.

Organizational structure of the Olympic Committee of Serbia (OCS), its vision, mission and its strategy as well as other development documents are in accordance with organizational structure of the IOC and with documents of the Olympic movement. However, there are some differences. In order to get adequate presentation of the obtained results about the way the Olympic Committee of Serbia works, it was necessary to compare it with the way of work and organizational structure of the umbrella organization of the Olympic movement. Although IOC is an international sports organization which has global character whereas the Olympic Committee of Serbia is a national sports organization, it has to act in accordance with the Olympic Charter and follow and adjust its work with the IOC.

The ways of choosing the president and the members are similar, as well as summoning sessions and duration of some mandates. There is a difference about the age of members. The age limit for the IOC members elected after 1999 is 70, whereas there is no such limit in the OCS. There are 115 members in the IOC whereas it is unlimited.

The fact that already disputable presidential elections in the Olympic Committee of Serbia have been repeated twice suggests the need for closer monitoring and control. The first case was recorded in 2005. The other was the election of the last and current president. The Olympic Committee of Serbia should have elected its president according to the Statute in force until February 2017. However, there was a warning by the IOC to respect the OCS Statute (<http://www.novosti.rs/vesti/sport.297.html:635736-MOK-uputio-upozorenje-u-OKS-Strogo-postujte -Statut>). The event which followed was changing of the Statute articles (<http://www.oks.org.rs/skupstina-olimpijskog-komiteta-usvojila-izmene-i-dopune-statuta-oks/>). This event enabled repeat presidential elections resulting in election current president of the OCS on 9th May 2017 (<http://www.oks.org.rs/bozidar-maljkovic-novi-predsednik-oks/>).

Apart from this, mandate of the OCS general secretary is defined neither by the Statute nor by Rules of the Assembly Procedures, so that current the OCS general secretary has the third

mandate. This omission enables unlimited function which is simply inadmissible for any of the positions, especially for a national Olympic Committee⁴.

Number of commissions the OCS has is significantly smaller than in the IOC. Work of these commissions is not available to the public and there is no plan of activities or a report on their work. Article 12 of the OCS Statute defines work of National Olympic Academy within jurisdiction of the OCS executive council. However, the International Olympic Academy is a separate and independent body working on research and scientific work. This rises the question of whether it is possible that science and research in the area of Olympism are within jurisdiction of the OCS executive council. An interesting fact is that the OCS (16) has more executive council members than the IOC. (15).

As a difference from the IOC, the Olympic Committee of Serbia has supervisory board which has no real value since the IOC work is public through various documents and reports (reports of commissions, financial reports, etc.) whereas documents of the OCS available to the public are scarce and only the final report on realization of the programme for 2015, where it is possible to find part of the financial report, is available at the official site (<http://www.oks.org.rs/wp-content/uploads/Zavrsni-izvestaj-OKS-za-2015.pdf>). In the OCS there are no annual reports, marketing or other types of reports, for we cannot say a period of 105 years of its existence, but for the period from 2006 since it started working independently.

In 2017 the OCS formed the Commission for the Olympic values which used to be called Commission for the Olympic education. It was found out that except sporadically organized events of meeting schoolchildren population, there are no planned organized or implemented events or activities related to the Olympic education and Olympic values.

In the Olympic Committee of Serbia, Fund for Sport and Olympism deals with the issues of the Olympic education and the Olympic values. As an educational body of OCS, Fund for sport and Olympism, besides the museum, has educational programmes and the Youth Council of Serbia – commission for the youth. Activities of this Council, that is of Commission for the Youth, are not presented anywhere. Data about work of the Fund on the Olympic values can be found only in the news on the official site. It can be seen that meetings with children from primary schools are occasionally organized. The Fund organizes visits of the Olympic athletes to schools when pupils have “The Olympic Class“. Even though the Fond has published a rather fantastic book „The Olympic tale“ there was a lack of systematic approach in spreading and

⁴ For more details compare the Statute of the OCS with the IOC Statute. The OCS bodies are namely: the Assembly of the OCS, the Executive Committee OCS, the President of the OCS, the Supervisory Board of the OCS, the permanent sports arbitration of the OCS, which greatly reflects the organizational structure of the IOC, thus challenging the question of unlimited choices through the prism of the provisions of the IOC.

presenting the book before pupils in early grades which is a pity since the book was intended to them and future generations (Mitrović, 2011).

Olympic Committee of Serbia was one of initiators of starting a competition inspired by the Olympic games with the aim to promote mass sport development: Memorial athletic race "Svetomir Đukić", Memorial cycling race "Olympic trophy Svetomir Đukić" and Memorial athletic race "Dragutin Tomašević". Current programme of activities of OCS is: Development of winter sports Pyeongchang 2018 with the tendency to develop winter sports continually, Developmental programme for timely identification of the most talented young athletes, that is the need to provide optimal conditions for their development and the Olympic programme Tokyo 2020 with application and further development of a concept of direct funding of the best athletes and teams in Serbia.

Besides the previously mentioned programmes, the Olympic Committee of Serbia, following the pattern of IOC, created the programme "Career after Sport". This programme was created with the aim to offer help and advice to the athletes about how to achieve good results in other spheres of life besides the sports one and how to transfer themselves from the sports terrain to the business terrain.

Ten years of official existence of Montenegrin Olympic Committee (MOC) with participation in three Olympic Games leaves little space for research of history of this national Olympic committee. Since there is a lack of facts/results, data about medal winners presented on the official site of MOC probably tried to "fulfil" the missing history. There are names and surnames of athletes "gold medal winners from Montenegro" (<http://www.cok.me/olimpijske-igre/osvajaci-medalja-iz-crne-gore/>). Vagueness and incompletely explained listing of athletes can cause confusion and wrong interpretations by the wider public. Athletes who competed for FNRJ, SFRY, FRY, that is under the flag of the YOC (Yugoslav Olympic Committee), and who declared themselves as Serbian or Croatian citizens are on the list of this site because of their place of birth. If we bear in mind that most of the previously mentioned athletes are Serbian, what were the criteria for placing them on the list of medal winners from Montenegro?

The National Olympic Committee of Montenegro, as all other national Olympic committees has the obligation to work in accordance with the Olympic Charter. As part of the Olympic movement, management of this organization has to be adjusted with both sports policy in its own country and with the management of the International Olympic Committee as the umbrella organization of the Olympic movement.

However, besides realized and listed success, world-class sport in Montenegro is at the turning point for both its organizational improvement and systematic formation. Sport, especially world-class sport, encounters a large number of problems directly influencing not only its future development but also keeping the attained level of development. Problems in sport are different and they can be internal, specific only to a sports organization or external such as inadequate technical, infrastructural and financial conditions for achieving particular sports results. Budgets

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of national sports associations and sports clubs are a segment which defines aims and directions of their work to the largest extent.

When talking about the Olympic movement in Montenegro, Begović says that statistical position of Montenegro should be taken into account and that since it is a state with the population of fewer than a million people, sports activities should be led by state authorities but through decentralized units within national sports associations (2014). The principle of decentralization means that all people who do or play a sport actively – from athletes to sponsors should be engaged. Sport plays a very significant role in Montenegrin identity, especially at times when the economic crisis extremely widened the gap between classes with negative influence on socialization of the affected population. Due to these negative consequences, sports organizations had the tendency to follow the structure of other governmental organizations (Begović, 2014).

Montenegrin Olympic Committee is considered to be a young sports organization whose athletes have support for the approaching competitions within the Olympic family. However, other segments of work of the Montenegrin Olympic Committee, which every national committee should adjust with the International Olympic Committee to the largest possible extent, are humble. Of course, it should not be expected from any national Olympic committee, and also in that case not from the Montenegrin Olympic Committee, to have identical bodies as the International Olympic Committee.

A small number of available (or voted) documents within jurisdiction of the Montenegrin Olympic Committee, their organizational structure as well as the realized activities do not speak in favor of realization of programme activities of the Montenegrin Olympic Committee set up by the current president five years ago. Beside the Statute, the Montenegrin Olympic Committee also passed the following documents: Protocol about athlete of the year election, Protocol about categorization of athletes, Protocol about MOC arbitration work and Marketing strategy of MOC.

However, within the project “3,4, start” MOC has done certain program activities and along with other projects has created a position as a leader in strategic development of sports in Montenegro (<http://tricetirisad.me/kategorija/aktivnosti/>).

Beside marketing and promotional activites relating to Olympic games in Rio 2016 that were undertaken as „Olympic caravan Rio“ (that are almost identical and eponimus to activities of OCS, <http://www.oks.org.rs/sutra-na-100-dana-do-rija-olimpijski-karneval-u-centru-beograda/>) it can be noticed that attention is given to development of univeristy sport and development of mass, recreational sport activities where the MOC actually follows the ideological orientation of IOC.

Marketing strategy of MOC – positioning sport as an element of the national brand is a document which shows the future direction of MOC activities. Apart from this document, the public has no access to any other current project.

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It can be seen that planned programme tasks have not even been started for five years. Thus, for example, none of the bodies have been formed, that is commissions for the Olympic education, women and sport, sport and the environment, sports commission, etc.

The main problem of the Olympic movement in Montenegro is threatened position of the athletes (Begović, 2014). According to IOC recommendations given at the Congress in October 2009 “All athletes are at the heart of the Olympic movement. They are supported by extensive structures which include local clubs, National and International Federations and National Olympic Committees. [...] Athletes should be encouraged to take part in organization and development throughout 21st century.” (The Olympic Movement in Society, 2009).

The Olympic movement in Montenegro has neither formally nor informally organized institutions for protection of athletes which have the aim to keep them active after their sports careers. This is very important because, on one hand they could be a role model and what is even more important, it would decrease the possibility that a former athlete becomes a problematic member of the society.

Montenegrin Olympic movement is a state oriented system managed by private or politically eligible person and constellation in the NOC in Montenegro makes it very influential. The Statute of the Montenegrin NOC enables representatives of the associations to take positions in different commissions whether they have necessary prerequisites for them or not. Athletes should be involved in the whole process of making decisions. The role of athletes in the Olympic movement institutions: “Athletes must be included within the decision-making bodies of the Olympic movement through Athletes’ Commissions and other positions that carry full voting rights.” (The Olympic Movement in Society, 2009).

In the chapter with recommendations by IOC from the Congress in 2009 “Structure of the Olympic movement”, autonomy in sport is highlighted as a key segment with the aim to promote differences and peculiarities: “The relevant intergovernmental organisations and governments should acknowledge the necessary and essential autonomy of the Olympic Movement including, in particular, respect for and enforcement of the rules of good governance, equality and fairness in sport and sport administration, established by the Olympic Movement and set out in the Olympic Charter, to ensure the best and fairest possible practice of sport.... All constituents of the Olympic Movement should review their rules and activities to ensure that they fully comply with the Olympic Charter and the fundamental principles and values of Olympism.” (The Olympic Movement in Society, 2009).

Perception of autonomy within the Montenegrin Olympic Committee (mostly in the structure of NPRS) is usually misinterpreted as a term for a sovereign, especially about making strategic decisions about development of the sports system or development of a particular sport on one hand and the way of spending state funds (dedicated for athletes’ development) on the other hand (Begović, 2014).

The Montenegrin Olympic Committee has no working body dealing with the Olympic values. Occasional meetings of famous Olympic athletes of Montenegro with pupils can be seen in the news on the official site. This is definitely not enough to talk about work on spreading the Olympic education and the Olympic values.

One of positive initiatives is realization of the initiative to be the host of Games of the Small States of Europe. The Montenegrin Olympic Committee gave the initiative to be the organizer of 2019 Games of the Small States of Europe together with the elaboration on socio-financial justification of organizing 2019 Games of the Small States of Europe. Directorate for the youth and sport supported the initiative since organization of such a sports competition is a big sports event for Montenegro bearing in mind that this competition is especially appreciated in the world Olympic circles. This very principle is based upon the following text "*The importance of the event was highlighted by the presence of many sports and government authorities, including IOC president Thomas Bach, who in his address said: "These games confirm the power that sport has to unite all of us. In sport we are all equal; no matter who we are or from where we come. Sport always builds bridges. It never erects walls*" (<http://www.eurolympic.org/17th-san-marino-games-of-the-small-states-of-europe-open/>).

CONCLUSION

The Olympic Games today represent powerful and significant movement. Its importance could not have been predicted even by their founder. National Olympic committees of member states of the movement encountered factors which influenced their development in the same way the International Olympic Committee, which manages the Olympic movement, encountered the whole range of external factors influencing the Olympic movement and the whole organization and management of the international Olympic movement.

On basis of the research on management of the Olympic Committee of Serbia and the Montenegrin Olympic Committee as members of "the Olympic family" whose duty is to act in accordance with the Olympic Charter and other documents significant for the Olympic movement, it can be concluded to what extent these committees follow and fulfil requirements of contemporary Olympic movement. By analyzing facts the following can be noticed:

Establishment of the International Olympic Committee in Paris in 1894 opened a new phase in evolution of contemporary sport and in that way of management of the biggest sports organization in the world. Influence of the International Olympic Committee management and historical circumstances in our region enabled, through examples of development of management in sport throughout history of the Olympic Committee of Serbia and the Montenegrin Olympic Committee, better understanding of contemporary situation in national Olympic Committees of Serbia and Montenegro.

Nine decades of common work and activities of Serbia and Montenegro in all segments of life implied also the same technological, economic and political challenges they were facing

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within the common National Olympic Committee. Since their breakup, management of both National Olympic Committees has been still under the same or similar technological, economic and political influences. World globalization, and especially global approach of the IOC to all national Olympic committees additionally contribute to equalization of their work. The given facts imply that influence of technological, economic and political challenges on management of the Olympic Committee of Serbia and the Montenegrin Olympic Committee was the same.

Although longtime cooperative work within the YOC followed requirements of the Olympic movement, after breakup of the states, OCS and MOC have different approach to programme activities and projects.

Regular working bodies of OCS and MOC are different. Thus, within MOC there is no Commission for women and sport or Commission for the Olympic values in MOC, whereas they exist in OCS.

The Olympic Day of Running is organized by both OCS and MOC as well, which does not highlight direct similarity in their work since all national Olympic committees organize and celebrate it.

Management of IOC is insufficiently followed by managments of OCS and MOC. However, the data and facts we have presented show that conducting projects of the Olympic movement has different scopes within the Olympic Committee of Serbia and within the Montenegrin Olympic Committee.

The Olympic Committee of Serbia formally has a commission which deals with the issues of the Olympic values, whereas the Montenegrin Olympic Committee does not have this commission among its working bodies. However, since a form is not the essence of the problem, results of the research show that spreading of the Olympic values comes down to identical/similar meetings of the Olympic athletes with pupils. Thus, it can be concluded that spreading of the Olympic values is equally present within the Olympic Committee of Serbia and within the Montenegrin Olympic Committee.

Application of management concept in the Olympic Committee of Serbia and the Montenegrin Olympic Committee is different. Thanks to its longtime membership in the Olympic movement and the experience it gained, the Olympic Committee of Serbia follows global trend of the Olympic movement more than the Montenegrin Olympic Committee. Projects for development of sport, especially the project “Career after Sport”, then a large number of publications and published documents in comparison with the Montenegrin Olympic Committee confirm this difference in work between OCS and MOC. Commissions of the Executive Council are also different, MOC pays more attention to association of former Olympic athletes in comparison with the same body of OCS. There is also a difference in the scope of following social networks of these two national committees.

Results of the research of the Montenegrin Olympic committee work point to the fact that it is necessary to have its urgent reconstruction and application of contemporary management concepts. Besides this, activation of actions in accordance with the programmes of the Olympic movement and first of all with the promised programme activities of the president, could improve a current situation in MOC.

Organization of Games of the small states of Europe which will be held in Budva in 2019 can be seen as a starting point of contribution to further development of Montenegrin sport and Montenegrin society as a whole. Organization of Games of the Small States of Europe is an opportunity for promotion of Montenegro and its natural beauties and tourist potentials which is a step further towards growth of recognizable features of the state of Montenegro.

Bearing in mind the previously stated facts, the obtained results of the research show that a degree of development of management in sport of the Olympic Committee of Serbia and the Montenegrin Olympic Committee is caused by duration of their membership in the International Olympic Committee. This survey should point to further directions in the application of management in sport in leading national Olympic organizations of Serbia and in Montenegro. Results of the research should also help understanding the Olympic movement on a global plane in order to adapt it to global tendencies of the Olympic movement.

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SAŽETAK

Predmet ovog istraživanja se odnosi na razvoj menadžmenta u sportu kroz istoriju Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta. Analiza rada Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta i predstavljanje njihove organizacione strukture, saradnja sa međunarodnim i nacionalnim sportskim organizacijama, načini podsticanja razvoja vrhunskog sporta koji se razlikuju po dužini svog delovanja, ali koji imaju i prožimanje zajedničkog delovanja kroz dve države na našim prostorima, svakako je predstavljalo istraživački izazov. Poseban izazov jeste zajednička politička prošlost, odnosno društveni obrasci koji su karakteristični za obe države, a koji su i dalje prisutni u svakodnevnom političkom životu što neposredno utiče na rad većine nacionalnih tela pa tako i olimpijskih komiteta, odnosno na njihovu organizaciju i funkcionisanje. Cilj ovog istraživanja je bio da se utvrdi značaj rada Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta sa aspekta menadžmenta. Ovim naučnim istraživanjem utvrđen je razvoj menadžmenta u sportu kroz istoriju na primeru Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta. Rezultati istraživanja ukazuju da je stepen razvoja menadžmenta u sportu Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta uslovljen dužinom njihovog članstva u Međunarodnom olimpijskom komitetu. Pored toga, utvrđeno je da je uticaj tehnoloških, ekonomskih i političkih izazova za menadžment Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta bio identičan; da je sprovođenje projekata Olimpijskog pokreta različitog obima u Olimpijskom komitetu Srbije i Crnogorskom olimpijskom komitetu i da je širenje Olimpijskih vrednosti podjednako prisutno u Olimpijskom komitetu Srbije i Crnogorskom olimpijskom komitetu. Značaj istraživanja se ogleda u stručnom i naučnom sagledavanju rada Olimpijskog komiteta Srbije i Crnogorskog olimpijskog komiteta. Ovo istraživanje daje doprinos budućim stručnjacima sportskih organizacija da uspešno primene njihove modele menadžmenta u sportu u okviru svojih sportskih organizacija.

Ključne reči: istorija, menadžment, Nacionalni olimpijski komitet, Srbija, Crna Gora.

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Correspondence:

Violeta Šiljak

Faculty of Sport and Physical Education, University of Belgrade, Serbia

Blagoja Parovića 156

11030 Belgrade, Serbia

violeta.siljak@fsfv.bg.ac.rs

vsiljak@yahoo.com

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CONNECTION BETWEEN BODY POSTURE INDICATORS AND DOMINANT HAND WITH SCOLIOTIC BODY POSTURE IN HANDBALL PLAYERS

POVEZANOST IZMEĐU POKAZATELJA DRŽANJA TIJELA I DOMINANTNE RUKE SA SKOLIOTIČNIM TJELESNIM DRŽANJEM KOD RUKOMETĀŠA

Abstract

The modern way of life is the cause of the increasing occurrence of improper body posture in children and adolescents. In athletes, improper body posture can lead to numerous chronic health problems and injuries that affect their performance in sports. The handball game is characterized by dynamism and mobility, with constant and rapid changes of body positions and technique elements. Due to certain characteristics of handball as a sport (parts of the technique that are asymmetric due to playing with one hand) there is a reasonable doubt that handball players are exposed to factors that can cause a development of postural deformities. The aim of the study is to investigate whether scoliotic posture is a frequent occurrence in adolescents who train handball, and whether there is a correlation between the relevant indicators of improper body posture and the dominant hand with scoliotic body posture in handball players. The study was conducted on a sample of 98 adolescents aged 13-18 who had been involved in the training process for over three years and were tested with clinical Adams forward bend test. A posterior examination was used to determine the types of body posture. The sample of variables for the assessment of body posture contained numerical values of eight reference points in the posterior examination. To determine the differences between groups in variables of the questionnaire, and in determining the difference between the respondents in the variables obtained from the questionnaire, the Chi-square test was used, and a contingency table with frequencies and percentages was determined. A significant difference was found between right-sided and normal body posture, where right-sided posture subjects spent significantly more years training a handball compared to those with normal body posture, which suggests that this sport can be associated with the occurrence of a scoliotic posture.

Key words: *body posture, dominant hand, scoliotic posture, handball.*

Vedrana Grbavac¹, Martina Rezić², Ivana Čerkez Zovko²

¹*University Clinical Hospital in Mostar*

²*University of Mostar, Faculty of Natural Sciences, Mathematics and Educational Sciences*

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Correspondence:

Vedrana Grbavac

University Clinical Hospital in Mostar

vgrbavac01@gmail.com

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INTRODUCTION

The problem of today is hypokinesia (a state of reduced motion) that leads to uneven development of individual muscle groups. Neglected paramorphisms, especially during the developmental period, may lead to dysmorphisms that require long-term and painful treatment. Incorrect body postures resulting from the weakened structure of postural muscles that have been identified during growth and development, and especially those detected at an early age, can be corrected by additional physical exercise programs. Early, i.e. timely diagnosis is the most important element of successful treatment (Paušić, 2007). Although, generally speaking, it is clear that physical activity has multiple positive effects on certain organ systems and human organisms as a whole, however, doctors of sports medicine point to an increased incidence of improper posture and deformities in those who are actively involved in sports activities (Kosinac, 2002). Professional sport has its negativities, and most of these negativities can be reflected on the health of athletes.

Handball is a sport of complex polystructural movements in which there are a whole range of different moves (a step, a cross step ...), jumps (smash, block, shot ...), throws and falls (dive, rolling ...) static planks in positions, hits (Jankovic, Marelić and Jankovic, 2003). The technical elements of handball, which are asymmetrical due to one-handed performance, point to the likelihood that handball players are exposed to factors that may cause postural deformities. The asymmetric load in combination with a large number of jumps and landings on hard surfaces can have a very negative impact on the locomotor apparatus. Rapid growth in the adolescent growth momentum and the inability of the musculoskeletal system to overcome these sudden changes leads to irregular body postures (scoliosis, kyphosis, lordosis). Since irregular body postures can take on different forms, these forms are defined by various authors through the types of body postures (Aagaard and Jørgensen, 1996). The literature does not offer a large number of papers that investigate the scoliotic posture and its connection with sport, especially handball. The results of this research aim to show the special features of the handball and its connection with the scoliotic posture. The aim of the study is to investigate whether scoliosis is a frequent occurrence in adolescents who train handball, and whether there is a correlation between the relevant indicators of improper posture and the dominant hand with scoliotic body posture in handball players.

METHODS

The research was carried out on a sample of 98 male adolescents who practice handball in the handball club "MI Izvidjac" Ljubuski. All athletes aged 13-18, who had been involved in the training process for over three years, were tested with the clinical Adams forward bend test (Theologis, Fairbank, Turner-Smith, and Pantayopoulos, 1997). After a forward bend test, an estimate using a plummet was performed to estimate spine deviations in the frontal plane and anthropological measurements by which the data on the bilateral difference was obtained. A posterior examination was used to determine the types of body postures. The sample of variables for the assessment of body posture contains numerical values of eight reference points in the posterior examination (Pausic, 2007). Determination of body posture types was made using a plummet with the photographs of each respondent in order to obtain the most objective result.

Indicators of body posture in the posterior examination:

- PUHO - by placing markings on the upper edge of the left and right ear, one can determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters if the left side is lowered (-) if the left side is raised (+)
- PRAM - by setting markings to the highest top of the left and right shoulders: acromion, it is possible to determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters if the left side is lowered (-) if the left side is raised (+)
- PLOPG - by setting markings on the left and right angulus of superior blades, it is possible to determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters if the left side is lowered (-), if the left side is raised (+)
- PLOPD - by setting markings on the left and right angulus of inferior blades, it is possible to determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters, if the left side is lowered (-), if the left side is raised (+)
- PZDJ - by setting markings on the left and right spina illiacu superior posterior, it is possible to determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters, if the left side is lowered (-), if the left side is raised (+)
- PKOL - by setting markings on the left and right epicondylus medialis, it is possible to determine a deviation of the line connecting two markings from the horizontal in degrees and centimeters, if the left side is lowered (-), if the left side is raised (+)
- PNZG - by setting markings on the left and right malleolus medialis, it is possible to determine a deviation of the line that connects the two markings from the horizontal in degrees and centimeters, if the left side is lowered (-), if the left side is raised (+).
- PKRALJ - by setting markings to processus spinosus vertebrae, it is possible to determine a deviation of the line linking the vertebrae markings with the line of the plummet, if the spine deviation is to the left (-), if the spine deviation is to the right (+).

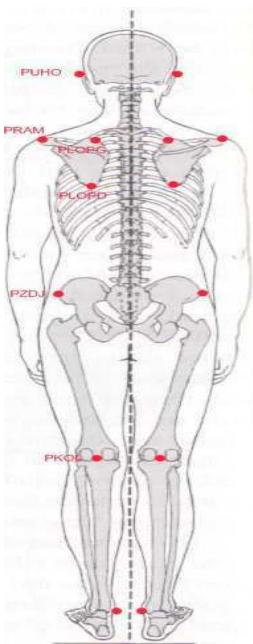


Figure 1 - Reference points in posterior examination of body posture (17)

Processing of data that was collected by the said experimental procedure was done for each class separately (by age), and all data was processed with Statistica 7 statistical set (StatSoft, USA), and SPSS 16 (USA).

K-means method of cluster (taxonomic) analysis (Hartigan, 1978) was used to determine the types of body postures, which is used to determine the number of groups of maximally different subjects, and by means of which using the analysis of the variance the differences between the groups in each indicator can be determined. This method allows defining a number of groups independently. The following parameters are used in this method: descriptive parameters: arithmetic mean (AS) and standard deviation (SD), variance analysis indicators (F - value, p - level of significance), number of respondents in each group, membership of the respondents to a particular group.

To determine the differences between groups in variables of the questionnaires, and in determining the difference between the respondents in the variables obtained from the questionnaire, a Chi-square test was used, and a contingency table with frequencies and percentages was determined.

RESULTS

In this chapter, the results of research work that correspond to the set goals are presented. Below is the data obtained by statistical processing. By means of analyzes, the respondents were divided into three groups based on the type of body posture that statistically significantly differed.

Table 2 - Body posture type

Type of body posture	Number of respondents	Percentage %
Left-sided scoliotic posture	16	16,3
Normal body posture	34	34,7
Right-sided scoliotic posture	48	49,0
Total	98	100

In the examined sample, respondents with right-sided scoliotic posture were the most present (χ^2 test=15,755; df=2; P<0,001).

Table 3 - Overview of right-handed and left-handed persons in relation to type of body posture

Dominant hand		Type of body posture			Total
		Left-sided	Normal	Right-sided	
Right	Count	12	31	46	89
	% within Type of posture	75,0%	91,2%	95,8%	90,8%
Left	Count	4	3	2	9
	% within Type of posture	25,0%	8,8%	4,2%	9,2%
Total	Count	16	34	48	98
	% within Type of posture	100,0%	100,0%	100,0%	100,0%

Respondents with the dominant right hand had significantly more often a right-handed scoliotic posture than those with dominant left hand (χ^2 test=6,253; df=2; P=0,044). Left-sided scoliotic posture was determined in 16 respondents, of which 12 (75.0%) were right-handed, 4 (25.0%) were left-handed. Normal body posture was shown by 34 subjects, of whom 31 (91.2%) had a dominant right hand, and 3 (8.8%) were left-handed respondents. Right-sided scoliotic posture was demonstrated in 48 respondents, consisting of 46 (95.8%) right-handed and 2 (4.2%) left-handed.

Table 11 - Overview of positions of players and the type of body posture

Player position		Type of posture			Total
		Left-sided	Normal	Right-sided	
Right back	Count % within	2	2	4	8
	Type of posture	12,6%	5,9%	8,4%	8,2%
Right wing	Count % within	5	3	3	11
	Type of posture	31,3%	8,8%	6,3%	10,2%
Goalkeeper	Count% within	0	6	9	15
	Type of posture	0,0%	17,6%	18,8%	15,3%
Left back	Count % within	1	5	4	10
	Type of posture	6,3%	14,7%	8,3%	10,2%
Left wing	Count % within	3	4	16	23
	Type of posture	18,8%	11,8%	33,3%	23,5%

Line player / Pivot	Count % within	4	9	8	21
	Type of posture	25,0%	26,5%	16,7%	22,4%
Centre back	Count % within	1	5	4	10
	Type of posture	6,3%	14,7%	8,3%	10,2%
Total	Count % within	16	34	48	98
	Type of posture	100,0%	100,0%	100,0%	100,0%

There was no significant difference in the ratio of the player position relative to the type of posture (Monte Carlo method, P = 0,192).

Table 13 - Overview of respondents' postures and years of handball training

	N	Mean	Std. Deviation	Minimum	Maximum
Left-sided	16	4,44	1,36	1	6
Normal	34	4,24	1,39	1	7
Right-sided	48	5,15	1,68	1	9
Total	98	4,71	1,58	1	9

The number of years of training differed significantly between the types of scoliotic posture ($F(2,97)=3,775$; $P=0,026$). Posthoc tests showed a significant difference between right-sided and normal posture (Posthoc Tukey test, $P = 0,026$), where subjects with right-sided scoliotic posture had spent significantly more years training handball compared to normal posture.

The mean value of training years was $4,71 \pm 1,5$ years. The minimum number of years of training was 3, and the maximum number of years of training was 9 years.

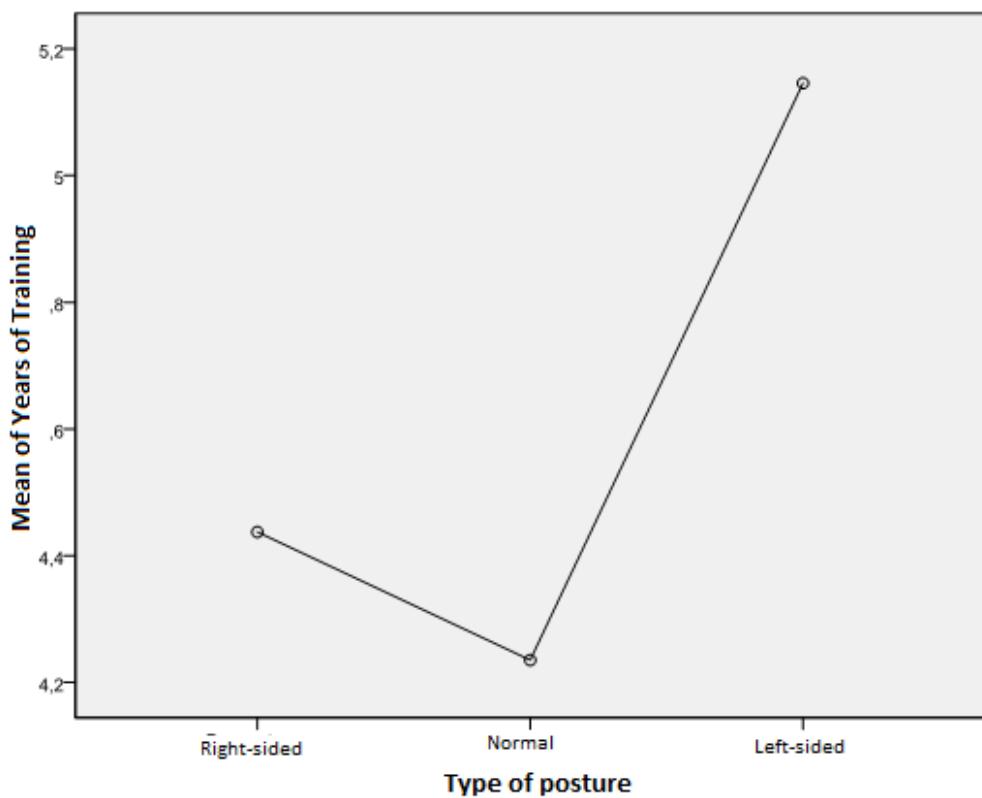


Figure 2 - Overview of respondents by type of posture and years of training

DISCUSSION

Dominant right-handed respondents had a significantly higher incidence of right-sided scoliotic posture than those with dominant left hand (χ^2 test=6,253; df=2; P=0,044). Left-sided scoliotic posture was found in 16 subjects, out of which 12 (75,00%) right-handed, 4 (25,0%) were left-handed. 34 respondents show normal body posture, of whom 31 (91,2%) are the dominant right-handed respondents, and 3 (8,8%) of the respondents with left hand. Right-sided scoliotic posture was proven in 48 respondents, 46 (95,8%) right-handed and 2 (4,2%) left-handed. The conclusion is that persons with a dominant right hand have significantly more frequent right-sided skolioic posture compared to those with dominant left hand, where this difference is not found to be statistically significant. In the general population, almost 90% of the people are right-handed (Incel, Ceceli, Durukan, Erdem and Yorgancioglu, 2002). Goldberg et al. (1990) found in right-handed respondents the connection between hand use and overcoming the right side of thoracic curve in adolescent idiopathic scoliosis. However, this connection was not confirmed in the left-handed children, it was found that the curvature direction of the spine in this group was randomly distributed. Hansgerd (1998) proved that sport in which specific stresses for the upper extremity are mostly single-sided, during growth can lead to changes in soft tissues and bones. The research conducted on professional tennis players showed hypertrophy of the upper arm bone on x-rays on the dominant hand, ie. the one that is more active in the sport. The difference in the cortical thickness of the bones of dominant and non-dominant hand is a response to exercise and increased physical effort (Jones, Priest, Hayes, Tichenor and Nagel, 1977).

The ratio of the type of body posture with a player's position in handball showed that the highest number of players with right-sided scoliotic posture was in the *left wing* position (33,3%) and the lowest at the right wing (6,3%). The position with the highest number of players with normal posture is the *pivot* (26,5%), and the lowest on the *right back* position (5,9%). The left-sided scoliotic posture is the most common among the players in the *right wing* position (31,3%), and not even one in the *goalkeeper* position. A statistically significant difference has not been demonstrated. Previous studies have shown that players in particular positions differ significantly from one another in some morphological parameters, particularly in body height and subcutaneous fat tissue (Chinn, Priest and Kent 1974; Hansgerd, Andreas, Gerd and Alfried-Krupp, 1998; Sporic, Čanaki and Barisic, 2007; Pieper, 1997). There were differences in body height between back and wing positions and the amount of body fat between the goalkeeper and other team players (Hansgerd, Andreas, Gerd and Alfried-Krupp, 1998; Pieper, 1997; Sporic, Čanaki and Barisic, 2007).

All of the above can be the reason for this distribution of body postures in the handball players. The study showed that the years of training were in a positive correlation with the length of the hand (Spearman's rho=0,288; P=0,004). The difference in the length of the arm was in a positive correlation with the difference in the length of the hand (Spearman's rho=0,317; P=0,001) as well as the difference in the upper arm circumference (Spearman's rho=0,304; P=0,002). The difference in the length of the hand was in a positive correlation with the difference in the upper arm circumference (Spearman's rho=0,523; P<0.001). Fingers are the smallest, lightest parts of the motor apparatus, therefore they are the parts that can easily divert power of a ball, but at the same time, controlling the ball over the fingers is especially important for the accuracy of the various shots in handball. Types of scoliotic posture vary considerably according to the years of training handball $F(2,97)=3,775$; $P=0,026$. The index of left and right arm symmetry in the observed sizes (arm length, hand length and upper arm circumference) did not prove to be a significant difference with regard to the types of body postures in the frontal plane.

CONCLUSION

In this research, it has been determined that the greatest number of players with a right-sided scoliotic posture is in the left wing position and the lowest in the right wing position, and that the pivot playing position is the position with the highest number of players with normal posture, and the right-back position with the lowest. It has also been found that left-sided scoliotic posture is most common among the players in the right wing position, and not even one in the goalkeeper position. There is a significant difference between right-sided and normal body posture, where right-sided posture respondents have spent significantly more time practicing handball compared to those with normal posture, suggesting that this sport can be associated with the appearance of a scoliotic posture.

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SAŽETAK

Suvremeni način života uzrok je sve veće pojave nepravilnih tjelesnih držanja kod djece i adolescenata. Kod sportaša nepravilna tjelesna držanja mogu izazvati brojne kronične zdravstvene probleme i ozljede koje utječu na njihovu uspješnost u sportu. Rukometnu igru karakterizira dinamičnost i pokretljivost, uz stalne i brze promjene položaja tijela i elemenata tehnike. Zbog određenih karakteristika rukometa kao sporta (dijelovi tehnike koji su asimetrični zbog igranja jednom rukom) postoji osnovana sumnja, da su rukometari izloženi faktorima koji mogu uzrokovati razvoj posturalnih deformiteta. Cilj istraživanja bio je ispiti je li skoliočno držanje česta pojava u adolescenata koji treniraju rukomet, te postoji li povezanost između relevantnih pokazatelja nepravilnog držanja i dominantne ruke sa skoliočnim tjelesnim držanjem kod rukometara. Istraživanje je provedeno na uzorku 98 adolescenata u dobi od 13-18 godina koji su uključeni u trenažni proces preko tri godine, a testirani su kliničkim Adamsovim testom pretklona. Za utvrđivanje tipova tjelesnog držanja primijenjen je posteriorni pregled. Uzorak varijabli za procjenu tjelesnog držanja sadržavao je numeričke vrijednosti osam referentnih točaka u posteriornom pregledu. Za utvrđivanje razlika između skupina u varijablama upitnika, te kod utvrđivanja razlike između ispitanika kod varijabli dobivenih iz upitnika, korišten je Hi kvadrat test, te je određena kontingencijska tablica s frekvencijama i postotcima. Ustanovljena je značajna razlika između desnostranog i normalnog tjelesnog držanja, gdje su ispitanici s desnostranim držanjem značajno više godina proveli trenirajući rukomet u odnosu na one sa normalnim držanjem, što navodi na zaključak kako ovaj sport može da se povezuje uz pojavu skoliočnog držanja.

Ključne riječi: držanje tijela, dominantna ruka, skoliočno držanje, rukomet

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Correspondence:
Vedrana Grbavac
University Clinical Hospital in Mostar
vgrbavac01@gmail.com

DESIGN OF THE AUDITORIUM IN SPORT FACILITIES

PROJEKTOVANjE GLEDALIŠTA U SPORTSKOM OBJEKTU

Duško Kuzović¹

¹*Dhofar University, College of Engineering,
Department of Architecture Engineering
Salalah, Sultanate of Oman*

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Corespondent author:
Assist. Prof.Dr. Duško Kuzović, dipl. eng.arch.
Faculty of Civil and Environmental Engineering
Dhofar University, Salalah, Sultanate of Oman
dusko.kuzovic@gmail.com
dkuzovic@du.edu.om

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Abstract

Auditorium is an important element for the correct perception of events in the sports field. Many elements influence the quality of the auditorium: the perception of the sports field, the maximum / minimum distance of the viewing, the speed and size of the ball, etc. The relationship between the theater and the sport field must be carefully established. It is necessary to prevent spectators entering in the field, and spectators injures. In practice, three forms of auditorium - sports field separation are applied: perimeter fence, trenches, change of floor level. Before the design process starts, it is necessary to define: the visibility of the sport field, the capacity of the auditorium, the minimum/maximum viewing distance, the type of seats, the level of seating comfort, the competition category seating standards, the structure of the seats, etc. The aim of the paper is to analyze the individual elements of the auditorium. The result of the work should increase the quality of design service, and satisfaction of the spectators of the sports facility.

Keywords: auditorium, perimeter fence, trenches, floor level change, visibility of a sports event, auditorium seats.

UVOD

Gledalište, pored sportskog terena, je najvažniji segment sportskog objekta. Od udobnosti gledališta zavisi stepen zadovoljstva posmatrača, i interakcija sa dešavanjima na sportskom borilištu. Stoga je pravilno projektovanje gledališta od primarne važnosti. Takođe, kod postojećih sportskih objekata provera postojećih rešenja može doneti saznanja koja će biti korisna na unapređenju kvaliteta sportskog objekta. Cilj rada je definisanje osnovnih elemenata gledališta u sportskom objektu, sagledavanje standarda za organizaciju, oblikovanje, veza, i strukture prostora. Takođe, cilj rada je da se specificiraju osobine koje mora da poseduje prostor gledališta. Rezultat rada treba da pomogne u vrednovanju novih i postojećih prostora u sportskom objektu, uočavanje nedostataka i neophodnih izmena.

Literaturu, korištena za ovaj rad, čine publikacije FIFA (FIFA, 2004; FIFA, 2011a; FIFA, 2011b), UEFA (UEFA, 2011a; UEFA, 2011b; UEFA, 2011c), OECD (OECD, 2011), specijalizovanih službi državnih administracija (Department for Culture, Media and Sport, 2008), kvalitetna publikacija o projektovanju sportskog objekta „*STADIA: A Design and Development Guide*“ Geraint, Sheard & Vickery (Geraint, Sheard i Vickery, 2007). Važne publikacije koje obrađuje navedenu temu je knjiga Rudolpha Ortner „*Sportbauten, Anlage-Bau-Ausstattung*“ (Ortner, 1956), potom knjiga „*Arhitekturnoe proektirovanie obyestvennykh zdaniy i sooruzhenii*“ iz Rusije (Rožin, Urbah, Adamovič, Barhin, Varežkin, Vinogradova, Gajnutdinov, Gnedorvskij, Golubev, Gusev V.V., Gusev N.M., Erofeeva N.M., Erofeeva N.N., Zmeul, Ionov, Krasil'nikov, Matveenko, Movčan, Obolenskiy, Ovsjanikov, Opočinskaya, Platonov, Popov, Rannev, Rožin, Satunc, Sergeev i Čitovič, 1985), zatim knjiga „*Sporski objekti*“ Slobodana Ilića (Ilić, 1998) i Miroslava Mitrovića „*Sportski objekti, Sadržaj i obeležja igre i sporta u stambenoj sredini i naselju*“ (Mitrović, 1983). Takođe, korisne informacije mogu da donesu i publikacije koje tretiraju bezbednost u sportskom objektu „*The facility manager's guide to environmental health and safety*“ Gallant (Gallant, 2008), i McGregor & Shiemi-Shin Then „*Facilities Management and the Business of Space*“ (McGregor i Shiemi-Shin, 2003).

DISKUSIJA

Kontrola kretanja posetilaca je jedan od glavnih zadataka osoblja koje upravlja sportskim objektom. Tom prilikom, pored jasno definisanih putanja kretanja, potrebno je predvideti ponašanje pojedinca ili grupe (u zavisnosti od događaja na terenu i oko terena). Pri tome treba imati u vidu da se ponašanje grupe može značajno razlikovati od ponašanja pojedinca koji formiraju grupu. Razlozi koji okupljaju pojedince da se udružuju u grupu kako bi posećivali sportski događaj su raznorodni i zavise od mnogo okolnosti. Veoma malo energije je potrebno da zajednica mirnih pojedinaca promeni ponašanje, formira grupu i postane generator problema u sportskom objektu. Stoga je proučavanje, stalni nadzor i rad na predviđanju ponašanja grupe od ključne važnosti za uspešnu realizaciju sportskog događaja koji uključuje i publiku. Ukoliko je ponašanje gledalaca suprotno kućnom redu u objektu potrebno je da osoblje brzo i precizno reaguje što podrazumeva jasne pravce delovanja, za koje je potrebno obezbediti prostor prilikom projektovanja. Potrebno je opominjati publiku da se ponaša u skladu sa pravilima kućnog reda, za šta su potrebna sredstva komunikacije. Iskustvo govori da ukoliko je objekat nov (ili nedavno renoviran) publika se ponaša više u skladu sa propisima. Ukoliko se na objektu previše jasno i uočljivo koriste rešenja kojim se sprečava vandalizam za očekivati je da se u publici javlja više vandalizma. Glavna intencija upravljanja ponašanjem publike u gledalištu je destimulacija izlaska na sportski teren; da se ponaša prema propisanom kućnom redu; da se spreči vandalizam na gledalištu. Ne treba izgubiti iz vida, publika je izvor značajnog dela dohotka. Prema istraživanjima u SAD 92% publike vrednuje način ponašanja osoblja prema njoj (Geraint, Sheard i Vickery, 2007). Publika je korisnik, a zadovoljnost korisnika, je važna kao i u drugim uslužnim delatnostima.

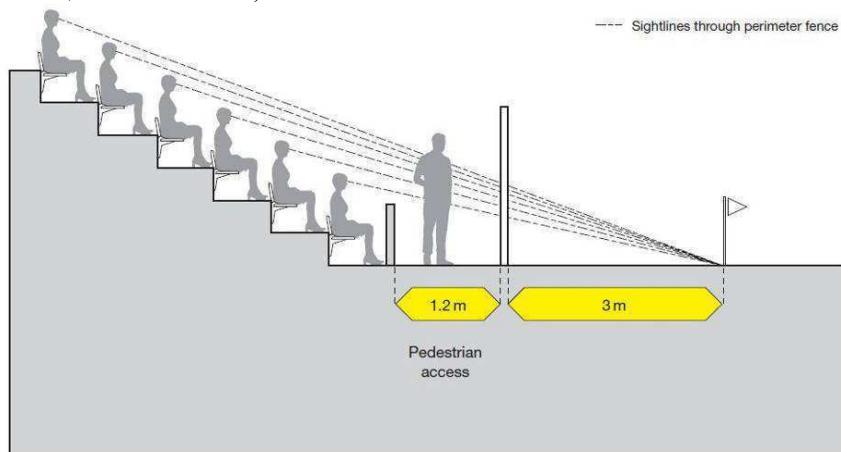
1. Gledalište – Sportski teren

Osnovna dva razloga, zbog kojih je potrebno razdvajanje gledališta od sportskog terena, su zaštita igrača i osoblja od nasilnih gledalaca i zaštita terena od oštećenja obućom i težinom. U

kritičnim situacijama, publika smatra slobodan sportski teren kao sigurno mesto kome teže svi koji se nalaze u publici. Masivna ograda je smetnja sagledavanju sportskog događaja. Potom, potencijali je izvor povreda koje nastupaju kod posetilaca pritisnutih uz ogradu (u slučaju panike). Stoga, lokacija i tip ograde mora biti pažljivo odabran, uz poštovanje sledećih faktora: ograda je potrebna u slučaju fudbalskog meča (manje u ostalim sportskim disciplinama na istom terenu), lokalni običaji na nekim mestima u Evropi zahtevaju da publika nosi na ramenima kapitena (isti praksa, na drugim mestima, je zabranjena). U praksi se primenjuju tri osnove tehnike razdvajanja gledalaca od sportskog terena: perimetarska ograda, rovovi i promena nivoa. (Geraint, Sheard i Vickery, 2007; UEFA, 2011; FIFA, 2011).

a. Perimetarska ograda

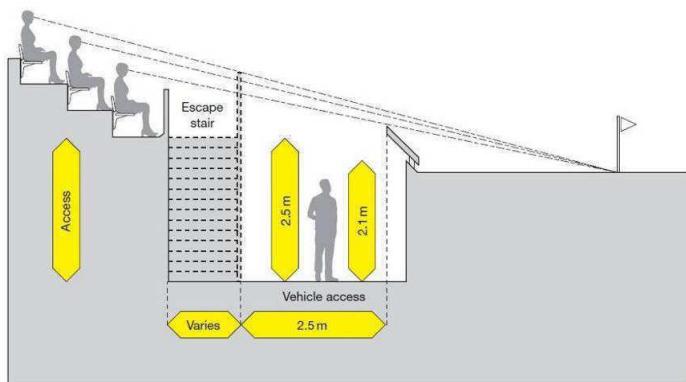
Preporuke FIFA i UEFA 2006. godine, govore da se mečevi najvišeg nivoa ne mogu igrati na terenima koji su ograđeni visokom ogradom. Ukoliko se planiraju, visoke ograde moraju imati izlaze za slučaj opasnosti. Preporuke „*Guide to Safety at Sports Grounds*“ (Department for Culture, Media and Sport, 2008) propisuju da, na novim terenima se ne praktikuje perimetarska ograda. Na objektima gde postoji ograda: ne sme biti viša od 2,2 metra; mora biti stabilna; mora biti u stanju da se suprotstavi pritisku grupe navijača; da sadrži ispuš širine 1,1 metar. Ograda mora biti tako oblikovana da na nju ne mogu navijači da se penju. Ograda mora biti takva da ne sprečava / ometa pogled na sportski teren. Na njoj mora biti izlaz za evakuaciju u pravcu sportskog terena (u formi kapije ili panela). Izlazi moraju da se otvaraju ili sklapaju. Broj i raspored otvora u ogradi se određuje prema broju gledalaca. Izlazi moraju biti jasno i vidljivo označeni. Na višenamenskim objektima ograda mora montažno-demontažna. Bez obzira na tip ograde, mora postojati stalni nadzor osoblja sportskog objekta. (FIFA, 2004; FIFA, 2011a; FIFA, 2011b; UEFA, 2011; UEFA 2011b).



Slika 01. Perimetarska ograda

2. Rovovi

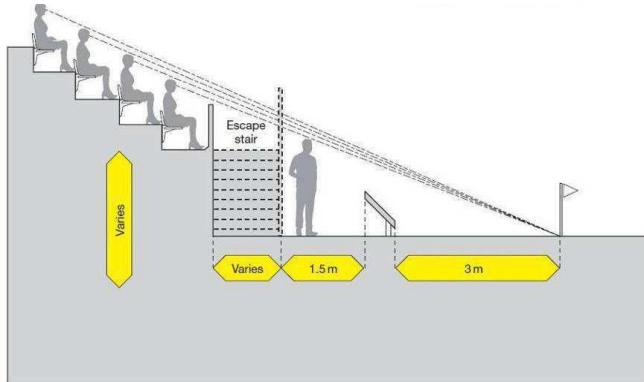
Rovovi su građevinske konstrukcije kojima se razdvaja gledalište od sportskog terena. Rovovi služe ujedno kao trasa za kretanje oko sportskog terena (za osoblje objekta i obezbeđenje, medicinsko osoblje, medije). Širina i visina rovova mora uskladiti sa potrebama navedenih grupa korisnika. Prema preporukama FIFA minimalna širina rova je 2,5 metara a dubina 3,0 metra. Nedostatak rovova je što povećava distancu između gledališta i sportskog terena. Stoga su rovovi pogodniji za velike stadione (na koje malo utiče širina rova od 2,5-3,0m). Rovovi moraju da imaju, na određenom razmaku, izlaze za evakuaciju u nivou poda. Rovovi ne smeju imati vodu po podu. U slučaju potrebe, radi pristupa vozila na sportski teren, moraju imati prelaz u vidu mosta (koji može da izdrži težinu i udar očekivanog tipa vozila). Potrebno je obezbediti pristup gledalaca rovu stepenicama i silazima odgovarajuće širine. Ukoliko se rovovi koriste kao mesto za deponovanje otpada prilikom čišćenja gledališta, moraju imati otvore u ogradi. Pristup rovovima (igrača, izvođača i policije) mora biti kroz tunele ili pokrivenе prolaze. Kiosci za prodaju mogu biti locirani i u rovu ukoliko ne sužavaju minimalnu širinu prolaza (Geraint, Sheard i Vickery, 2007).



Slika 02. Rovovi

3. Promena nivoa

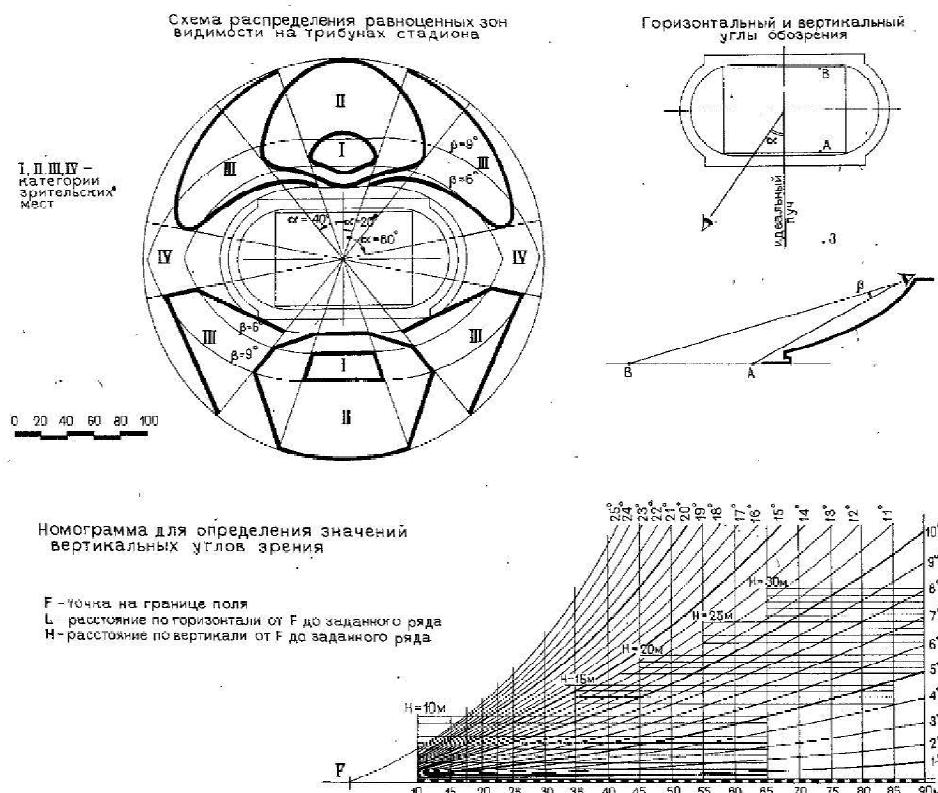
Promena nivoa poda je povišenje / sniženje poda između gledališta i sportskog terena (prema propisima i standardima). Promene visine poda su manje od dubine rova a manje od visine ograde. Realizuju se podizanjem prvog reda gledališta iznad terena, tako da prelazak na teren je težak ili nemoguć. Prednost ovakvog rešenja je u tome što akteri događaja na sportskom terenu, se mogu locirati pored ogradnog zida ne ometajući gledaoce. Međutim, promena nivoa poda je smetnja samo za malo motivisane gledaoce. Ako se očekuje pristojno ponašanje gledalaca promena nivoa poda je korisna. Uobičajena visina prvog reda (u odnosu na teren) je 1,5 do 2,0 metara. Na pomenutu visinu se dodaje još 1,0 metar visoka ograda. Podizanjem prvog reda u gledalištu postiže se bolja vidljivost (FIFA, 2004; FIFA, 2011a; FIFA, 2011b; UEFA, 2011; UEFA, 2011b).



Slika 03. Promena nivoa poda između gledališta i sportskog terena.

02. Gledalište

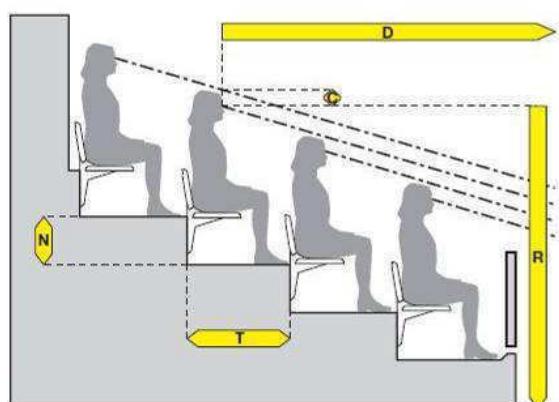
Osnovna obaveza osoblja koji upravlja sportskim objektom je da svim gledaocima omogući kvalitetan i jasan pregled dešavanja na sportskom terenu. Faktori koji utiču na kvalitet sagledavanja su: uočljivost centralnog predmeta sportskog takmičenja sa mesta u gledalištu, orientacija sportskog terena, veličina terena, veličina lopte, brzina kretanja lopte. Na osnovu navedenih činjenica se određuje maksimalna udaljenost gledaoca (da se pri tome ne ugrozi vidljivost i sagledljivost igre). Ovaj podatak određuje maksimalni kapacitet sportskog objekta. Povećanje kapaciteta sportskog objekta treba vršiti kada postoji puni dokazi da će se zadržati kvalitet sagledavanja gledalaca. Sportski objekat može da primi duplo više gledalaca ukoliko su tribine projektovane za stajanje (ne za sedenje). Za međunarodna takmičenja pravila zahtevaju isključivo sedeća mesta. Na donošenje odluke o povećanju broja mesta u gledalištu uticaj mogu imati: veličina gravitacione zone objekta, mogućnosti sponzora, istorija kluba, mogućnosti lokacije, kvalitet vizure novih mesta, pokrivenost krovom, estetski kvalitet objekta, troškovi izgradnje / rekonstrukcije, troškovi osoblja / obezbeđenja, mogućnosti infrastrukture, struktura sedišta (VIP, službenike, direktore, hendikepirane) itd.



Slika 04: Kategorije sagledljivosti pojedinih delova gledališta (prema Polikarpovu).

Kapacitet gledališta sportskog objekta zavisi od gravitacione zone. Što je brojnija gravitaciona zona objekta, razlozi za povećanje broja mesta za gledaoce su veći. Odluka o početnom broju gledalaca treba da bude doneta na osnovu umerenih procena. Takođe, planirati mogućnost da se broj gledalaca povećava (kroz dogradnju / proširenje). Proširenje može biti jednokratno ili u više faza.

Distance za sagledavanje su maksimalne udaljenosti sa kojih se nesmetano uočava centralni predmet sportskog događaja. Zasnivaju su na biološkim karakteristikama ljudskog oka. Ljudsko oko veoma teško uočava predmete koji su van ugla od 0,4 stepena. Ukoliko se premet koji se posmatra kreće brzo, sagledavanje se otežava. Na taj način se dolazi do proračuna da maksimalna udaljenost koja garantuje vidljivost predmeta koji je 250 mm u prečniku (fudbalska lopta) iznosi 150 metara, apsolutni maksimum je 190 metara. Za tenis (prečnik lopte 75 mm) maksimalna distanca iznosi 30 metara (BS EN 13200- 2003 Spectator facilities – Part 1: Layout criteria for spectator viewing area – specification). Uobičajeno rešenje (za fudbal) se zasniva kroz formiranje kružnice prečnika 90 metara koja ima središte u centru sportskog terena (linije pretpostavljene optimalne vidljivosti za gledaoca). Tačka fokusa je tačka u nivou poda sportskog terena u odnosu na koju se određuje sagledljivost sa gledališta. Kod višefunkcionalnih objekata (gde se koriste lopte različitog prečnika) maksimalna vidljivost se menja, što utiče na geometriju gledališta. Takođe, pomenuta dimenzija 90 metara se zasniva na horizontalnoj projekciji. Međutim, gledaoci sede na tribinama koje se postepeno uzdižu od nivoa terena (do 20 metara), čime se udaljenost od fokusne tačke postepeno povećava. Pomenuto udaljenje treba uzeti u obzir prilikom procene sagledljivosti sa određene tačke (Grupa autora, 1985). Posebnu pažnju treba posvetiti rešenju uglova gledališta. Isključenje ove zone iz gledališta donosi jevtiniju izgradnju, bolje provetrvanje sportskog terena, i isključuje za gledaoce najmanje vrednovanu lokaciju.



Slika 05. Sagledljivost sportskog terena

Sedišta zahtevaju pažljivo oblikovanje. Osnovni preduslovi su: da je gledalište dovoljnog kapaciteta, gledaoci su blizu prostoru aktivnosti najviše moguće, najveći broj gledalaca bira mesta koja preferiraju (u odnosu na sportski teren). Na osnovu navedenog se formira „linija vidljivosti“. Linija se zasniva na mogućnosti da gledalac komotno vidi najbližu tačku od interesa na sportskom terenu - „tačku fokusa“. Matematički ovaj odnos se izražava na sledeći način:

$$N = [(R+C) * (D+T) / D] - R$$

gde je:

N – korak uzdizanja

R – visina između oka na tački fokusa na sportskom terenu

D – distanca od oka do tačke fokusa na sportskom terenu

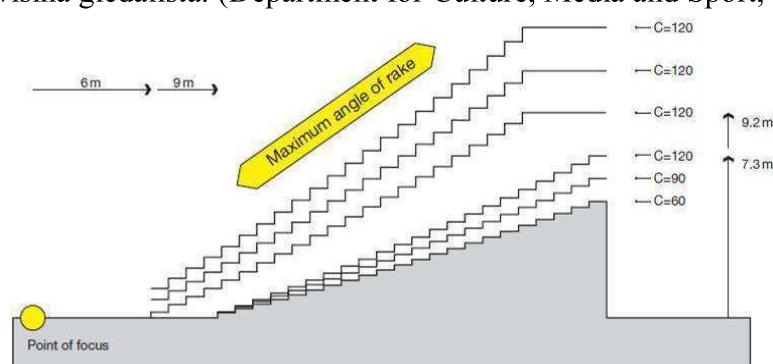
C – „C“ vrednost (150 mm za gledaoce sa šeširom, 120 mm za stajaće mesto sa dobrom vidljivosti, 90 mm gledalac sa glavom nagnutom unazad, 60 mm između glava gledalac u redu).

T – dubina reda sa sedištima

Za gledaoca sa hendikepom odnos u formuli se menja (u skladu sa preporukama). U praksi se projektuju posebne platforme za ovu vrstu gledalaca (UEFA, 2011c). Preporuke za projektovanje gledališta: (BS EN 13200- 2003)

1. Definisati tačku fokusa na sportskom terenu (tačka koja ima najmajnje uslove za sagledavanje).
2. Opredeliti vrednost koeficijenta „C“ (60 - 150 mm).
3. Opredeliti udaljenost između prvog reda sedišta i tačke fokusa.
4. Opredeliti visinu prvog reda sedišta u odnosu na sportski teren (ne manja od 80 cm).

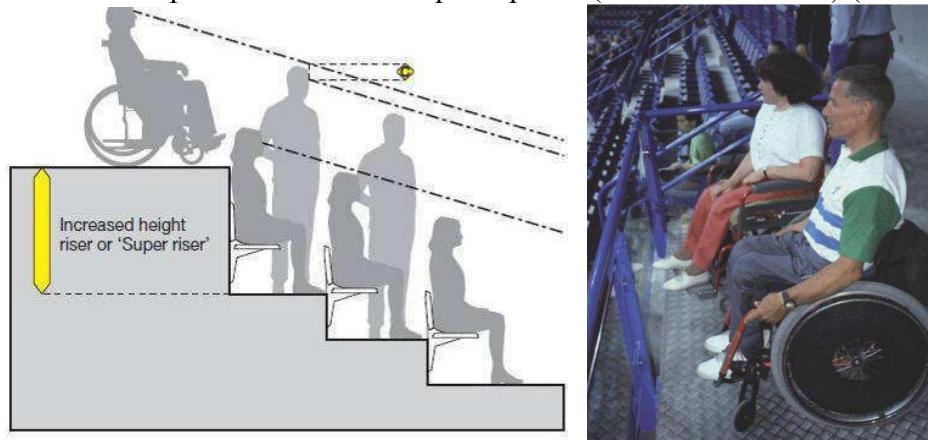
Nagib gledališta se može kretati od 34° (maksimalno) stepena pa naniže. Posledica izbora ugla gledališta je visina gledališta. (Department for Culture, Media and Sport, 2008).



Slika 06: Analiza promene nagiba gledališta

Zadovoljstvo gledalaca gledalištem se može analizirati kroz četiri elementa: komfor, bezbednost, robustnost i ekonomija (Geraint, Sheard i Vickery, 2007). Komfor zavisi od dužine sedenja gladaoca u sedištu (zavisi od vrste sporta). Komfor je jedna od najskupljih kategorija ali i glavna sila koja privlači gledaoce. Bezbednost treba posmatrati sa stanovišta kontrole gledalaca, rešenja kojima se olakšava kretanje službi (policije, Hitne pomoći, obezbeđenja, servisnih službi, osoblja objekta), vrste materijala sedišta (bezbednost od požara, vandalizma). Materijal za sedišta mora biti otporan na vremenske uslove, robustan i udoban. Najpopularniji materijal je polipropilen, polietilen, najlon, PVC ili armirana providna plastika. Zbog opasnosti

od vandalizma sve se više koriste držači sedišta načinjeni od plastičnih materijala. Sedišta moraju biti jednostavna za čišćenje a učvršćivanje mora biti robustno. Očekivani vek upotrebe ovakvih sedišta je do 20 godina. Savremena sedišta (u pojedinim zonama gledališta sportskog objekta) treba da imaju držače za čašu / program / dvogled. Pojedina sedišta imaju mobilne komunikacione uređaje kojima se naručuje posluženje. Sedišta za gledaoce sa hendikepom zavise od lokacije u gledalištu. Broj sedišta zavisi od ukupnog broja mesta u sportskom objektu. Lokacija mesta za hendikepirana lica mora biti pristupačna (od ulaza do mesta) (UEFA, 2011c).



Slika 07. Gledalište sa platformom za hendikepirana lica.

Ekonomija (konstrukcije i materijal sedišta) zavisi od budžeta investitora. Može se kretati od jevtinih materijala poput drveta do savremenih rešenja (nesklapajuća/ sklapajuća sedišta). Sedišta mogu biti ugrađena kao grupe ili kao pojedinačna. Dubina redova sedišta se kreću od 700 - 800 mm. Ukoliko sedište ima naslon širina je 500 mm, bez naslona za ruke je 460 mm. Preporuke definišu širinu sedišta od 500 mm kao minimalno za kvalitetno sedenje (BS EN 13200-2003). Struktura sedišta zavisi od vrste sporta i ekonomске strukture gledalaca. Sportski objekti sa širokim dijapazonom usluga su pogodniji za višenamenske sadržaje. Struktura sedišta u gledalištu je data u Tabeli 1 (Geraint, Sheard i Vickery, 2007).

Tabela 01. Struktura sedišta u gledalištu fudbalskog stadiona

Privatna sedišta	Privatni prostor sa mogućnošću ručavanja i bara	1-2% gledalaca 10 do 20 gledalaca u boksu 3 godine ugovor
Izvršna sedišta	Grupe sa delećim barom	1-2% gledalaca 4 do 20 gledalaca u boksu
Klupska sedišta	Grupno sedenje sa deljenjem bara	1-3 godine ugovor 1-2% gledalaca stolovi sa 2 do 6 osoba
Članovi – sedenje i obedovanje	Grupno sedenje sa deljenjem bara i obedovanja	1-2% gledalaca sezonska karta
Članovi – sedenje	Grupno sedenje sa deljenjem bara	2-5% gledalaca sezonska karta
Javno sedenje	Sedišta sa javnim barom	50% gledalaca karte za meč ili sezonom
Generalno – sedenje	Sedenje na klupi sa javnim barom	5-15% gledalaca karte za meč ili sezonom
Teniski boksovi	Grupe 8-12 sedišta	Opremljeni sa hladnjakom i osveženjem
Terase za stajanje	Prostori za stajanje sa javnim servisom	5-15% gledalaca karte za meč ili sezonom

ZAKLJUČAK

Gledališta je važan element za pravilnu percepciju sportskog događaja. Zadovoljstvo gledalištem je osnovno merilo prilikom vrednovanja sportskog objekta. Projektovanje novog ili rekonstrukcija postojećeg gledališta se mora zasnivati na sledećim analizama: sagledljivost sportskog terena, veličina i brzina kretanja lopte, maksimalne / minimalne distance za sagledavanje, itd. Odnos između gledaišta i sportskog terna mora biti pažljivo uspostavljen. Potrebno je sprečiti ulazak gledalaca na teren i, povređivanje gledalaca usled izbora tipa ograde. U praksi se primenjuju sledeći oblici razdvajanja gledališta od sportskog terena: Perimetarska ograda, Rovovi, Promena nivoa poda. Prilikom projekovanja gledališta potrebno je definisati sledeće elemente: sagledljivost sportskog terena, kapacitet terena, distance za sagledavanje, tip sedišta za posetioce, stepen komfora sedenja gledalaca, standarde sedišta za adekvatnu kategoriju takmičenja, strukturu sedišta, itd. Pravilnim razumevanjem uloge pojedinih elemenata gledališta postiže se bolji kvalitet projekta i povećava zadovoljstvo gledalaca.

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Abstrakt: Gledališta je važan element za pravilnu percepciju događaja na sportskom terenu. Veliki broj elemenata utiču na kvalitet gledališta: sagledljivost sportskog terena, maksimalne/minimalne distance sagledavanja, brzina i veličina lopte, itd. Odnos između gledališta i sportskog terena mora biti pažljivo uspostavljen. Potrebno je spreciti ulazak gledalaca na teren, i povređivanje gledalaca. U praksi se primenjuju tri oblika razdvajanja gledališta od sportskog terena: Perimetarska ograda, Rovovi, Promena nivoa poda. Prilikom projektovanja gledališta potrebno je definisati: sagledljivost sportskog terena, kapacitet, distance za sagledavanje, tip sedišta, stepen komfora sedenja, standarde za kategoriju takmičenja, strukturu sedišta, itd. Cilj rada je analiza pojedinih elemenata gledališta. Rezultat rada treba da pomogne povećanju kvaliteta usluge, i zadovoljstva gledalaca sportskog objekta.

Ključne reči: gledalište, perimetarska ograda, rovovi, promena nivoa poda, sagledljivost sportskog događaja, sedišta u gledalištu.

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Corespondent author:
Assist. Prof.Dr. Duško Kuzović, dipl. eng.arch.
Faculty of Civil and Environmental Engineering
Dhofar University, Salalah, Sultanate of Oman
dusko.kuzovic@gmail.com
dkuzovic@du.edu.om

BUOY AS A TOOL IN TEACHING BASIC ELEMENTS OF SAILING

PLUTAČA KAO POMAGALO U PODUCI OSNOVNIH ELEMENATA JEDRENJA

**Nikola Prlenda¹,
Ivan Oreb¹ & Danijela Vujčić¹**

¹*Faculty of Kinesiology University of Zagreb, Zagreb, Croatia*

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Correspondence:
Danijela Vujčić, prof.,
postgraduate doctoral student
danijela.vujcic@kif.hr
danijelakostanic@gmail.com

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SUMMARY

The aim of the research is to determine efficiency of buoys as a methodic tool in teaching and learning of basic elements of sailing. Analyzed sailing elements were heading up, tacking, bearing away and jibing on three different sailing positions (helm, main sail and jib). The research was carried out on the sample of 178 Kinesiology faculty students, divided into two groups (control group and experimental group). The experimental group examinees were subjected to teaching using various buoy ranges, while control group examinees were subjected to classic teaching methods (without buoy range). The teaching process was carried out during seven days period on Elan 19 sailboats. Teaching and evaluation of sailing elements was conducted by teachers with long experience in teaching of sailing. By means of descriptive statistics the difference in amount of acquired knowledge using two different models of teaching of sailing skills was determined. The results of descriptive statistics show higher score for examinees of experimental group in almost all elements of sailing technique, except in element tacking-jib. One-way analysis of variance showed that those differences are significant on the position helmsman in elements heading up, bearing away and jibbing, on the position mainsail, in the element heading up and also on the jib position, element heading up. Through further analysis, a discriminant analysis confirmed significant difference in the amount of acquired knowledge of sailing technique between two analyzed groups ($\chi^2 = 47,73$, $p = 0,00$). Finally, the authors conclude that buoy range had significant influence on the amount of acquired knowledge of sailing skills.

Key words: buoy range, teaching methods, sailor, sailing school, beginner

INTRODUCTION

In the last two decades interest in sailing and its popularity are constantly increasing (Neville & Folland, 2009; Having et al, 2013), resulting today in the existence of hundreds of sailing classes (Allen & De Jong, 2006), and in over 16 million people enjoying sailing (Neville & Folland, 2009) in both recreational and competitive way. Constant development of nautical tourism in the world, opening of numerous sailing schools, and organizing of more and more big sailing competitions demand professional staff in sailing ever growing in number and quality. Furthermore, increasing tempo of life is causing that guests stay for a shorter period of time, so it is necessary to adjust sailing school programs to their needs as well. These are exactly the reasons why it is expected of buoy range to speed up, and with it to improve the quality of teaching. Today, buoy range is everyday tool in teaching of recreationalists, competitors, children etc. Oreb (2000) speaks of „buoy corridor“ as a tool that, from the organizational aspect, enables extraordinary control of a sailor, spatial definition and awareness, sureness in moving himself and moving among other sailboats. Also, from the methodic aspect, buoys are represented as a landmark by means of which sailor is able to comprehend, experience and carry out elements such as heading up, tacking, bearing away and jibing. Besides, Oreb concludes that such ranges are satisfying considering game playing, situational behavior and technique mastering. White & Wells (1995) bring a series of examples of ranges as possible means in teaching of competitors. When speaking about buoy range, it is not hard to recognize many advantages that such kind of tool, or playground, brings into teaching of sailing skills. Nevertheless, in praxis some issues arise questioning actual profitability of buoy range. In that matter, there is an obvious problem of time necessary to install such a range, especially in areas where the depth of the sea is often up to 150 meters. These were the problems that induced the authors to carry out the research in order to find out when and to which extent exactly do buoy ranges contribute to acquiring of sailing skills.

METHODS

The research was conducted on the sample of 178 Kinesiology faculty students, that were divided into control ($n = 86$) and experimental ($n = 92$) group by random selection. The main condition examinees should fulfill to enter examinee specimen is that they have never been sailing. To determine the level of acquired mastering of sailing skills, four main

technique elements were selected (heading up, tacking, bearing away and jibing) on three working positions (helm, main sail, jib) on the Elan 19 sailboat.

Elements were evaluated on the basis of video footage used to document demonstration of mentioned elements by examinees. The evaluation of learned specific motor knowledge in sailing domain was carried out by three educated reviewers with long experience in sailing skills evaluation. The reviewers were instructed beforehand on criteria of assessing of every element. All reviewers made their evaluation simultaneously and independently. Sailing knowledge in this research was evaluated through scores ranging from 1-5, and the results of evaluation were expressed through five-point Likert scale, which ranks as ordinal measurement scale (Mejovšek, 2003 according to Supek, 1981). Elements learned by the examinees are part of the every sailing school training in the world, and are taught as a part of the regular curriculum in the Kinesiology faculty of the University in Zagreb. With the aim of conducting of planned research, an experiment was carried out in duration of four weeks, while the process of teaching individual student lasted for seven days (Table 1). Examinees of experimental group were subjected to teaching by means of different buoy ranges, while examinees of control group were submitted to classical teaching methods (without buoy range). Very important factor in the research conduction was choosing of examinees with the same sailing experience, and also ensuring the equal conditions during the training. The training and knowledge evaluation of all the examinees took place on the same type of sailboat (Elan 19), in the same waters. All examinees had optimal wind conditions (between 4 and 6 knots), and calm to slightly rough sea.

Table 1 Sailing technique elements teaching and training plan

Teaching course	Distribution of sailing technique elements by days	
	Experimental group	Control group
1st day	Basic information on the sailboat and the equipment	Basic information on the sailboat and the equipment
	Sailing positions and moving on the boat	Sailing positions and moving on the boat
	Sail raising	Sail raising
2nd day	Sail adjusting	Crosswind sailing

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	Crosswind sailing in buoy range	Sail adjusting
3rd day	Heading up	Heading up
	Bearing away	
	Heading up and bearing away in buoy range	
4th day	Maximum heading up	Maximum heading up
	Maximum bearing away	
	Maximum heading up and bearing away in buoy range	
5th day	Tacking	Tacking
	Tacking in buoy range	
6th day	Jibing	Jibing
	Jibing in buoy range	
7th day	Repetition	Repetition
	Assessment	

All the data obtained were processed by statistic package for data processing „Statistica 8“. For every group (experimental and control) basic statistical elements were calculated individually: arithmetic mean and standard deviation. By means of discriminant analysis the existence of significant difference was determined between experimental and control group when applying different methodic procedures in teaching and training of sailing technique elements. Also, applying one-way analysis of variance (Anova) significant difference was determined between experimental and control group for every criterion variable individually.

RESULTS

As described before, three reviewers were assessing the amount of knowledge acquired by students on twelve sailing technique elements. Their objectivity was determined through correlation between given scores on individual technique element (from $r=64$ to $r=94$), and using factor analysis it was determined that their object of assessment is highly

concordant meaning that they observe and assess the same thing, enabling applying of the mean score by three reviewers for the individual technique element in the further research.

In Table 2 the results of descriptive statistics are shown (arithmetic mean and standard deviation) for both groups of examinees and also results of one-way analysis of variance.

Table 2 Descriptive indicators for both examinee group and results of one-way analysis of variance

Sailing elements	Experimental group (buoy range)		Control group		ANOVA	
	M	SD	M	SD	F	p
Heading up-helm (HH)	3,77	0,79	3,40	0,70	10,61	0,00
Heading up-mainsail (HM)	3,87	0,72	3,48	0,61	14,89	0,00
Heading up-jib (HJ)	3,69	0,67	3,46	0,72	5,07	0,03
Tacking- helm (TH)	3,59	0,76	3,39	0,87	2,65	0,11
Tacking - mainsail (TM)	3,73	0,73	3,63	0,71	0,87	0,35
Tacking - jib (TJ)	3,57	0,77	3,63	0,74	0,27	0,60
Bearing away- helm (BH)	3,67	0,69	3,39	0,67	7,65	0,01
Bearing away - mainsail (BM)	3,74	0,69	3,61	0,71	1,44	0,23
Bearing away - jib (BJ)	3,60	0,64	3,50	0,68	1,15	0,28
Jibing- helm (JH)	3,65	0,75	3,31	0,77	8,94	0,00
Jibing - mainsail (JM)	3,66	0,80	3,50	0,66	2,29	0,13
Jibing - jib (JJ)	3,58	0,65	3,57	0,70	0,02	0,89

It is evident that arithmetic means of scores for examinees are higher for experimental group examinees in all elements of sailing technique except in element tacking-jib. In experimental group the lowest scores were achieved in elements tacking and jibing on jib position (3,57 and 3,58), and highest mean scores were achieved on element heading up, on main sail and helm position (3.87, 3.77), while situation was reversed for control group, meaning that the lowest scores were given on helm position for every sailing element (JH-3,31, BH-3,39, TH-3,39, HH-3,40,) and higher average scores were achieved on jib and mainsail position (TM-3,63 and TJ-3,63).

The biggest differences in arithmetic means were for elements heading up- main sail (0.39), heading up – helm (0.37) and jibing – helm (0, 34), while differences are the smallest in jibing - jib(0.01), tacking - jib (-0. 06) and bearing away - jib (0. 10).

Results of one-way analysis of variance show the existence of significant difference in models applied, on the helmsman position for elements heading up, bearing away and jibing, on main sail position for element heading up, and on jib position for element heading up in favor of experimental group.

By means of discriminant analysis the significance in difference is determined for sailing technique performance between experimental and control group. It is shown by significance level of the χ^2 test (p) which is lower than 0,01 (Table 3).

Table 3 Results of discriminant function between experimental and control group

λ	Rc	w λ	χ^2	df	p
0,32	0,49	0,76	47,73	12	0,00

λ – eigenvalue, Rc – canonical correlation, w λ – Wilks' lambda, χ^2 – values of chi-square test, df – number of degrees of freedom, p – significance level of discriminant function

In Table 4 correlations of variables to discriminant function is shown, while in Table 5 location of centroids for experimental and control group on discriminant function are displayed.

Table 4 Correlation of variables to discriminant function

Variables	
Heading up-main sail	0,51
Heading up-helm	0,43
Jibing-helm	0,40
Bearing away-helm	0,37
Heading up-jib	0,30
Tacking-helm	0,22
Jibing-main sail	0,20
Bearing away-main sail	0,16
Bearing away-jib	0,14
Tacking-main sail	0,12
Tacking-jib	-0,07
Jibing-jib	0,02

Table 5 Location of centroids of groups on the discriminant function

Location of centroids of experimental(1) and control group(2)	
1	0,55
2	-0,59

Examinees of control group are positioned on negative pole of discriminant function and have value of - 0, 59, while average score of experimental group is on positive pole (0, 55). The structure of discriminant function is also bipolar. According to correlations of variables to discriminant function, it is evident that examinees of experimental group achieve better results in all the elements of sailing technique, except on variable tacking - jib (- 0, 07) where control group examinees have slightly better average result. The most significant projection on discriminant function has variable heading up - mainsail (0, 51), then follows heading up - helm (0, 43), jibing - helm (0, 40), bearing away - helm (0, 37) and heading up - jib (0, 3) while other variables have correlation to discriminant function lower than 0, 3.

DISCUSSION

The biggest problem for basic sailing school attendants is spatial disorientation, mostly increased by undeveloped sense for wind direction. It is known that wind cannot be seen, but must be sensed, and this problem is bigger when the wind is weak (Pluijms et al, 2015), as is the case with our examinees and most beginners.

Wheras in sailing, conditions are different on every sailing position (Allen & de Jong, 2006), it is to be expected that some students will cope better with some position than the other. Years of practice show that beginners have bigger problems in adjustment to helm position than to main sail or jib position, which is a logical result of aforementioned bad orientation, since helmsman is exactly the person directing the boat and having he biggest responsibility, while sailors on main sail and jib are following him and are adjusting sails to his direction of sailing. The same reason makes an element as heading up difficult for beginners, because it is necessary to determine the point to which sailing up wind is possible. Also, it is proven that in every competitive sailing course, two thirds of total racing time is spent on sailing upwind (Callewaert et al, 2014), it is not much different in teaching of sailing, which makes it difficult to concentrate, especially for beginners.

It is interesting to notice that results achieved in control group show expected difficulty for sailboat positions (helm, main sail, jib). These results are especially interesting when compared to the experimental group, in which examinees were subjected to teaching using buoy range, and the ratio of average scores was completely changed, showing highest results for element heading up on main sail and helm position (Table 1). So, the biggest differences in arithmetic means between the two groups are for elements heading up – main sail (0.39), heading up - helm (0.37) and jibing – helm (0, 34).

Univariate analysis of variance confirmed that differences between the two groups for these three variables are significant at significance level $p = 0, 05$, and also showed that the two groups are significantly different for variables tacking – helm and heading up - jib.

By means of discriminant analysis significant difference was determined (significance level of χ^2 test lower than 0,01) for the sailing technique performance between control and experimental group (Table 2), in favor of experimental group which is positioned on the positive pole of discriminant function (Table 4). Correlations of variables to discriminant function (Table 3) confirmed the results of univariate analysis of variance and showed that five mentioned variables have the biggest projection on discriminant function and that these are exactly the ones making the greatest difference between the two groups of examinees.

Based on the results achieved we can conclude that experimental group is superior to the control group, especially on more demanding elements of sailing technique such as heading up, and on the more demanding helmsman position, therefore we are certain that we can claim these results to be the consequence of buoy range application. From the perceptual area, sailing is a sport that requires a high level of visual stimulus perception (Manzanares et al, 2015). The most important role of buoy range is its help in understanding of sailing space to beginner, and facilitating orientation to the wind (Oreb, 2000). Intelligence and attention underlie learning (Alexandru & Gloria, 2015), using buoy range we help the beginner to pay attention better and we enable him to concentrate on basic maneuvers in directing the boat, or in adjusting the sails. The biggest problem for basic sailing school attendants, as we mentioned before, is spatial disorientation and we believe that it is the very problem evident in control group. Therefore we can conclude that buoy range has successfully lessened the confusion in heads of experimental group examinees which is result of loosing of spatial orientation, and is mainly evident in helmsman who is responsible for adjusting of angle of sailboat in relation to the wind. It is also possible to assume that using the buoy range increased the interest in examinees for training during the teaching.

Results achieved through this research are difficult to compare to the existing knowledge. Namely, although in the last two decades number of scientific researches in sailing is significantly increased, (Felici et al., 1999), there are very few facts that are directing to the research revealing optimal methodical procedures and tools, and accelerating process of teaching and learning sailing skills. One of those rare researches was conducted by Oreb (1984), but in agnate sport, windsurfing, in which synthetic learning method has shown to be superior to analytic method. Almost thirty years after, in his doctoral dissertation Prlenda (2012) is researching effectiveness of different teaching models in windsurfing. His research is partially concordant to this one. Shortly, although in that research experimental group examinees using buoy range show higher average scores than control group examinees, those differences were not statistically significant. Author explains it by stating that in the first days, when student is making his first steps on the windsurf board, he can be more concentrated to the demand not to step out of corridor (range), than he is to the performance of assigned element, and in that case buoy range can become disturbing factor in some individuals, instead of help. He is also sure that significance of buoy range is increasing with the advancement of the student and that the full role of buoy range would be evident in the further course of instruction.

Although mentioned researches were conducted in the agnate sport, nevertheless, movement structures are completely different and it is not surprising that the results are not completely concordant. To conclude, achieved results are showing applicability of buoy range in teaching beginner helmsman, especially in more demanding technique elements such as heading up in sailing. Although some advancement is evident in other elements too, it is not big enough to be considered significant. Such results will facilitate future planning and programming, and in the end even organization of sailing schools, thus accelerating the teaching and instruction process. Further, installation of buoy ranges in the areas where longer period of time is needed, for example due to the depth, will be therefore carried out only for learning of more demanding elements (heading up, etc.).

CONCLUSION

The research was carried out on two groups of examinees (experimental and control group) on which two different methodic approaches in teaching of sailing skills were applied. One group (control) was subjected to standard approach to teaching without using buoy range as a teaching tool, while the other group (experimental) was taught entirely by applying

assignments on buoy range. It is important to mention that to all the examinees this was first encounter with sailing. Considering all analyzed results, it is possible to conclude that buoy range as a methodic tool has significant influence on the amount of acquired knowledge of sailing skills. Also, based on the results achieved, we can conclude that buoy range mostly affects the speed of acquiring of the most demanding elements for a beginner such as heading up. It means that in beginning phases of sailing school such ranges can be omitted (due to the difficult conditions during installation of such ranges and with aim to reduce time loss) and installed only in days when more difficult elements are taught. It should be mentioned that both these groups trained in ideal conditions with wind constantly between 4 and 6 knots and sea, due to the islands surrounding it, was calm or slightly rough. Because of the mentioned reasons, a question arises, would these results that are in favor of model using buoy range be more evident in situation of open sea (fear of unknown, waves etc.), or would stronger wind facilitate orientation and with it lessen the differences between the two groups.

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SAŽETAK

Cilj istraživanja je utvrditi učinkovitost plutača kao metodičkog pomagala u poduci i učenju osnovnih elemenata jedrenja. Analizirane elemente jedrenja činili su prihvatanje, letanje, otpadanje i kruženje na tri različite jedriličarske pozicije (kormilo, glavno jedro i flok).

Istraživanje je provedeno na uzorku od 178 studenata Kineziološkog fakulteta koji su bili podijeljeni u dvije grupe (kontrolna i eksperimentalna). Ispitanici eksperimentalne grupe bili su podvrgnuti poduci uz pomoć različitih poligona plutača dok su ispitanici kontrolne grupe bili podvrgnuti klasičnoj poduci (bez primjene poligona plutača). Proces poučavanja proveden je u trajanju od 7 dana na jedrilicama tipa Elan 19. Poučavanje te vrednovanje jedriličarskih elemenata provele su osobe s dugogodišnjim iskustvom u poduci jedrenja. Deskriptivnom statistikom utvrđena je razlika u količini usvojenog znanja primjenom dvaju modela učenja jedriličarskih vještina. Rezultati ukazuju na više ocjene ispitanika kod eksperimentalne grupe gotovo u svim elementima jedriličarske tehnike osim kod elementa letanje-flok. Jednosmjerna analiza varijance pokazala je da su te razlike značajne na poziciji kormilar u elementima prihvatanje, otpadanje i kruženje, poziciji glavno jedro, element prihvatanje te poziciji flok također element prihvatanje. U daljnjoj analizi diskriminacijska analiza potvrdila je značajnu razliku po količini usvojenog znanja jedriličarske tehnike između dviju analiziranih grupa ($\chi^2 = 47,73, p = 0,00$).

Na temelju dobivenih rezultata autori zaključuju da poligon plutača značajno utječe na količinu usvojenog znanja jedriličarskih vještina.

Ključne riječi: poligon plutača, metode poučavanja, jedriličar, škola jedrenja, početnik

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Correspondence:
Danijela Vujčić, prof.,
postgraduate doctoral student
danijela.vujcic@kif.hr
danijelakostanic@gmail.com

EFFECTS OF SPEED AND AGILITY TRAININGS AT YOUNG FOOTBALL PLAYERS

UČINCI TRENINGA BRZINE I AGILNOSTI KOD MLADIH NOGOMETĀŠA

ABSTRACT

The goal of this research is to determine the progress in development of speed, agility and explosiveness in young footballers. The research was conducted on a sample of 25 young footballers aged 9.50 ± 0.50 , height $143,4 \pm 6,6$ cm and weight $33,5 \pm 7,9$ kg. The respondents are members of the football club "NK Sloga" from Ljubuski, who are trained in the age category "Limaci (U-11)". A total of 3 tests were applied: 1. Running at 20 meters from the high start (Tr20m); 2. Running back and forth with a change of 90° (TrNN); 3. Zig-zag running between poles (TrZZ). An analysis of the differences (T-test) between initial and final measurements resulted in an improvement in the results. The average result of the initial 20m run measurement is 4,43 seconds while the average result of the final measurement is better for 10 hundredths and is 4,33 seconds. In the zig-zag test, the average score of the initial measurement was 9,34 seconds, while the final result was 9,1 seconds. The average score was improved by 0,24 hundredths. In a 180° shift running, respondents ran averaged 14,37 seconds in the initial measurement, or 14,08 seconds in the final measurement. The average score improved by 0,29 hundredths. Correlation analysis found that there was a statistically significant connection between all three tests. The highest connection between the two different tests was measured at the initial measurement of the run test with 180° change of direction and the final measurement at the 20m running test and it was 0,89.

Vladimir Pokrajčić¹, Luka Herceg¹, Boris Dugonjić¹ & Milenko Vojvodić²

¹University of Mostar, Faculty of Natural Sciences, Mathematics and Educational Sciences

²University of Banja Luka, Faculty of physical education and sport

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Correspondence:
ass. Vladimir Pokrajčić
University of Mostar,
Faculty of Natural Sciences and
Mathematics and Education
v.pokrajcic@gmail.com

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INTRODUCTION

Football is one of the most popular sports games of today. Given the popularity of football, the interest in this kind of activity is present in children and their parents. Football training in children is a complex process that is based on the adoption and implementation of specific sets of movements and actions of the football game, and therefore requires a special treatment of their training (Mrsic and Jerković, 2010). Success in football requires a large number of skills, qualities and knowledge, the most important of which are the anthropological characteristics, specific skills and knowledge of football players, and situational efficiency and results in the competition (Dujmovic, Elsner and Fiorentini, 2000). The training of younger age groups should be focused on motor and psychological development and motivation for physical activity rather than the early expectation of sporting results in children (Jukic, 2016), because early achievements can endanger emotional, physical or creative aspects of child development (Spock and Parker, 1998) . In this research, we elaborated development of speed and agility of young footballers. In a study conducted by Jozak, Segedi, Despot, Marceic, Sos and Ivanjko (2010), the results showed that there are significant changes in 20m sprint tests and agility at 4 x 8 meters, primarily due to improvement of unning technique, range of training, and development of coordination. Samija (2011) determines changes in morphological characteristics, motor and functional abilities created under an influence of specific speed and agility training (SAQ) for junior footballers, and results show that there are statistically significant changes in the experimental group in all variables, while tere are statistically significant changes in morphological variables in the control group, and on variables for assessing agility, explosive strength the type of sprint, flexibility and on the variable for assessing aerobic endurance, a very small decrease or stagnation of the assessed abilities is found. Jukic (2016) explores the differences between a selected and non-selected group of young footballers of the same age in motor skills and abilities. According to the results, children in the selected football group and open school do not differ in motor skills and abilities except in the beep test.

Many studies have shown that there is no statistically significant correlation, namely that speed and agility are relatively independent attributes of professional football players - Buttifant, Graham and Cross (2001), Little and Williams (2003), Sporis, Milanovic, Trajkovic and Joksimovic (2011). The aforementioned researches also show that basic skills without a ball have a greater correlation with speed, agility and explosiveness than ball skills.

A review of literature shows that significant changes in the test results occur for speed and agility, and that speed and agility show relatively low correlation in the patterns of senior football players. In addition, the difference in success in the performance of speed and agility tests with ball and without the ball is noticeable. Most of the previous research has been devoted more to professional footballers or older ages, and for this reason, this research has been carried out to determine the progress in speed and agility development and to establish the correlation between speed and agility in young footballers aged $9,5 \pm 0,5$.

METHODS

In this study, the respondents of 25 young footballers aged $9,5 \pm 0,5$ years, height $143,4 \pm 6,6$ cm, and mass $33,5 \pm 7,9$ kg were included. The respondents are members of the football club "NK Sloga" from Ljubuski, age category "Limaci (U-11)". They trained twice a week and they competed at weekends in "!Hej U-11 League". The football experience in the club was 1 to 3 years.

Experimental training was conducted twice a week for 8 weeks, with initial and final measurement performed one week before or after treatment. Trainings took place in the open,

in the main playground of the "Babovac" stadium in Ljubuski with natural grass. In addition to other aids (ladders, pins, poles, circles, hurdles), the respondents were training with the ball no. 4 (lighter and smaller than the standard size). The treatment was performed in the period from 17 Oct until 18 Dec 2017. The trainings took place in the afternoon at 14:00. The training lasted approx. 60 mins and consisted of three parts: introductory-preparation (25 min), main part (30 min) and final part (5-10 min). Experimental treatments were not done during the whole training but only in the introductory - preparatory part of the training (20 minutes). The sample of variables in this research was obtained from three tests: *Tr20m* - running at 20 meters from high start, *TRZZ* – zig-zag running between poles and *Tr180°* - running with 180° change of direction.

Measures of morphological characteristics (height and weight) were obtained by applying basic anthropological instruments (centimeter tape and scale). The tests were recorded with a high-frequency camera and were then analyzed and measured in the Kinove program. Values are expressed by hundredths of seconds. Measurement was carried out at the city stadium "Babovac" in Ljubuski. The results of the research were processed in the program Statistica 13. *Descriptive statistics* were used to determine the descriptive parameters of the initial and final measurements. The distribution regularity was determined by Kolmogorov-Smirnov test. The dependent T-test was used to determine the differences between the initial and final measurements, while correlation analysis was used to determine the correlation between all three tests.

RESULTS AND DISCUSSION

Table 1 shows the results of the descriptive statistics of the initial and final measurements obtained in *Tr20m*, *TrZZ* and *Tr180°* tests. The average result of the initial measurement of the *Tr20m* test is 4,43 seconds while the average result of the final measurement is better for 10 hundredths and is 4,33. The results ranged from 3,9 to 4,92 seconds in the initial measurement, or 3,86-4,93 seconds in the final measurement. For *TrZZ* test results it is apparent that they are in the range from 8,53 to 10,84 seconds in initial measurement, ie. 8 to 10,71 seconds in the final measurement. The average result of the initial measurement was 9,34 and the final 9,1 seconds. In *Tr180°* test, the respondents ran 14,37 seconds on average in initial measurement, ie. 14,08 seconds in final measurement. The best result of the initial measurement was 12,76 seconds, and of the final 12,58, while the worst result of the initial measurement was 16,44 seconds and of the final 16,21 seconds. We determined by KS test that distribution does not deviate significantly from normal distribution and we continued with further processing of data.

Table 1 - Descriptive parameters of the results achieved in the initial and final measurement ($N=25$)

Variables	Mean	Min	Max	SD	MaxD
Tr20m I	4,43	3,9	4,92	0,27	0,120397
Tr20m F	4,33	3,86	4,93	0,28	0,139811
TrZZ I	9,34	8,53	10,84	0,63	0,135993
TrZZ F	9,1	8	10,71	0,63	0,124699
Tr180° I	14,37	12,76	16,44	1,01	0,093553
Tr180° F	14,08	12,58	16,21	0,92	0,098470

LEGEND: Mean - arithmetic mean; Min - minimal result; Max - maximum result; SD - standard deviation; MaxD - distribution normality

Table 2 shows the average results of the initial and final measurement in the *Tr20m* test. In the initial measurement, the average score is 4,43 seconds, while the final measurement result is 4,33 seconds. On average, the score was improved for 10 hundredths. The standard deviation is 0,27 at the initial, 0,28 at the final, which tells us how much on average the elements of the set deviate from the arithmetic mean. Based on an error of less than 0,05, we can say that there are statistically significant differences between initial and final measurements.

Table 2 - T-test for dependent patterns for determining the difference between initial and final measurements in 20m running

Variables	N	Mean	SD	p
Tr20m I	25	4,43	0,27	
Tr20m F	25	4,33	0,28	0,00

LEGEND: N - number of respondents; Mean - arithmetic mean; SD - standard deviation; p - level of significance

Table 3 shows the average results of the initial and final measurement of the *TRZZ* test. At initial measurement, the average result was 9,34 seconds, and in the final measurement 9,1 seconds. The average score of this test improved by 0,24 hundredths. The standard deviation is 0,63 for both measurements. Based on an error of less than 0,05, we can say that there are statistically significant differences between initial and final measurements.

Table 3 - T-test for dependent samples for determining the difference between initial and final measurements in zig-zag running

Variables	N	Mean	SD	p
TrZZ I	25	9,34	0,63	
TrZZ F	25	9,1	0,63	0,00

LEGEND: N - number of respondents; Mean - arithmetic mean; SD - standard deviation; p - level of significance

Table 4 shows the average results of initial and final measurement in the *Tr180°* test. The average result of the initial measurement was 14,37 seconds, while of the final measurement it was 14,08 seconds. And we note here the improvement of the mean value results for 0,29 hundredths. The standard deviation at the initial measurement was 1,01, while at the final measurement it was 0,92. Based on an error of less than 0,05, we can say that there are statistically significant differences between initial and final measurements.

Table 4 - T-test for dependent samples for determining the difference between initial and final measurements in running with 180° direction change

Variables	N	Mean	SD	p
Tr180° I	25	14,37	1,01	
Tr180° F	25	14,08	0,92	0,00

LEGEND: N - number of respondents; Mean - arithmetic mean; SD - standard deviation; p - level of significance

The implemented program resulted in progress. As it is a relatively short period of time, the progress made is largely the result of better performance techniques. Namely, respondents practiced running mechanics at each training session by performing running athletics exercises that had the goal of achieving optimal length and frequency of steps. Progress is also evident in direction changes in agility tests.

Table 5 - Correlation between initial and final measurements of all three tests

Variables	Tr20m I	Tr20m F	TrZZ I	TrZZ F	Tr180° I	Tr180° F
Tr20m I	1,00	0,95	0,81	0,84	0,86	0,82
Tr20m F	0,95	1,00	0,82	0,85	0,89	0,84
TrZZ I	0,81	0,82	1,00	0,96	0,86	0,84
TrZZ F	0,84	0,85	0,96	1,00	0,87	0,85
Tr180° I	0,86	0,89	0,86	0,87	1,00	0,98
Tr180° F	0,82	0,84	0,84	0,85	0,98	1,00

Little and Williams (2003) analyzed the correlation between running speed and agility (zig-zag test) on a sample of professional footballers. Significant but also relatively low correlations ($r < 0.70$) between the tests ($r = 0,45$) were obtained. The authors therefore concluded that the speed and agility of relatively independent qualities and that they require specific training solutions. Unlike the above-mentioned research, high correlation between the tests (Table 5) was obtained in this paper. The correlations indicate that there is no clear differentiation in ability in younger age, but it is mainly to do with universally successful individuals. High correlations were obtained between all three tests in both initial and final measurements. The initial measurement of the Tr180° test and the final measurement of the Tr20m test showed the highest correlation of 0,89. The lowest correlation between the two different tests is the initial measurement of the Tr20m and TrZZ tests and is 0,81.

CONCLUSION

According to the research we can conclude that the speed and agility of young footballers are highly related qualities. It is therefore to assume that speed training will have a significant impact on agility training and vice versa. High correlations point to the fact that in younger age there is no clear distinction of abilities, but it is generally about universally successful individuals. The obtained results are not in line with the research on the population of professional footballers, where as a rule we obtain low correlations between speed and agility, or different agilities. Improvement of the results between the initial and final

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measurements was achieved in all three tests and indicates that the training procedure was effective. However, it remains unclear how these improvements were results of football training itself, and how much of additional content which developed speed and agility. This data will remain deprived because of the fact that the research did not include a control group that would not perform additional contents, but only football training. The probable reason for a significant improvement in all three tests lies in the fact that speed and agility have similar characteristics. The basis of training in methodology of speed and agility training is learning the technique of walking, running, changing direction of movement, economy of movement, etc. Given that the sensitive phase of the development of speed and agility in boys and girls is between the ages of 7 and 11, it is evident why the results of the initial and final measurement were significantly improved. Since they had not met this type of testing earlier, respondents were most likely to advance in the technique, ie. economy of running. The training of young athletes must be considered as a long-term plan by which the increase in load and total physical, technical-tactical and mental demands is applied gradually during the growth and development phases. The foundations of childhood training should be set up through multifaceted development rather than through a narrow, sport-specific training, which will give the young athlete a better base for top performance.

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SAŽETAK

Cilj ovog istraživanja bio je utvrditi napredak u razvoju brzine, agilnosti i eksplozivnosti kod mlađih nogometara. Istraživanje je provedeno na uzorku od 25 mlađih nogometara starosne dobi 9.50 ± 0.50 , visine $143,4 \pm 6,6$ cm i težine $33,5 \pm 7,9$ kg. Ispitanici su članovi nogometnog kluba „NK Sloga“ iz Ljubuškog, koji treniraju u uzrasnoj kategoriji „Limači (U-11)“. Primijenjeno je ukupno 3 testa: 1. Trčanje na 20 metara iz visokog starta ($Tr20m$); 2. Trčanje naprijed-nazad s promjenom pod 90° ($TrNN$); 3. Zig-zag trčanje između štapova ($TrZZ$). Analizom razlika (T-test) između inicijalnog i finalnog mjerjenja utvrđeno je poboljšanje rezultata. Prosječan rezultat inicijalnog mjerjenja trčanja na 20m iznosi 4,43 sekunde dok je prosječan rezultat finalnog mjerjenja bolji za 10 stotinki i iznosi 4,33 sekunde. U zig-zag testu prosječan rezultat inicijalnog mjerjenja iznosi 9,34 sekundi, dok je kod finalnog iznosi 9,1 sekundu. Prosječni rezultat popravio se za 0,24 stotinike. U trčanju s promjenom smjera 180° ispitanici su prosječno trčali 14,37 sekundi u inicijalnom mjerenu, odnosno 14,08 sekundi u finalnom mjerenu. Prosječni rezultat popravio se za 0,29 stotinki. Korelacijskom analizom utvrđeno je da postoji statistički značajna povezanost između sva tri testa. Najveća povezanost između dva različita testa izmjerena je kod inicijalnog mjerjenja testa trčanje s promjenom smjera za 180° i finalnog mjerjenja kod testa trčanje na 20 metara i iznosi 0,89.

Ključne riječi: *trening, brzina, agilnost, mlađi nogometari*

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Correspondence:
ass. **Vladimir Pokrajčić**
University of Mostar,
Faculty of Natural Sciences and Mathematics and Education,
Mostar, Bosnia and Herzegovina
v.pokrajcic@gmail.com

BODY COMPOSITION, EATING HABITS AND RISK FACTORS FOR THE DEVELOPMENT OF EATING DISORDERS IN FEMALE ELITE ATHLETES

TJELESNA KOMPOZICIJA, NAVIKE U ISHRANI I RIZICI ZA RAZVOJ POREMEĆAJA ISHRANE U UZORKU ELITNIH SPORTISKINJA

ABSTRACT

The number of women who actively participate in sports has drastically increased in the last few decades, which is a trend followed by many health benefits and serious harmful health side effects as well. The Female Athlete Triad stands out among these as a condition which includes eating disorders, menstrual disorders and osteoporosis. Eating disorders are the first link to which all other disorders are later attached, while the risk for their development remains undetected despite the specificities of certain sports. They often develop out of eating restrictions (diets) or out of an unhealthy eating habit. The aims of this paper were to detect risks for the development of eating disorders by 1) determining body composition parameters and harmful eating habits and 2) identifying risk factors suggested by American Academy of Family Physicians.

The sample of examinees was comprised of elite female athletes ($N=111$) divided into three groups (sports that use a ball, dance and athletics), each with different risks for the development of eating disorders. The control group ($N=27$) consisted of non-athlete female students. They had their body composition and BMI determined and they answered a questionnaire which estimated risks for the development of eating disorders in primary health care.

Based on the answers to screening questions and eating habits, the results showed significantly higher risks for the development of eating disorders in the athletes' group, compared to the control group. Low BMI of less than 18.5, as a direct criterion for energy deficiency, was also more present ($p<0,05$) in the athletes' group.

Therefore, based on body index values and key screening questions, we conclude that active participation in sports carries a higher risk for the development of eating disorders.

Nenad Ponorac¹, Mira Spremo² i
Tanja Šobot¹

¹University of Banja Luka, Faculty of Medicine, Banja Luka, Bosnia and Herzegovina

²University Clinical Center of the Republic of Srpska, Banja Luka, Bosnia and Herzegovina

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Correspondence:
Ponorac Nenad, PhD.
University of Banja Luka,
Faculty of Medicine, Banja Luka,
Bosnia&Herzegovina
nenad.ponorac@med.unibl.org

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INTRODUCTION

The number of women who actively participate in sports has drastically increased in the last few decades. This trend has caused many physical and mental benefits to female athletes and has generally affected health improvement among physically active women (Mountjoy, Sundgot-Borgen, Burke, Carter, Constantini and ass., 2014). However, clinical experience and scientific studies clearly indicate that there are some side effects to doing sports which are harmful for female athletes (Mountjoy , Sundgot-Borgen , Burke, Ackerman, Blauwet, Constantini and ass., 2018). The Female Athlete Triad is primarily taken into account here, which is a direct consequence of inadequate and unbalanced diet or of energy (calory) deficiency compared to energy expenditure during physical activity (Otis, Drinkwater, Johnson, Loucks, Wilmore and ass., 1997). The Triad is officially defined as a combination of energy deficiency caused by eating disorders eventually leading to menstrual disorders and finally to low bone mineral density or osteoporosis (Drinkwater, Loucks, Sherman, Sundgot-Borgen and Thompson, 2005). Eating disorders in sports represent a continuous model of disorders. They move along a wide spectrum, ranging from abnormal and often very dangerous eating habits, whose aim is body weight reduction, to serious clinical mental conditions which can be associated with other psychiatric pathologies (Joy, Kussman and Nattiv, 2016). According to Publication Manual of the American Psychological Association DSM - V, 2013, the continuum of eating disorders in sports include clinical disorders; anorexia nervosa, bulimia nervosa and unspecified eating disorders. Besides the mentioned Triad symptoms, female athletes with this condition may not only develop musculoskeletal, cardiovascular, renal, metabolic, neuropsychiatric symptoms but face the fatal outcome as well (Nativ, Loucks, Manore, Sanborn, Sundgot-Borgen and Warren, 2007). The most significant factors are: 1. female athletes' effort to meet specific criteria of body weight or shape which a particular sport requires, 2. visible benefit in physical ability resulting from reduced body weight or shape, 3. increased sensitivity to socio-cultural demands/pressures (media, audience) to accomplish a specific body composition. These factors can lead to a completely wrong perception of one's body, dangerous changes in eating habits, irrational restrictions in food (*diets*), which eventually lead to clinical eating disorders. Similarly, female athletes who do endurance sports with significant energy expenditure during intense trainings are often not aware of their calorie needs. The resulting energy deficiency initiates a cascade of Triad symptoms (Nativ and ass. A. 2007; Mountjoy, 2015). Specific risks for the development of the Triad with all or some of its symptoms are present in biotypes of female athletes who do endurance sports (marathon, cycling, swimming), aesthetic sports (figure skating, gymnastics, dance, ballet), weight-based sports (martial arts) as well as sports which favour clothes that reveal much of the female body such as volleyball or basketball (Dosil, 2008). A lot of diagnostic procedures have been developed to confirm eating disorders, but the base are questionnaires with targeted questions. Majority of the questionnaires have a lot of questions and are time consuming, which is why many female athletes often give up on the procedure. Thus, American Academy of Family Physicians has suggested targeted questions for early detection of eating disorders in primary health care.

Suggested screening methods are convenient for usage in primary health care or even by a coach or club's doctor/nutritionist. In accordance with answers to given questions, a female athlete can be treated as a potential risk bearer and subsequently referred to a detailed examination (Pritts, 2003). One such method was used in our research. Risk for the development of eating disorders can be traced on the basis of body mass index/BMI value if it is below the minimum reference values of 18.5 or on the basis of presence of any unhealthy eating habits which are often an entry point for a clinical disorder (Thorsveit and Sungot-Borgen, 2005). The purpose of this research was to determine risk factors for the development of eating disorders or present energy deficiency, which are entry points for the Female Athlete Triad appearance. Some of the questions/parameters used in this research are diagnostic criteria for clinical eating disorders as well as for risk assessment for the development of any such disorders.

The research objectives were to detect risks for the development of eating disorders by 1) determining body composition parameters, 2) determining harmful eating habits, 3) identifying risk factors suggested by American Academy of Family Physicians.

METHODS

The examinees ($n=117$) were divided into two groups, experimental or female athlete group (A) and control group (C). The experimental group ($n=84$) was comprised of three subgroups of elite female athletes who do different sports: 34 female athletes who do sports that use a ball, current world champions (basketball and handball), 27 female athletes who do athletics, mostly state representatives (running in the long and middle distances), 23 female athletes who engage in sports dance, all with international experience. The types of sports were chosen according to different sport-related specific risks for the development of eating disorders. Sports that use a ball bear a risk because of the clothes that reveal much of the female body, dance belongs to aesthetic sports which are appearance-oriented and athletics belongs to endurance sports with potential energy deficiency. At the time all female athletes were finishing their competition season, which provided cumulative effect of physical activity on their bodies. The control group ($n=27$) was comprised of female students at the Faculty of Medicine in Banjaluka, of similar age to female athletes in the experimental group, who do not participate in sports actively. All the examinees and their coaches were given written information on the research objectives and procedures and the examinees signed written consent for participation before entering the research. The research participants were a part of a wider research on the Female Athlete Triad appearance. The first phase of the research consisted of introducing the examinees to the research purpose and answering a questionnaire comprised of a section on

general information, a section on general health status and a section aimed at detecting risks for the development of eating disorders. The questions represented a combination of real diagnostic criteria and questions suggested for primary health care of female athletes. A positive answer to any of these questions indicated risks for the development of eating disorders and required further evaluation using a precise method. Body composition (fat percentage, BMI) was determined by body composition analyser (Gaia Jawon 357, South Korea) using bioimpedance method. The results were statistically analysed using SPSS 20 program expressing standard statistical variables.

RESULTS

The descriptive statistics parameters of the groups, age, sports experience, weekly physical load and body mass index are given in Table 1.

Table 1. Descriptive characteristics of the examinees groups (age, sport experience, weekly physical load, body mass index and body fat percentage) given as mean \pm SD.

Group	Sports that use a ball N=34	Dance N=23	Athletics N=27	Control group N=27
Age (years)	19,64 \pm 2,63	17,69 \pm 2,97	17,41 \pm 4,24	20,88 \pm 0,42
Sport experience (years)	9,5 \pm 2,21 ^a	6,52 \pm 1,81	5,18 \pm 2,4	0
Weekly physical load (hours per week)	12,20 \pm 2,51 ^b	7,32 \pm 3,77	13,98 \pm 5,19 ^b	0
Body mass index (BMI) (kg/m ²)	22,26 \pm 1,82 ^c	19,53 \pm 1,83	19,10 \pm 1,72	21,13 \pm 2,70
Body fat percentage (%)	17,44 \pm 6,01 ^d	14,44 \pm 5,45	8,60 \pm 4,00 ^e	20,94 \pm 6,31

^a (p<0,01) compared to dance and athletics
^b (p<0,01) compared to dance
^c (p<0,05) compared to dance and athletics
^d (p<0,05) compared to dance
^e (p<0,01) compared to dance and sports
that use a ball

Significantly most experienced female athletes are from the group of sports that use a ball, who are on average the oldest female athletes as well. The overall female athletes sample shows long

enough sport careers which can reveal both positive and negative effects of participating in sports. The degree of weekly physical load, unless it is followed by adequate calorie intake, represents one of the factors for the development of so called “low energy availability” or low energy supplies crucial for the development of the Triad. The group of female athletes who do athletics and the group of female athletes who participate in sports that use a ball are weekly significantly more loaded, at the level of $p<0,01$, than the group of female athletes who engage in dance, while the difference between the first two is almost insignificant.

The value of the body mass index, widespread in describing body composition, is lately losing importance in application in sports. Nevertheless, it is taken as a risk factor since it is marked as one of criteria for the risk for the development of eating disorders and closely related to menstrual dysfunctions. The highest BMI is among the female athletes who participate in sports that use a ball while in the groups of female athletes who engage in dance and do athletics average BMI values are near 18.5 kg/m^2 which is considered a parameter of energy deficiency. The percentage of body fat is the best indicator of body composition. The lowest percentage of body fat was detected among the female athletes who do athletics and the highest among the control group examinees. Answers to the questions used in the Questionnaire gave us parameters which refer to the detection of risk factors for the development of eating disorders. Table 2 presents results for the overall sample as well as comparison between the female athletes and the female non-athletes, which shows the role of participating in sports as a risk factor for the development of eating disorders.

Table 2. Risk factors for the development of eating disorders in the overall sample and in the athletes compared to the control group, given as number (n) and the percentage of examinees (%) in a group.

Group	Overall sample	Athletes (S)	Control
	N=111	N=84	N=27
	n (%)	n (%)	n (%)
Are you satisfied with your weight?	Yes 72 (64,9)	Yes 49 (58,3)	Yes 23 (85,2)
	No 39 (35,1)	No 35 (41,7) ^a	No 4 (14,8)
Are you satisfied with your looks?	Yes 86 (77,5)	Yes 64 (76,2)	Yes 22 (81,5)
	No 25 (22,5)	No 20 (23,8) ^b	No 5 (18,5)
Objections of environment to your looks and weight?	Yes 29 (26,4)	Yes 23 (27,4) ^c	Yes 6 (22,2)
	No 82 (73,6)	No 61 (72,6)	No 20 (74,1)
Are you on a ‘diet’ now?	Yes 5 (4,5)	Yes 4 (4,8)	Yes 1 (3,7)

	No 106 (95,5)	No 80 (95,2)	No 26 (96,3)
Have you ever been on a 'diet' during your career?	Yes 11 (9,9) No 100 (90,1)	Yes 8 (9,5) No 76 (90,5)	Yes 3 (11,1) No 24 (88,9)
Do you use training regime for weight reduction?	Yes 11(9,9) No 100 (90,1)	Yes 8 (9,5) No 76 (90,5)	Yes 3 (11,1) No 24 (88,9)
Do you vomit meals in order to lose weight?	Yes 1(0,9) No 110 (99,0)	Yes 1 (1,2) No 83 (98,8)	Yes 0 (0) No 27 (100)
Do you use 'weight loss products' (diueretics, laxatives, appetite suppressants)?	Yes 4 (3,6) No 107 (96,4)	Yes 4 (4,8) ^a No 80 (95,2)	Yes 0 (0) No 27 (100)
Do you avoid any foods/forbidden foods?	Yes 29 (26,1) No 82 (73,9)	Yes 25 (29,8) ^c No 59 (70,2)	Yes 4 (14,8) No 23 (85,2)

^a (p<0,01) compared to (C)

^b (p<0,05) compared to (C)

^c (p<0,01) compared to (C)

^d (p<0,01) compared to (C)

^e (p<0,01) compared to (C)

Questions about examinees' attitude towards weight and appearance can reveal risks for the development of harmful and irregular eating habits, which bear potential for transformation into symptoms of real criteria for eating disorder diagnosis. Answering the question "*Are you satisfied with your weight?*" 41,7 % of the female athletes said *no*, which indicates the prevalence of this attitude among young female athletes. The difference in answer is statistically significant compared to the control group, which shows the female athletes orientation towards body weight values. Answering the question "*Are you satisfied with your looks?*" 23,8 % of the female athletes said *no*, which is statistically significant when compared to the non-athletes. Answering the question "*Does your environment (coaches, parents, teammates, friends) have objections to your looks or weight?*" 27,4 % of the female athletes said *yes*. Almost one out of three female athletes from our sample is under the pressure because of the looks, body weight or composition. Diets i.e. restrictive diets with the aim of weight reduction are usual means to control or achieve desired body weight. Inadequate diet leads both to absence of desired results, which opens a vicious cycle of pathological eating habits, and to fatal effects on physical ability and thus sport results. Answering the question "*Are you on a diet trying to reduce body weight?*" only 4,5% of the examinees in the overall sample said *yes*, which is encouraging. Due to the small number of the examinees who answered positively, there is no statistical significance in the difference between the athlete groups and the non-athlete groups nor among the groups of female athletes. One female athlete, a dancer, answered positively to the question on vomiting meals as

a means to control body weight. Despite the fact that she alone was not enough for statistical significance, she deserved attention since vomiting meals is a diagnostic criterion for bulimia nervosa. Weight loss products as a means to control body weight were significantly more used by the female athletes; the same is true for avoidance of certain foods in diets.

Table 3. Risk factors for the development of eating disorders in the athlete groups compared to the control group given as number (n) and the percentage of examinees (%) in a group.

Group	Sports that use a ball (N=34) n (%)	Dance (N=23) n (%)	Athletics (N=27) n (%)	Control (N=27) n (%)
Are you satisfied with your weight?	Yes 18 (52,9) No 16 (47,1)	Yes 13 (56,5) No 10 (43,5)	Yes 18 (66,7) No 9 (33,3)	Yes 23 (85,2) No 4 (14,8)
Are you satisfied with your looks?	Yes 26 (76,5) No 8 (23,5)	Yes 17 (73,9) No 6 (26,1)	Yes 21 (77,8) No 6 (22,2)	Yes 22 (81,5) No 5 (18,5)
Objections of environment to your looks and weight?	Yes 12 (35,3) No 22 (64,7)	Yes 4 (17,4) No 19 (82,6)	Yes 7 (25,9) No 20 (74,1)	Yes 6 (22,2) No 20 (74,1)
Are you on a 'diet' now?	Yes 1 (2,9) No 33 (97,1)	Yes 2 (8,7) No 21 (91,3)	Yes 1 (3,7) No 26 (96,3)	Yes 1 (3,7) No 26 (96,3)
Have you ever been on a 'diet' during your career?	Yes 2 (5,9) No 32 (94,1)	Yes 4 (17,4) No 19 (82,6)	Yes 2 (7,4) No 25 (92,6)	Yes 3 (11,1) No 24 (88,9)
Do you use training regime for weight reduction?	Yes 4 (11,8) No 30 (88,2)	Yes 3 (13,0) No 20 (87,0)	Yes 1 (3,7) No 26 (96,3)	Yes 3 (11,1) No 24 (88,9)
Do you vomit meals in order to lose weight?	Yes 0 (0) No 34 (100)	Yes 1 (4,3) No 22 (95,7)	Yes 0 (0) No 27 (100)	Yes 0 (0) No 27 (100)
Do you use 'weight loss products' (diuretics, laxatives, appetite suppressants)?	Yes 0 (0) No 34 (100)	Yes 0 (0) No 23 (100)	Yes 4 (14,8) ^a No 23 (85,2)	Yes 0 (0) No 27 (100)
Do you avoid any foods/forbidden foods?	Yes 4 (11,8) No 30 (88,2)	Yes 12 (52,2) No 11 (47,8)	Yes 9 (33,3) No 18 (66,7)	Yes 4 (11,8) No 23 (85,2)

^a (p<0,05) compared to the group of dance and sports that use a ball.

Table 3 presents answers to questions divided into the groups of female athletes. This way we wanted to determine the existence of sport specific risks for the development of eating disorders. Result analysis shows that the determined risk is equally distributed in the groups. An exception

is the usage of weight loss products, which is present only in the group of female athletes who do athletics. They are also the athletes with the lowest BMI and the lowest body fat percentage. BMI value below 18.5 kg/m² is taken as malnutrition border and a risk for the development of eating disorders. Table 4 shows that the female athletes are under a significantly higher risk than the female non-athletes while the risk among the athlete groups remains equal.

Table 4. The number of examinees in groups with BMI<18,5 kg/m²

Group	N	n (%)
Overall sample	111	21 (18,9)
Athletes (A)	84	16 (19,04) ^a
Control group (C)	27	5 (18,51)
Sports that use a ball (S_b)	34	0
Dance (D)	23	7 (30,43)
Athletics (A)	27	9 (33,33)
Control group (C)	27	5 (18,51)

^a (p<0,05) compared to the control

DISCUSSION

The nature and extent of problems related to nutrition have received significant attention in the last two decades. (Sundgot-Borgen, Bratland-Sanda, Engen, Pettersen, Friberg and ass. 2018). Death and serious health consequences among several elite female athletes (Christy Heinrich in 1994, for example) are part of strong claims that female athletes are under an especially high risk for the development of these disorders. Terms ‘normal eating’, ‘disordered eating’, ‘pathological eating habits’ are used to describe the continuum of individual appearances and habits in eating to the most serious clinical appearances (anorexia nervosa and bulimia nervosa). Eating disorders often have insidious and inconspicuous beginning. They start with moderate efforts to correct body weight or shape, usually through a harmless diet, and end up with eating and body weight preoccupation. Symptoms become evident not until significant body weight loss (Mountjoy, 2015). Symptoms of these disorders are usually kept as a secret or overlooked, which is why it is difficult to determine the exact percentage of athletes with eating disorders. Numerous studies have documented higher frequency of eating disorders among athletes compared to non-athletes, as well as among female athletes compared to male athletes (Rome, 2003). According to DSM-V criterion, anorexia and bulimia frequency with general population ranges from 1% to 3% while eating disorder frequency among female athlete population ranges from 15% to 62% depending on a sport (Sundgot-Borgen and Torstveit, 2004). Recent data show frequency of energy

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deficiency or of eating disorders, ranging from 7.1% to unbelievable 89.2% depending on a sport (Williams, Statuta and Austin, 2017). Diagnostic screening tests, suggested to be used in primary health care, are of great value and we used them as well. Our results were compared to a similar bigger study whose aim was to determine the prevalence of eating disorders among student athletes (Johnsom, Powers, and Dick, 1999). Six episodes of vomiting meals or diuretics and laxatives usage were taken as risk factors, similar to the questions in our research. Based on our results, we note that one female athlete or 1,2% answered positively to the question. This criterion is one of the most important criteria when diagnosing bulimia purging type in DSM-V. The second question which is related to pathological eating habits and which is a direct indicator for eating disorders refers to diueretics, laxatives and appetite suppressants usage. 3,8% of the female athletes answered it positively. It is significantly less than in a study which included 182 female athletes where it was concluded that 32% of female athletes vomited their meals, used diueretics or laxatives every day for at least a month in their careers (Rosen and Hough, 1988). Negative attitude towards looks and weight is not a direct indicator, but it is qualified as a risk factor for the development of eating disorders (Pritts, 2003). 22,5% of overall examinees sample in our study answered negatively to the question whether they were satisfied with their looks or not. This attitude shows great percentage of young women who are dissatisfied with their bodies. Considering variance between the groups we have discovered that there is statistically significant difference between the group of female athletes and the group of female non-athletes. Even though it is significant, this number is much smaller than in a study of Arthur-Cameselle which showed that up to 88% of female athletes and 82% of female non-athletes were dissatisfied with their looks (Arthur-Cameselle, Sossin and Quatromoni, 2017). In an older study conducted on the sample of 955 female swimmers, Dammer and associates discovered that 80,5% of examinees wanted to lose weight in order to look better, 58,5% wanted to lose weight in order to achieve better sport results and 21,9% wanted to lose weight because of general health (Dummer, Rosen, Heusner, 1988). In one study 13,7% of female athletes and 11,8% of female non-athletes were dissatisfied with their looks and continuously tried to lose weight (Sundgot-Borgen, 1994). Several studies show high percentage of coaches who participate in looks or weight estimation and correction of female athletes in a wrong way (Sherman, Thompson R, 2005; Plateau, Arcelus McDermott, Meyer, 2015). Analysing our results we note that 27,4% of the female athletes are under the pressure of environment because of their looks or body weight. There is no statistically significant difference within the sport groups, but we note that the group of sports that use a ball is most threatened. 35% of them said that their coaches had some objections related to their looks and they are also the group with the highest body weight and BMI values. A similar study, conducted by Rosen and associates, showed that two thirds of female athletes stated that their coaches had negative opinion about their looks and thought them to be overweight (Rosen and ass., 1988.). We took BMI lower than 18.5 as an indirect method for energy balance disorder. It also served as an additional criterion within risks for disordered eating. Taking low BMI values as a risk factor for the development of eating disorders, we note that 19,04% of the female athletes have disordered energy balance or are under the risk

for the development of eating disorders. The number is equally distributed among the athlete groups. Despite the fact that many athletes show better physical abilities after drastic body weight reduction, lower food intake affects energy supplies significantly which eventually reduces physical ability. Early and quick diagnosis and quick treatment are priorities for risk control and development of eating disorders prevention, which ensures perspective in this study.

CONCLUSION

The female elite athlete group is under statistically higher risk for the development of eating disorders compared to the control group if following factors are taken as indicators of higher risk: attitude towards looks and body weight, objections (influence) of environment to one's looks or weight, usage of weight loss products (diuretics, laxatives and appetite suppressants) and BMI value lower than 18.5 kg/m^2 .

There is no statistically significant difference among the athlete groups.

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SAŽETAK

Trend povećanja broja žena koje aktivno učestvuju u sportu drastično je porastao u zadnjih nekoliko decenija, donoseći mnoge zdravstvene benefite ali i neke ozbiljne štetne posljedice po zdravlje. Među njima se izdvaja Ženska sportska trijada, sindrom koji obuhvata poremećaje ishrane, menstrualnog ciklusa i osteoporozu. Poremećaji ishrane su prva karika na koju se vežu ostale, a rizik za njihov nastanak često ostaje neprepoznat uprkos specifičnostima koje nose pojedine vrste sportova. Često počinju restrikcijama u ishrani (dijeta) ili nekom nezdravom navikom u ishrani. Ciljevi rada su bili utvrditi rizike za nastanak poremećaja ishrane određivanjem: parametara tjelesne kompozicije i štetnih navika u ishrani i praćenjem faktora rizika predloženih od strane Američke akademije porodičnih ljekara. Ispitanice su bile elitne sportiskinje (111) podijeljene u tri grupe sportova (igre sa loptom, ples i atletika), svaka sa različitim rizicima za nastanak poremećaja ishrane. Kontrolnu grupu (27) činile su studentice, nesportiskinje. Ispitanicama je određena tjelesna kompozicija, BMI i popunile su upitnik sastavljen od pitanja kojim se procjenjuje rizik za poremećaje ishrane u primarnoj zdravstvenoj zaštiti. Rezultati govore o statistički značajno većem riziku za razvoj poremećaja ishrane u grupama sportiskinja u odnosu na kontrolu ako se prate odgovori na skrining pitanja ili navike u ishrani. Niska vrijednost BMI ispod 18,5 kg/m kao direktni kriterij energetskog deficit je takođe bila značajnije zastupljena ($p<0,05$) u uzorku sportiskinja. Zaključuje se da aktivno bavljenje sportom nosi povećan rizik za pojavu poremećaja ishrane prateći vrijednosti tjelesnih indeksa i ciljanih skrining pitanja.

Ključne riječi: ženska sportska trijada, poremećaji ishrane u sportu, tjelesna kompozicija.

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Correspondence:
Ponorac Nenad, PhD.
University of Banja Luka,
Faculty of Medicine, Banja Luka, Bosnia&Herzegovina
nenad.ponorac@med.unibl.org

DERMATOGLYPHIC PROFILE AND SOMATOTYPE OF BRAZILIAN ATHLETES OF SPEED CANOEING

DERMATOGLIFSKI PROFIL I SOMATOTIP BRAZILSKIH KANUISTA

Abstract

The focus of this study was analyze dermatoglyphic profile and somatotype of Brazilian athletes of speed canoeing. This study is descriptive comparative and involved a sample of $n = 60$ male athletes of canoeing speed, divided into four groups according by the proof and yield classification: ka = high performance of kayak, Ki =intermediate performance of kayak, Ca =high performance of canoe and Ci =intermediate performance of canoe. For dermatoglyphic was used the protocol of Cummins and Midlo, and to somatotype protocol of Heath & Carter. Statistical analyzes were performed using Kruskal-Wallis test and Bonferroni test. Regarding the dermatoglyphic sample showed a predominance of "L" and the digital formula " $L > W$ ", featuring athletes of speed and strength, power and coordination as well as is necessary in canoeing. No significant differences in D10, SQTL, MESQTL and MDSQTL between groups. The mean of somatotype was the mesomorph, featuring athletes with extremely strong structure and low levels of body fat. It showed statistically significant differences between the groups when it came somatotype index. Studies such as this aims to optimize strategies for selection and guidance training of Brazilian elite athletes.

**Ana Paula Soares de Sousa¹,
Heros Ribeiro Ferreira¹,
Jefferson da Silva Novaes¹ &
Jose Fernandes Filho¹**

¹*Univercidade Federal do Rio de Janeiro, Laboratório de Biociência do Movimento Humano. Rio de Janeiro, RJ.*

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Correspondence:
Ana Paula Soares de Sousa,
Rio de Janeiro, Brasil
anapdesousa@hotmail.com

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INTRODUCTION

The canoe is the oldest means of transport. Six thousand years ago it was used by North American Indians, Eskimos and others populations as a means of locomotion by rivers and lakes (Marchi & Mezzadri, 2003). The first canoeing competitions were in the Berlin Olympics in 1936, through speed mode, since then remained on the Olympic stage. Practice the speed canoeing in lakes (calm waters) with canoes (C) and kayaks (K).

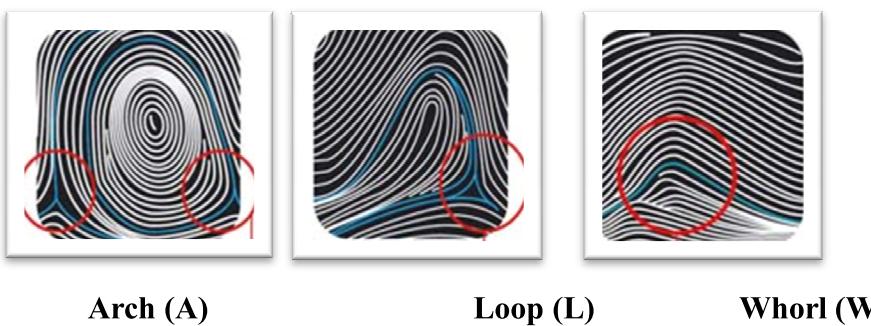
It is worth mentioning, although this sport is not considered popular in the country, Brazilian speed canoeing has achieved unpublished results in recent years, among them gold medal in the world championship of Germany

To increase the qualification of the sport, coaches seek possible explanations for scientific rationale for the relationship between sport, physical type, athletic performance and genetic, morphological, physiological, psychological, environmental factors, among others (Fernandes Filho, Dantas Moreira, & Roquette Fernandes, 2006).

According to Fernandes Filho et al. (2006), the development of a talented sportsman is mutual result of genetic endowment and the environment. In other words, Borin, Padovani, Aragon, and Gonçalves (2012) points out that the performance of an athlete is determined by the capabilities of complex, innate and acquired. Medina and Fernandes Filho (2002) concludes that the finding of these features can benefit the athlete's performance and help select appropriate training methods and targeted to motor skills inherent to sport.

Regarding high yield, Zary (2008) and Sousa, Ferreira, and Fernandes Filho (2016) observed that athletes of this level could serve as a standard to be followed by those who practice this sport, determining model parameters and characteristics, since successful athletes must submit a favorable genetic profile to the specificities of each modality. Stands out among these genetic markers, the dermatoglyphic, consisting of a tool to assessment and interpretation of fingerprints of 10 fingers and identification of intrinsic physical qualities to the individual and the sport (Abramova, Nikitina, Izaak, & Kochetkova, 2000). Most authors distinguish three groups of drawings: Arch, Loop and Whorl.

Figure 1- Drawing types of Fingerprints



Source: Fernandes Filho (2009)

The researchers established an association of fingerprints with physical qualities:

- Speed and explosive power: loops increased (> 7), decreased whorls. (<3), and increased presence of the arches.
- Aerobic capacity, endurance and combination of complex motor activities: lower arches (to 0) and loops (<6), increased whorls (> 4).

Many studies were conducted to trace the dermatoglyphic and somatotypic profile Brazilian high-level athletes in various modalities in an attempt to get them to maximum performance with a genetic profile and adequacy of the guidance according by the requirements inherent in each modality training. (Abad-Colil, Hernández-Mosqueira, & Fernandes Filho, 2017; Aitken & Jenkins, 1998; Castanhede, Dantas, & Fernandes Filho, 2003; Dantas & Fernandes Filho, 2004; Fernandes Filho, Carvalho, & Novaes, 2005; Fernandes Filho, Silva Dantas, Albergaria, & Fernandes, 2004; Ferreira, Barbosa, & Fernandes Filho, 2008; Fonseca, Silva Dantas, & Fernandes, 2008; Gobbo et al., 2002; Medina & Fernandes Filho, 2002; Paz et al., 2013; Takehara, 2016).

The morphological configuration becomes very important for the improvement of these motor skills and characterization of a high performance athlete. According Heath and Carter, somatotype is the method as a sequence of three numerals, always in the same order, where each represents a physical component, describing the variations of the individual with respect to morphology and composition (Castanhede et al., 2003; Rocha, Fernandes, & Filho, 2013). Tubino and DaCosta (2006) emphasizes the importance of the correlation between body structure and performance capabilities.

Gobbo et al. (2002) highlights the lack of research on canoeing in Brazil. Thus, due the dearth of information about this sport, justifies the need for scientific research to assist in the selection and planning training of athletes. Therefore, the aim of this study was to evaluate the

dermatoglyphic profile and somatotype of Brazilian athletes of speed canoeing, of canoe and of kayak. This analysis will allow a better exploitation of the sport, allowing guide the training methodology for the development of the athlete's performance in both the initiation and with high yield.

METHODS

This study involved a comparative descriptive character sample of $n = 60$ male athletes in speed canoeing, and of these $n = 31$ athletes vying for evidence in canoe (C) and $n = 29$ in kayaks (K). Of the total, $n = 26$ ($n = 15$ Ca and Ka $n = 11$) subjects were classified high yield medalists, champions of Pan American, world championships and / or Olympics and $n = 34$ (C = 16 and K n = 18) intermediate athletes with medals in national championships. Both levels with over 5 years of training experience.

The gather of fingerprints was performed using a Verifier 320 LC Cross Match® scanner used according to the protocol dermatoglyphic described by Cummins and Midlo (Fernandes Filho, 2009). The distal phalanges of the fingers were pressed on the digital player performing a rotational motion and then identified the following Dermatoglyphic Drawings: Arch (A), Loop (L) and Whorl (W) and the following dermatoglyphic indices:

- Type of drawings of each finger of each hand (MET and MDT);
- The amount of these types of drawings in 10 fingers (D10),
- The sum of total number of lines of 10 fingers (SQTL).

The analysis of the dermatoglyphic characteristics was held for three (3) researches trained in Bioscience Laboratory of Human Movement of Federal University of Rio de Janeiro.

Somatotype indices were obtained from the protocol Heath & Carter. It was used a measure of Subscapular, triceps, supraspinatus and medial calf bone diameters, weight, height, circumference of right arm contracted corrected, corrected perimeter of the right leg, and bone diameter of femoral and humeral (Fernandes Filho, 2010). The following instruments were used: bioimpedance scale InBody R-20, a stadiometer, a caliper, an anthropometric tape and a caliper of Sanny brand. After registration of the data of each component was calculated.

Data collection was approved by the Brazilian Canoe Confederation (CBCa, in Portuguese) and his current president. Written free and informed consent forms were obtained from all the athletes.

In conducting the statistical analysis, we used the Statistical Package for the Social Sciences (SPSS 16.0). The descriptive analyzes were performed considering the mean and standard deviation statistical parameters.

Data normality was verified by the Shapiro-Wilk test, which identified that the results were nonparametric for all variables. To carry out the comparisons between groups, we used the Kruskal-Wallis test, which verified if hypotheses of averages of group presented differences statistically significant. Then, was held the Bonferroni test, which corrected the value of "p" avoiding the tendency of the error type I. All these procedures were treated with significance level ($p < 0.05$).

RESULTS AND DISCUSSION

By observing the results described in Table 1, it can be seen in relation to the Age of group athletes intermediate performance of canoe (Ci) has a lower mean than everyone else, but when making the comparison was identified a significant difference only between this group and the intermediate performance of kayak (Ki) (sig. = 0.004).

The results concern the Body Mass demonstrate again that the Ci group had a lower mean, but this time the comparison showed significant differences with all other groups, High performance of kayak (Ka) and intermediate performance of kayak (Ki), High performance of canoe (Ca) : Ci x Ka ($p = 0.023$) Ci x Ki ($p = 0.007$) and CixCa ($p = 0.005$).

As for height, it was found that the Ci group showed a lower mean than all other groups, but was not identified significant differences ($p = 0.318$).

Table 1- Descriptive results relating to Age, Height and Body Mass of Brazilian athletes speed canoeing.

Variable	Groups ($\mu \pm s$)			
	Ka(n=16)	Ki(n=18)	Ca(n=15)	Ci(n=11)
Age (years)*	22,4±6,5	21±8,5	22,6±4,5	18,2±34
Body Mass (kg)*	75,5±11,3	76,7±9,8	77,6±8,1	63,8±9,9
Height (cm)	178,2±7,1	175,5±3,8	176,6±5,5	172,7±6,8

μ = mean; s = standard deviation; * significant difference between groups

The study Gobbo et al. (2002) the mean age of male Brazilian athletes of speed canoeing of 2002 was 19.5 ± 2.5 years, mean body mass was 79.9 ± 5.7 kg and the height was of 182.6 ± 4.8 cm.

The descriptive results of the qualitative and quantitative characteristics of dermatoglyphic profile of Brazilian athletes in speed canoeing, of canoe and kayak, and of high and intermediate, are showed in Tables 2, 3 and 4.

It was assigned a value to each type of drawing of each finger: Arch=0, Loop=1, Whorl=2: The type of drawing of a particular group is classified based on mean values: lower than 0,5 will be considered as arch(A), between 0,51 and 1,49 loops (L) and upper and equal to 1,5 whorls (W).

Table 2 – Type classification of fingerprints of each finger of Brazilian athletes speed canoeing.

Table 2 – Type classification of fingerprints of each finger of Brazilian athletes speed canoeing.

		MET1	MET2	MET3	MET4	MET5	MDT1	MDT2	MDT3	MDT4	MDT5
Ka	$\mu \pm s$	1,50±0,5	1,25±0,4	1,13±0,3	1,38±0,5	1,13±0,3	1,50±0,5	1,49±0,5	1,19±0,4	1,38±0,5	1,27±0,5
	DRAWING	W	L	L	L	L	W	L	L	L	L
Ki	$\mu \pm s$	1,38±0,5	1,11±0,6	1,11±0,5	1,33±0,5	1,0±0,0	1,44±0,5	1,38±0,5	1,33±0,5	1,50±0,5	1,00±0,0
	DRAWING	L	L	L	L	L	L	L	L	W	L
Ca	$\mu \pm s$	1,27±0,5	1,36±0,5	1,29±0,5	1,43±0,5	1,0±0,0	1,33±0,5	1,40±0,5	1,29±0,5	1,47±0,5	1,13±0,4
	DRAWING	L	L	L	L	L	L	L	L	L	L
Ci	$\mu \pm s$	1,45±0,5	1,00±0,6	1,18±0,4	1,45±0,5	1,18±0,4	1,45±0,5	1,18±0,4	1,18±0,4	1,45±0,5	1,45±0,5
	DRAWING	L	L	L	L	L	L	L	L	L	L

MET= Type of design of each finger of the left hand (1st to 5th finger).); **MED**= Type of design of each finger of the right hand (1st to 5th finger).; **L**=loop; **W**=whorl.

The sample showed similar types compared the five fingers of one hand with the other when it comes groups of high yield, Ca and Ka. According to Fernandes Filho (2009) in high yield there is a tendency that the results show a complete overlap of the drawings, setting up of the "mirror".

Table 3 shows the low occurrence of arcs (A) and a predominance of loop (L). As explained Del Vecchio and Gonçalves (2011) and Santos, Moreira Silva Dantas, and Fernandes Filho (2008), in high yield there is a tendency to decrease the arches (A) and increase of complex drawings.

Table 3 – Frequency distribution of types of design and digital formulas of Brazilian athletes in speed canoeing

Groups	Drawing (%)			Digital Formulas (%)							
	A	L	W	AL	AW	ALW	10W	L>W	W>L	10L	L=W
Ka	1,8	66,4	31,8	18,2	0	0	0	36,4	18,2	18,2	9,1
Ki	5,6	68,3	26,1	0	0	38,9	0	16,7	5,6	16,7	22
Ca	2,7	68,7	28,7	13,3	0	0	0	40	20	20	6,7
Ci	0,6	71,3	28,1	0	0	6,2	0	50	12,5	25	6,2

A=arch; L=loop; W=whorl; AL= presence of Arcs and Loops; AW= Presence of Arcs and Whorls; ALW= Presence of Arcs, Loops and Whorls; 10W= Presence of 10 Whorls; L>W= Presence of Loop and Whorl with predominant than Loop; W>L= Presence of Whorl and Loop with predominant than Whorl; 10L= Presence of 10 Whorls; L=W Equal amount of Loops e Whorls.

Despite the differences presented in the Table above, there was no statistical significance when comparing the mean values of Groups of drawings dermatoglyphic A ($p = 0.93$), L ($p = 0.899$) and W ($p = 0.996$).

Table 4– Mean values and comparing the D10, SQTL, MESQTL MDSQTL and Brazilian athletes in speed canoeing.

VARIABLES	Ka	Ki	Ca	Ci	Kruskal-Wallis
	$\mu \pm s$	$\mu \pm s$	$\mu \pm s$	$\mu \pm s$	Sig.
D 10	12,8±2,8	12,6±2,5	12,6±3,4	13±3,6	0,934
SQTL	139,2±26,9	141,3±39,6	144,8±45,8	128,7±4,6	0,708
MESQTL	69,7±12,9	69,6±20,5	70,9±24,8	62,3±23,3	0,576
MDSQTL	66,5±16,1	71,8±19,6	73,9±21,5	66,4±22,9	0,794

D10 = number of drawings of the ten fingers of the hands; SQTL = Sum of the Total Number of Lines ; MESQTL = Sum of the Total Number of Lines Left Hand MDSQTL = Sum of the Total Number of Lines right Hand; μ = Mean; s =standard deviation;.

It is possible to observe in Table 3 and 4, which athletes of both modalities, kayak and canoe, showed high values in the indices of D10 and LQTS. Abramova, Nikitina, and Ozolin (1995) reported that in high performance, high number of D10, the absence of arcs (A), the greater amount of complex drawing (L and W) and a high value for SQTG featuring sports of speed and strength, power and coordination as well as canoeing.

It also indicated a predominance of digital formula “L> W” in all groups, and can say that they have a predisposition to prolonged speed activities, corroborating the study of Nakamura (2004), who also found this ratio in results in speed canoeing. However, this difference was not statistically significant.

Table 5- Mean values and comparison of somatotype indices of Brazilian athletes in speed canoeing

ÍNDex	Ka $\mu \pm s$	Ki $\mu \pm s$	Ca $\mu \pm s$	Ci $\mu \pm s$	Kruskal-Sig.
ENDOMORPH*	2,44±1,87	2,51±1,10**	1,86±0,67	1,66±0,44**	0,027
MESOMORPH*	5,59±1,13	5,73±1,09	6,35±1,03**	5,01±0,65**	0,019
ECTOMORPH*	2,42±1,04	1,91±1,24	1,74±0,62**	3,19±0,98**	0,007

μ = Mean; s = standard deviation; ; * significant difference between Groups: ** significant differences among themselves by the Bonferroni test ($\alpha = 5\%$)

Table 6- Frequency distribution of the somatotype classification of Brazilian athletes in speed canoeing

GROUPS	SOMATOTYPE	FREQUENCY	PERCENTAGE
Ka	Ecto-Mesomorph	1	6,2
	Endo-Mesomorph	1	6,2
	Meso-Endomorph	2	12,5
	Balanced Mesomorph	3	18,8
	Meso-Ectomorph	9	56,2
Total		16	100%
Ki	Balanced Mesomorph	1	5,6
	Ecto-Mesomorph	2	11,1
	Mesomorph Endomorph	2	11,1
	Meso-Ectomorph	3	16,7
	Meso-Endomorph	10	55,6
Total		18	100%
Ca	Meso-Endomorph	4	26,7
	Meso-Ectomorph	5	33,3
	Balanced Mesomorph	6	40
Total		15	100,0%
Ci	Meso-Endomorph	2	18,2
	Balanced Mesomorph	2	18,2
	Mesomorph Ectomorph	3	27,3
	Meso-Ectomorph	4	36,4
Total		11	100,0%

It can be seen in Table 6, that groups of Ka and Ci had a mean somatotype Meso-Ectomorph, showing a relative musculoskeletal development and greater volume of muscle and bone. The group Ca presented balanced mesomorph that also represents high muscle-skeletal development, large bone diameters, large muscle volume and large joints. In turn, the group Ki had a mean of meso-endomorphic somatotype, which represents a moderate musculoskeletal development.

Thus, corroborating with the study of Machado (2010) and Lima, Sigwalt, Rech, and Petroski (2008) who find Mesomorph as the mean of somatotype of elite athlete's modality requiring efforts predominantly in muscle strength and power.

CONCLUSION

Although this modality, speed boating, can be practiced in calm waters requires an extremely fatiguing effort of strength and muscle power, developing the processes of muscle hypertrophy, as evidenced in the classification of somatotype, with the predominance of the mesomorph component, an extremely strong structure and low levels of body fat.

The results of this study also showed dermatoglyphic characteristics of speed kayaking athletes of different vessels, kayaks and canoes. Knowing the profile of these high-performance athletes determined parameters and model characteristics, and enables the aggregation of dermatoglyphics as markers of genetic potential, plus an assessment protocol and parameters for orientation training for sports according to their specificities.

Worth noting, that Brazil has achieved impressive results, but set up a profile for this sporty is a necessity, since in many variables the results were not homogeneous. It is pertinent to emphasize a thought researcher Fernandes Filho "[...] is not the athlete who chooses the sport, and yes, the sport who chooses the athlete." (Fonseca, Dantas, Roquetti Fernandes, & Fernandes Filho, 2008).

Can conclude that research like this, to collaborate as references for future research. Nevertheless, future studies on the identification of the genetic profile of this modality are still necessary to provide a greater potential of success in this sport.

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SAŽETAK

U fokusu ovog istraživanja bio je analizirati dermatoglifski profil i somatotip brazilskih kanuista. Ova studija je opisno komparativnog karaktera i uključivala je uzorak od 60 kanuista u disciplini sprint, koji su bili podijeljeni u četiri grupe u skladu klasifikacije prema: ka = visokih performansi kajaka, Ki = srednjeg učinka, Ca = visokih performansi kanua i Ci = srednji učinak kanua. Za utvrđivanje dermatoglifskog profila je korišten protokol prema Cummins i Midlo, a za utvrđivanje somatotipa protokol prema Heath i Carter. Statističke analize izvršene su testom Kruskal-Wallis i Bonferroni testom. Što se tiče dermatoglifskog uzorka pokazala se dominantnost "L" i digitalna formula "L>W", a sportista mora posjedovati brzinu i snagu, moć i koordinaciju, jer su presudne za uspjeh kanuista u disciplini sprint. Nisu utvrđene značajne razlike u D10, SQTL, MESQTL i MDSQTL između grupa. Utvrđeno je da je kod kanuista izražen somatotip mezomorf, što upućuje na izuzetno jaku tjelesnu strukturu i nizak nivo tjelesne masti. Ali, pokazale su se statistički značajne razlike između grupa kada je reč o indeksu somatotipa. Studije kao što je ova imaju za cilj optimizaciju strategije za selekciju i vođenje trenažnog procesa brazilskih elitnih sportista.

Ključne reči: genetski, sportski, performansi

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Correspondence:
Ana Paula Soares de Sousa,
Rio de Janeiro, Brasil
anapdesousa@hotmail.com

THE BIRTHPLACE OF SOCCER PLAYERS OF BRAZILIAN NATIONAL TEAMS IN WORLD CUPS

RODNO MJESTO FUDBALERA BRAZILSKOG NACIONALNOG TIMA I NJIHOVO UČEŠĆE NA SVJETSKIM PRVENSTVIMA

Abstract

The study has the objective to identify the region where the players from the male Brazilian Soccer National Teams were born and that represented Brazil 1st teams in World Cups. It was analyzed all the players who represented Brazil 1st National Teams in all World Cups organized by Football International Football Association from 1930 to 2014. The Brazilian soccer register expressive results worldwide regarding winning Cups and providing top players to the soccer market in different countries. The result shows that the distribution it is heterogeneous about the birthplace of the soccer players. The southeast and the south regions concentrate 86,6% of the born place and only two Federative Units. Sao Paulo and Rio de Janeiro have 63,46 %. The professional soccer player origin , still needs deep studies to be oriented regarding potential demands into the formation of the soccer player .

Key Words: soccer, Brazilian National Time, Birthplace

Luis Antonio Verdini de
Carvalho¹, João Felipe
Machado^{1,2}, Ana Paula
Soares de Sousa^{1,2}, José
Fernandes Filho^{1,2}

¹Universidade Federal
do Rio de Janeiro
²Laboratório de Biociências do
Movimento Humano – LABIMH

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Coresponding author:
Luis Antonio Verdini de Carvalho
verdini@eefd.ufrj.br

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INTRODUCTION

Soccer it is one of the most played sports worldwide. FIFA(Football International Football Association) is the organization body that controls soccer all over the world with 209 National Federations (FIFA.com, n.d.-b). It has more associated than UN (United Nations), 193 countries ('Países-membros - ONU', 2014).

The financial resources involved in soccer and in the player formation to become professional it is very high Soccer worldwide it is a great business. Accordingly with the final report from the Modernizing Plan-Brazilian Soccer .(2000) , done by Getulio Vargas Foundation (FGV). Including direct agents , clubs and federations . And indirects , like sports kits - and the media . The soccer in the world moves around 250 billions us dollars per year .In Brazil , the same report shows that soccer it is an economic activity with great capacity to provide jobs , with multiplier effect bigger than traditional sectors , accounting ; 300 thousand direct jobs - 30 million players (formal and not) - 580 thousand participants in 13 thousand teams that are involved in organized games (formal sport) - 580 stadiums with capacity to receive 5.5 millions supporters - around 500 professional clubs playing an average of 90 matches per year - regarding sports materials and playing kits , it is around 9 million boots for soccer and fut 5 a side , 6 millions balls and 32 millions t shirts (Leoncini & Silva, 2005). The Brazilian trade and commerce has huge influence from soccer .Soccer business has a considerable weigh in the Brazilian export industry .Selling players to clubs outside Brazil represented an increase of 34% in 2005 (around 6 billion us dollars) . It represents 40 % of the Brazilian export services (in 2005 , all the Brazilian export services was around 16 billion us dollars) (Alcântara, 2006) .

Brazil holds an outstanding position in soccer , being so , it is necessary a detailed knowledge about the players to serve as reference to develop soccer in all Brazilian regions , increasing the possibilities to form new professional players ." Brazil is outstanding in the world soccer market , providing several professionals , especially players , to all the world "(SOARES, 2010).

The search to become professional in soccer in Brazil it is impressive ." Studies about detecting and training talented players in soccer indicates that the market has as support a new type of professional formation agent , that enroll youth teenagers , generally , that belongs to the groups popular - medium part of the population"(Guedes, 1998).

Up to now, we have had 20 World Cups, since 1930 till 2014. There were no World Cup in 1938, 1942, 1946, due to the World War II. Brazil is the biggest winner with 5 titles. Italy and Germany with 4 titles Uruguai and Argentine 2 titles. France, England and Spain 1 (FIFA.com, n.d.-a).

Brazil has continental dimensions. With 5 big regions (midwest, northeast, north, southeast and south), subdivided in 26 federative units (states), plus the Federal District, like this; Midwest region; Federal District, Goias, Mato Grosso and Mato Grosso do Sul; Northeast region; Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe; North region; Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins; Southeast region; Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo; South region; Paraná, Santa Catarina and Rio Grande do Sul.

The birthplace indicates where there is a big probability to live, in this case, initiate the soccer practice. At least 85,1 % from the Brazilians, they live in the birthplace. See the table1 (Justo & Neto, 2009) :

Table 1 — Dimension from the internal migration in Brasil — 1980-2000

Source : Census Demographic from 1980, 1991 and 2000.IBGE

	1980	1991	2000
Numero de migrantes	15.809.743	21.435.954	25.530.231
Relação migrantes/população	12,9	14,4	14,9

Source : Census Demographic from 1980, 1991 and 2000.IBGE

The studied must indicate where soccer has a better structure and development by showing low index of birthplace from the players. "the success in soccer depends on many external reasons, like, training structure, multidisciplinary team, personal factors, social and cultural from the players "(Soares, De Melo, & Da Costa, 2011).

The objective from this study was to identify the geographic distribution, Region and Federal Unit, the birthplace of the soccer players from the Brazilian national teams in the World Cups.

METHODS

The work it is original with research Theoretic Empiric , type descriptive , with transversal line , regarding the Approach and with etiology ex-post-facto , about the technical procedures.

The population was composed by 312 athletes that participated in all World Cups organized by the Federation International Football Association , from 1930 up to 2014 , by the Brazilian 1st National Team . The informations were collected in the web (site www.ogol.com from the athletes of the National Teams . The informations were presented in absolute numbers by the quantity of players in each state and in percentage form referring to the region and to the state of the birthplace of each player .

The information analyzes of the birthplace , specifically region and Federal Unit , was done by descriptive statistic , using parameters of percentage distribution . To enter and storage the informations was used the program Microsoft Excel 2010 version .

RESULTS

The registers showed the distribution related to the players quantity in table 2:

Table 2- Birth of soccer players

Federal Unit	Number of Births
São Paulo	103
Rio de Janeiro	95
Minas Gerais	29
Rio Grande do Sul	28
Bahia	12
Pernambuco	10
Paraná	09
Pará	05
Paraíba	04
Espírito Santo	03
Alagoas	02
Distrito Federal	02
Mato Grosso do Sul	02
Rio Grande do Norte	02
Maranhão	01
Sergipe	01

DISCUSSION

It was observed in this study that there is an heterogenous distribution between the regions and the Brazilian Federal Units regarding the birthplace of the soccer players who represented Brazil National Teams in World Cups . That might indicates , probably , that exists more investment in the south east - south and north east regions , respectively , while in mid west and north regions the investment appear to be very low . Being so , based on such informations , we can conclude : to potentialize the discover and development of talents for soccer , it is necessary a better planning and bigger investment , mainly on the north and mid west regions .

Regarding the Federal Units , it was possible observed a polarization in the link Sao Paulo / Rio de Janeiro and a significant representation from Minas Gerais, Rio Grande do Sul, Bahia, Pernambuco and Paraná, and the others 20 Federal Units presents far results comparing with these 7 mentioned . " there are worry gaps for the development of the sport in high level in the country , committing the performance in a long term "(Mazei, Bastos, BÖHME, & Bosscher, 2014)

CONCLUSION

These results demonstrated a predominance in the south East region with 73,72% of the players birthplace ; followed by the south region with 13,14% ; north east region with 10,26 % ; north region with 1,60 % and midwest region with 1.08%.

To give a better characteristic to the formation process of the soccer players , we suggest that new studies are done , searching not only the birthplace of the soccer players , but also others important factors , like for example , the player formation place , the formation time on the base categories , among others . Still must be study in each Federal Unit how was presented the informations regarding the cities of birthplace of the soccer players .

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SAŽETAK

Studija ima za cilj da identificuje region u kojem su rođeni igrači iz muških brazilskih nogometnih reprezentacija i koji su predstavljali prvi timo Brazila na svjetskim prvenstvima. Analizirani su svi igrači koji su predstavljali Brazilsku reprezentaciju na svim svjetskim prvenstvima koje je organizovala FIFA u periodu od 1930. do 2014. godine. Brazilski fudbal ostvaruje zapažene rezultate širom svijeta u vezi sa svjetskim kupovima i obezbjeđivanjem vrhunskih igrača na fudbalskom tržištu u različitim zemljama. Rezultat pokazuje da je raspodjela heterogena prema mjestu rođenja fudbalera. Jugoistočni i južni regioni koncentrišu 86,6% mesta rođenja i samo dvije federalivne jedinice - Sao Paulo i Rio de Janeiro imaju 63,46%. Porijeklo fudbalera i vezu sa učešćem za reprezentaciju Brazila trebalo bi detaljnije proučavati kako bi se našla povezanost sa nastupom za brazilski tim.

Ključne riječi: fudbal, reprezentacija Brazila, mjesto rođenja

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Coresponding author:
Luis Antonio Verdini de Carvalho
verdini@eefd.ufrj.br

THE TRAINING SYSTEM OF ATHLETES WITH DISABILITIES IN STRENGTH SPORTS

SISTEM OBUKE SPORTISTA SA INVALIDITETOM U SPORTOVIMA SNAGE

Abstract

The analysis of scientific and methodological literature shows the fragmentary nature of the available information on the issues of training system for athletes with disabilities in strength sports. The mechanical transfer of unadapt scientific and methodological approaches to the preparation of athletes in the Olympic sport to adaptive sports is observed today. The aim of the research is to identify the peculiarities of composing a training system for athletes with disabilities in strength sports. We involved coaches ($n = 54$) working in the field of strength sports in the research. The questionnaire was conducted in an open form on the basis of 15 Regional Centers of Physical Culture and Sports for the Disabled "Invasport". Based on the analysis of questionnaire results, the theoretical structure of long-term multiannual preparation of athletes with disabilities in strength sports was developed. In addition, we have determined the recommended quantitative indices of competitive and training activities for athletes in strength sports. It was established that the structure of long-term multiannual preparation should include five stages, the duration of which depends on the level of remained motor abilities of athletes. The necessity of approaches correction is revealed for composing training system for athletes with disabilities in strength sports on the basis of adaptation of the corresponding approaches of general theory to the peculiarities of training athletes with disabilities.

Key words: long-term multiannual preparation, structure, adaptive sports.

Mariia Roztorhui¹, Alina Perederiy¹, Yuriy Briskin¹ i Olexandr Tovstonoh¹

¹Lviv State University of Physical Culture, Lviv, Ukraine

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Correspondence author:
Mariia Roztorhui,
Candidate of Sciences,
Doctoral candidate of Lviv State
University of Physical Culture,
Lviv, Ukraine
mariia.roztorhyi@gmail.com

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INTRODUCTION

The effectiveness of training system of people with disabilities in strength sports is determined by a number of factors. Important among them are the correctness of approaches to scientific and methodological support of their preparation, taking into account the level of saved motor abilities and peculiarities of motor activity (Bolach & Prystupa, 2014; DePauw, & Gavron, 1995; Winnick & Porretta, 2017).

Modern scientific research on training of athletes with disabilities in strength sports is based on scientific and methodological works devoted to certain aspects of training athletes with musculoskeletal system damage in powerlifting as a Paralympic kind of sports (Prystupa, Stefaniak & Rudenko, 2017). In particular, the authors have investigated the impact of powerlifting on the body of athletes with disabilities (Biankina & Khomichenko, 2015), historical aspects of powerlifting development for people with disabilities (Stecenko, 2013), improvement of physical, technical and mental fitness of athletes with disabilities in musculoskeletal system (Prystupa, Stefaniak & Rudenko, 2017) and consideration of nosological features of strength lifters with disabilities in musculoskeletal system in the training process (Ilmatov, 2015). The problem of training athletes of other nosological groups in powerlifting and arm-wrestling was studied by authors in terms of identifying the effectiveness of arm-wrestling for the socialization of people with disabilities (Kharitonashvili, Comaia & Budzishvili, 2007) and powerlifting for improving physical fitness of athletes with visual impairment (Gromov, 2006).

The fragmentary nature of the available scientific research makes it impossible to operate an effective scientific and methodological support for the training of athletes with disabilities in strength sports. Therefore, in the practice of sports, the training of athletes with disabilities is predominantly characterized by a mechanical transfer of approaches of general theory of athletes' training to the training of athletes with disabilities in strength sports (Fishe, McNelis, Gorsey, Dolbow & Goetz, 2015; Prystupa, Stefaniak & Rudenko, 2017). It may lead to reduction of sport longevity and possibility of realizing sports potential of people with disabilities in the process of achieving the maximum possible result (Sakakibara, Shin, Watanabe, & Matsuoka, 2014; Gee, West, & Krassioukov, 2015; Chatzilelecas, Filipović, & Petrinović, 2015; Fidler, Schmidt & Vauhnik 2017).

An analysis of the scientific and methodological base of adaptive sport points to a number of problems. In particular, the system of training athletes with disabilities is not adapted to the regularities of the development of sports skills in strength sports and the specifics of their saved motor abilities. Thus, the formation of scientific knowledge about the structure and content of multi-year preparation of athletes with disabilities in strength sports is becoming relevant.

The aim of research is to identify the peculiarities of composing a training system for athletes with disabilities in strength sports.

METHODS

The following methods were used in this research: bibliographic study of theoretical-conceptual, methodological and practical outlines presented in specialized scientific-methodical literature; study of documentary materials; method of inquiry, questionnaire; expert evaluation methods; method of mathematical statistics. In preparing the research we used conceptual approaches to working out scientific research questionnaires in physical education and sports (Ashmarin, 1978).

In the research were invited 54 coaches, among them: the Honored Coaches of Ukraine ($n = 13$), coaches of the highest category ($n = 10$), coaches of the first category ($n = 16$), coaches of the second category ($n = 10$), coaches without category ($n = 5$). It had been

continuing from September 2017 to December 2017. Among the respondents, 31 coaches work in Regional Centers of Physical Culture and Sports for the Disabled "Invasport" and 23 coaches work on a voluntary basis with athletes with disabilities. The average work experience of respondents in the field of strength sports for the disabled was $9,44 \pm 6,01$ years, and their average age – $39,49 \pm 9,54$ years. All respondents gave permission to disclose information about their participation in the research.

The questionnaire included section on demographic information about respondents (age, work experience, qualifications, kind of sport) and the main part, which included 8 open-ended questions, 3 questions regarding the ranking of response criteria and 2 close-ended questions. Open-ended questions related to the definition of quantitative indices on different issues of training system for athletes with disabilities in strength sports (number of training sessions, number of hours in one microcycle, number of competitions, percentage ratios of different types of training).

The arithmetic mean (X) and the standard deviation (σ) were calculated to determine the average demographic information of the respondents and the answers to questions, where numbers were involved. There was calculated Kendall's coefficient of concordance (W) for the questions that provided the answer in the form of indices ranking for significance. The purpose of this was to evaluate the extent of the agreement among raters in relation to the ranking of response criteria. The statistical processing of the research materials was conducted using the Microsoft Excel 2010 software package and the Statistica 6.0 software.

RESULTS

The analysis of respondents' answers to the question about the methodological basis for composing training system of athletes with disabilities shows that 81,48% of respondents use syllabus for healthy athletes in their practice. At the same time, 90,74% of respondents indicated that while training athletes with disabilities, they primarily guided by their own experience, because there are no training programs of athletes with disabilities in strength sports. Only 44,44% of respondents are familiar with foreign programs for people with disabilities.

According to expert's opinion in the field of strength sports for the disabled (96,29% of respondents), the structure of long-term multiannual preparation of athletes with disabilities should differ from those accepted in the general theory of training of athletes. Among responses 98,14% consider that the length of stages of training system depends on the level of remained motor abilities of athletes.

Results of answers on the question allowed us to form the theoretical model of long-term multiannual preparation of athletes with disabilities in strength sports, which includes five main stages shown in Figure 1.

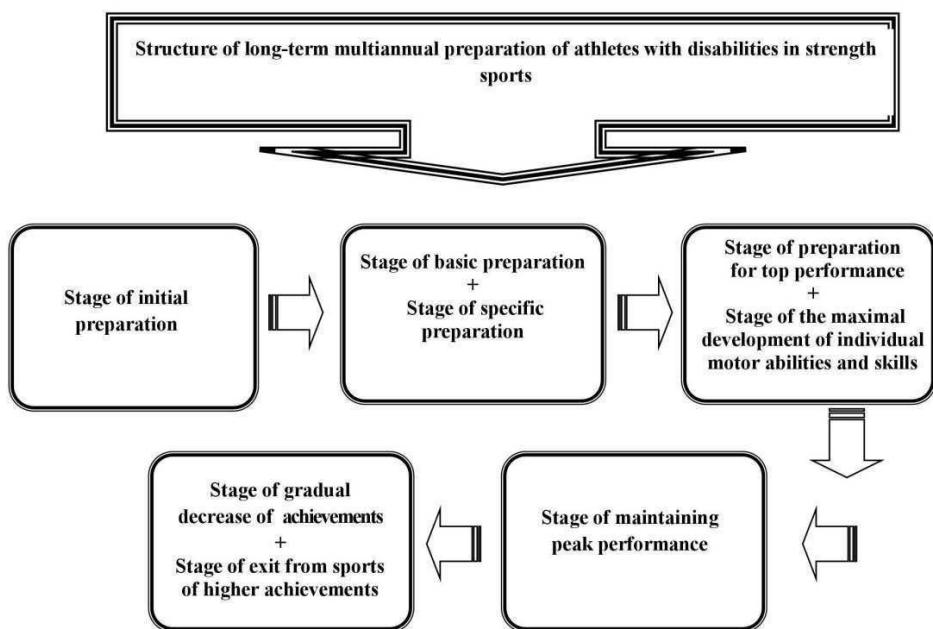


Figure 1. Theoretical model of the structure of long-term multiannual preparation of athletes with disabilities in strength sports.

In the structure of long-term multiannual preparation of athletes with disabilities in strength sports, it is necessary to single out the stages of initial preparation (100, 00% of respondents) and stages of maintaining peak performance (98,15% of respondents). Percentage indices about the allocation of other stages in the structure of long-term multiannual preparation for athletes with disabilities were less than the statistical majority.

Respondents indicated the need to combine some of the stages in different ways. According to 70,37% of respondents, in the structure of long-term multiannual preparation of athletes in strength sports there is a need for scientific and methodological substantiation of a new stage of preparation. The purpose and tasks of it will be deciding the declared goal and tasks of the stage of gradual decrease of achievements and exit from sports of higher achievements. In opinion of 55,56% respondents the stages of basic preparation and specific preparation need to be combined into a single stage in long-term multiannual preparation of athletes with disabilities. At the same time 53,70% of respondents believe that the stages of preparation for top performance and the maximal development of individual motor abilities and skills need to be reformatted into a single stage, which will solve the common tasks of preparation of both stages.

Respondents also determined the quantitative indices of competitive and training activities of athletes with disabilities of different qualifications in strength sports, which are described in Table 1.

Table 1. Recommended quantitative indices of competitive and training activities of athletes with disabilities of different qualifications in strength sports

Qualification of athletes	Number of competitions in annual training cycle		Number of training sessions in a weekly microcycle		Number of hours of training sessions in a weekly microcycle	
	X	σ	X	σ	X	σ
Junior grades	2,41	±0,69	3,28	±0,76	7,07	±1,71
III sporting grade	3,17	±0,67	4,20	±0,74	8,41	±1,46
II sporting grade	3,98	±0,69	4,76	±0,85	11,19	±2,19
I sporting grade	4,63	±0,77	5,74	±0,81	14,54	±2,62
Candidate for Master of Sport	5,54	±0,72	6,83	±1,16	19,26	±2,67
Master of Sport	6,46	±0,70	8,33	±1,27	24,35	±2,83
Master of Sport International Class	6,39	±0,66	9,82	±1,84	27,82	±2,17
Merited Master of Sport	5,48	±0,67	10,78	±1,94	28,65	±1,88

Legend: X – average mean; σ - standard deviation.

During the realization of research, we found that, according to the opinions of respondents, the most important criterion is the fulfillment of the requirements for the assignment of sports grades and titles. At the same time, the level of consistency of opinion of respondents in all cases was satisfactory (coefficient of concordance ($W = 0,698-0,764$).

When determining the significance of the criteria for the transfer of athletes with disabilities from junior grades to the next training group, the first place with a sum of 198 and an average grade of 3,67 (standard deviation, $SD = 0,52$) respondents gave to special transfer tests from the kind of sport. The next criterion of significance is the scales for assessing the motor abilities of athletes with disabilities with a sum of 165 and an average grade of 3,06 ($SD = 0,42$). The criterion for fulfilling the requirements for the assignment of sports grades and titles was ranked third (rank sum was 103, average rank 1,91, $SD = 0,70$). The criterion duration of training of athletes, according to respondents, is the least significant when determining readiness for transfer of athletes with disabilities to the next group of training (the sum of ranks was 64, the average rank 1,19, $SD = 0,40$). The value coefficient of concordance was 0,606, which suggests satisfactory consistency of opinion of respondents.

DISCUSSION

The assumptions concerning the mechanical transfer of approaches of general theory of athletes' training to the training of athletes with disabilities has been confirmed. This statement is found in the works of a number of authors, which studied the characteristics of the training of athletes in adaptive sports (Herasymenko, Mukhin, Pityn & Kozibroda, 2016; Cruz & Blauwet, 2018). The obtained results also confirm the necessity of taking into account the level of remained motor abilities when composing training system of athletes with disabilities, which was declared by other authors (Biankina & Khomichenko, 2015; Prystyta, Stefaniak & Rudenko, 2017).

For the first time was developed a theoretical model of the structure of training system for athletes in adaptive sports. The respondents identified five main stages in the structure of long-term multiannual preparation of athletes with disabilities. Some respondents proposed the allocation of a new stage, which is different from the stages declared in the general theory of training of athletes - a rehabilitation stage. Among of the interviewed coaches 33,33% indicated in the rationale for the structure of long-term multiannual preparation of athletes with disabilities that the modern system of long-term multiannual preparation for this athletes needs the allocation of a rehabilitation stage as a separate structural element. The percentages for the allocation of this stage are lower than the statistical majority. Simultaneously a qualitative analysis of the level of professional qualification of respondents who insist on the allocation of this stage, allow us to put forward some hypothesis. It refers to the need for additional researches on the rehabilitation stage as a separate structural element of long-term multiannual preparation of athletes with disabilities in strength sports. Among the respondents who indicated the need for the rehabilitation stage were 11 Honored Coaches of Ukraine, 3 coaches of the highest category and 4 coaches of the first category. This determines the need to take into account the opinion of these coaches in the process of scientific and methodological substantiation of long-term multiannual preparation. In researches of some authors there are attempts to substantiate this stage as an integral part of the structure of long-term multiannual preparation of athletes with injuries in the musculoskeletal system (Briskin, Evseev & Perederiy, 2010; Biankina & Khomichenko, 2015).

As the result of analysis of respondents' answers, for the first time has defined recommended number of competitions in annual training cycle, in which athletes with disabilities of different qualifications in strength sports should participate. In addition, the available information was supplemented with quantitative indices of training sessions in a weekly microcycle for athletes with disabilities of different qualifications in strength sports. Comparative analysis of the obtained indices number of hours of training sessions in a weekly microcycle for athletes with disabilities and the norms of the weekly regimen of training for people with disabilities in children's and youth sports schools, indicates the need of correction weekly training session norms for athletes with disabilities. Besides, the norms, which were approved by the normative documents of the weekly training work for athletes with disabilities coincide with these norms for healthy athletes. It reflects the negative tendency for the mechanical transfer of organizational and methodological approaches for preparation of athletes in the Olympic sport to the preparation of athletes with disabilities.

One of the results of research, which was found out for the first time, is the definition by respondents the importance of criteria for determining the readiness of athletes with disabilities of different qualifications specializing in strength sports for transfer to the next training group. According to the opinions expressed, the most significant for athletes of the youth grades are special transfer sports tests for the assessment of special preparedness. Equally important are the scales for assessing of remained motor abilities of athletes with disabilities. At the same time, the criterion of fulfilling the requirements for the assignment of sports grades and titles according to the Uniform Sport Classification, which respondents identified as the most significant for skilled and highly skilled athletes with disabilities, was ranked only third in the rankings for athletes of junior grades. As in strength sports, sports result directly depends on the level of remained motor abilities of athletes, athletes with severe forms of lesions cannot fully realize their sporting potential. This suggests the need for using special transfer tests and scales of assessment of saved motor abilities in order to assess the readiness of athletes for transfer to the next training group. And also it is confirming the need for a significant correction of approaches to the training of athletes with disabilities in strength sport.

CONCLUSIONS

It has been established that the structure of long-term multiannual preparation for athletes with disabilities should be different from the structure of long-term multiannual preparation for athletes in the Olympic sport. And also should be adapted to the needs of the practice of strength kinds of adaptive sports.

The theoretical model of structure of long-term multiannual preparation of athletes with disabilities was developed. There were determined recommended quantitative indices of competitive and training activities for athletes with disabilities of different qualifications in strength sports.

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SAŽETAK

Analiza naučne i metodološke literature pokazuje fragmentarnu prirodu dostupnih informacija o pitanjima sistema obuke sportista sa invaliditetom u sportovima snage. Danas se posmatra mehanički prenos neadekvatnih naučnih i metodoloških pristupa pripremi sportista u olimpijskom sportu do adaptivnog sporta. Cilj istraživanja je da se identifikuju specifičnosti sastavljanja sistema treninga za sportiste sa invaliditetom u sportovima snage. U istraživanju su uključeni treneri ($n = 54$) koji rade na snazi u sportu. Upitnik je proveden u otvorenom obliku na osnovu 15 regionalnih centara fizičke kulture i sporta za invalide "Invasport". Na osnovu analize rezultata upitnika razvijena je teorijska struktura dugoročne višegodišnje pripreme sportista sa invaliditetom u sportovima snage. Pored toga, utvrđeni su preporučeni kvantitativni pokazatelji konkurentnih aktivnosti sportista u sportovima snage. Utvrđeno je da struktura dugoročne višegodišnje pripreme treba da sadrži pet faza, čije trajanje zavisi od nivoa ostatnih motoričkih sposobnosti sportista. Otkrivena je neophodnost korekcije pristupa za sastavljanje sistema obuke za sportiste sa invaliditetom u sportovima snage na osnovu prilagođavanja odgovarajućih pristupa opšte teorije osobenosti treninga sportista sa invaliditetom.

Ključне речи: dugoročna višegodišnja priprema, struktura, adaptivni sportovi

ПОДГОТОВКА СПОРТСМЕНОВ С ИНВАЛИДНОСТЬЮ В СИЛОВЫХ ВИДАХ СПОРТАХ РЕЗЮМЕ

Анализ научно-методической литературы свидетельствует о фрагментарном характере имеющегося научного знания по проблематике подготовки спортсменов с инвалидностью в силовых видах спорта. Сегодня наблюдается механическое перенесение неадаптированных научно-методических подходов к подготовке спортсменов в олимпийском спорте в адаптивный спорт. Целью исследования является выявление особенностей построения подготовки спортсменов с инвалидностью в силовых видах спорта. Исследование проводилось с привлечением тренеров ($n = 54$), которые работают в области силовых видов спорта. Анкетирование было проведено в открытой форме на базе 15 региональных центров физической культуры и спорта инвалидов «Инваспорт». На основе анализа полученных результатов разработана теоретическая структура многолетней подготовки спортсменов с инвалидностью в силовых видах спорта, определены рекомендованные количественные показатели соревновательной и тренировочной деятельности спортсменов с инвалидностью в силовых видах спорта. Установлено, что структура многолетней подготовки спортсменов должна включать пять этапов, продолжительность которых зависит от уровня сохранившихся двигательных возможностей спортсменов. Выявлена необходимость в коррекции подходов к построению многолетней подготовки спортсменов с инвалидностью в силовых видах спорта на основе адаптации положений общей теории подготовки спортсменов к специфике подготовки спортсменов с инвалидностью.

Ключевые слова: многолетняя подготовка, структура, адаптивный спорт.

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Correspondence author:

Mariia Roztorhui,

Candidate of Sciences,

Doctoral candidate of Lviv State University of Physical Culture,

Lviv, Ukraine

mariia.roztorhyi@gmail.com

THE TEACHER AS A FACTOR OF IMPROVING THE EFFECTS OF PHYSICAL EDUCATION CLASSES AMONG YOUNGER SCHOOL AGE CHILDREN

NASTAVNIK KAO FAKTOR POBOLJŠANJA EFEKATA NASTAVE FIZIČKOG VASPITANJA UČENIKA MLAĐEG ŠKOLSKOG UZRASTA

ABSTRACT

The aim of this research was to present the effects of an experimental program including physical education classes among children aged 10-11. The experimental treatment lasted from March 1, 2010 to March 1, 2011, was realized in 16 elementary schools in the Republic of Srpska/B-H, and included the volunteer work of 20 physical education professors with no previous work experience with fourth and fifth grade students, that is, teachers, who in accordance with the law carry out the prescribed work with the aforementioned age group. The program included 1558 male and female students from city and suburb areas, 1213 of whom made up the experimental, and 345 the control group.

All of the participants were tested using the "EUROFIT" battery of tests. Seven variables from the area of motor skills were analyzed. The program was approved by the Ministry of Family, Youth and Sports and the Ministry of Education and Culture of the Republic of Srpska, and was realized in accordance with the national curriculum with the help of these two ministries, the Faculty of Physical Education and Sport of the University of Banja Luka and the Pedagogical Institute.

Following the completion of the initial and final measurements of the experimental and control group, the conclusion was reached that the students from the experimental group achieved statistically significant better results on the tests of motor skills. Considering that the experimental program lasted for one year, and that all the participants were tested using the same methods and under the same conditions, and after comparing the results of the final measurement, we could say that the work of the physical education teachers during physical education classes for younger school age children had a positive effect on the development of the tested motor skills of the students.

Keywords: teacher, physical education classes, younger school age

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Gorica Bilak-Moconja¹, Radenko Dobraš², Goran Tadić³, Aleksandar Kukrić², Borko Petrović² & Darko Stojanović⁴

¹Ministry of Family, Youth and Sport, Government of Republic of Srpska, Banja Luka, B&H

²Faculty of Physical Education and Sport, University of Banja Luka, B&H

³Public institution Primary School "Sveti Sava", Modriča, B&H

⁴Faculty of Sport and Physical Education, University of Niš, Serbia

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Coresponding author:
Gorica Bilak - Moconja,
Master of Science in Physical Culture,
Senior Associate for School Sports in the
Ministry of Family, Youth and Sports,
Republic of Srpska, B&H
goricabilak@gmail.com

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INTRODUCTION

Younger school age students are constantly exposed to increased stress, starting with the fact that prior to starting school, by playing in a carefree manner they constantly moved and did not have any continued obligations. A change in lifestyle, which primarily refers to long-term sitting, and carrying a school bag, which is often inadequate and too heavy for the age of the students, provide favorable conditions for creating a physical imbalance, and thus the occurrence of milder and/or more severe forms of physical deformity. Precisely because of that, it is necessary for physical education classes for younger school age children to be adapted to their needs, and thus make up for at least one part of the movement needed at that age. Adequate and properly managed physical education classes certainly have a positive effect on the body and the physical status of students, but at the same time, any incompetently organized classes can certainly have a negative effect on their body, but also their motivation to participate in physical activities in the future.

The national curriculum for elementary education in the Republic of Srpska prescribes three physical education classes a week for younger school age children, from the second to the fourth grade (the Ministry of Education and Culture, 2006). The fact that this particular subject has the greatest number of weekly classes (right after the native language classes and math classes) is a clear indication of the importance of this subject for the younger school age children. The goals of physical education for students is to satisfy their need for movement, preserve and fortify their health and healthy habits, the development of motor skills and psychomotor features, especially flexibility, strength, speed, agility, to accustom the body to more difficult and complex movement, overcoming and acquiring the basic techniques of particular sports, develop positive moral-voluntary features, prepare students for the practical application of the acquired content in everyday life, and thus the development of work habits. (Hadžikadunić & Mađarević, 2004). In the case of the number of weekly physical education classes, that is, the required weekly frequency of physical activity of the students, most authors, such as Findak (1989), prescribe a minimum of 30 to 60 minutes of physical activity a day, in order to provide for the proper development of the child (Strong, Malina, Blimkie, Daniels, Dishman, Gutin, Hergenroeder, Must, Nixon, Pivarnik, Rowland, Trost & Trudeau, 2005; Pate, Davis, Robinson, Stone, McKenzie & Young, 2006). Motor skills include human abilities which are included in solving motor tasks and which condition successful movement, irrespective of whether these abilities are acquired through training or not (Malacko, 1991). During growth and development, children pass through *sensitive phases* for motor development, that is, periods when it is most suitable to use systematic exercise to influence the development of certain abilities. These sensitive phases are periods when the systems of the human responsible for a certain ability undergo the greatest changes and are considered the most suitable for applying training for the development of these abilities. Bearing in mind precisely this fact, it is necessary to devote much more attention to the more professional physical education classes for students of a younger school age, as well as adhere to the prescribed number of classes for students of this age.

Classroom teachers in elementary schools in the Republic of Srpska who during their education attended the obligatory course Methodology of Physical Education for a period of two semesters, are in charge of carrying out physical education classes for students of a particular age. However, according to a survey which was carried out for the needs of the Sport development strategy of the Republic of Srpska for 2008-2012, the Ministry of Family, Youth and Sports (2008) announced that of the overall 377 analyzed students, only 3,9% of them

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responded that they had physical education classes three times a week, which is not even close to the recommended daily physical activities. The volunteers who carried out the experimental program are graduates of the Faculty of Physical Education and Sport, and were tasked, primarily, with carrying out physical education classes for the appropriate age groups, based on the national curriculum and adhering to the prescribed number of classes. Physical education teachers, when realizing the experimental program, carried out tasks in accordance with didactic principles (the principle of awareness, health-educational focus, practical applicability, obviousness, individualization, planned load, entertainment and relaxation, etc.), and submitted reports on the realization of the program and classes in general which provided control of the experimental program. They also acted in a motivated and responsible manner towards realizing the program, bearing in mind that they were aware of the importance of monitoring the development of the motor skills of students as a part of physical education classes. Over the past few years, authors from the US have especially focused on issues which are tied to the benefits of monitoring the physical development of children and youths within physical education classes (Keating & Silverman, 2004; Harris & Cale, 2006; Mahar & Rowe, 2008; Morrow & Ede, 2009). Namely, these authors confirm that at the end of the 1990's a new concept emerged in monitoring motor structures which speaks of the connection between motor skills and health, and which differs from the existing concepts and understanding of the measurements and monitoring of the values of the motor dimensions of children and youths.

The aim of this research was to determine the extent to which another approach to physical education classes of a younger school age, that is, carrying out physical education classes by physical education teachers (instead of classroom teachers) influences the motor skills of a particular age group.

METHOD

All of the participants were male/female fourth/fifth grade students, aged 10-11, who regularly attend physical education classes and do not have any physical impediments that would prevent them from attending these classes. The sample is homogenous and consists of a total of 1558 participants (790 male and 768 female students). The experimental group consisted of 1213 participants (634 male and 579 female students). The control group was made up of 345 participants (156 male and 189 female students). All of the students were tested using the "EUROFIT" battery of tests which is prescribed by the Committee for the development of Sport of the European Union. The "EUROFIT" battery of tests (Eurofit, 1993) is a set of nine simple tests which focus on flexibility, strength, endurance and power. Due to the lack of props and insufficient facilities of the school sports halls, it was not possible to perform two of the tests from the standard battery.

The following tests were used (Hadžikadunić, Rađo, Grozdanić & Turković, 2000):

- Flamingo balance test (FLB) – general balance
- Hand tapping (PLT) – speed of alternate movement
- Seated forward bend (SAR) – agility of the hip joint
- Standing depth jump (SBJ) – explosive power of the leg muscles
- Sit-ups (SUP) – repetitive strength of the abdominal muscles and the flexor muscles in the hip joint
- Hanging pull-up (BAH) – static power of the arm and shoulder belt muscles

- Running an obstacle course 10×5 (SHR) - agility

The data compiled during the research were processed using descriptive and comparative statistics (the T- test for dependent samples and the T- test for independent samples) using the statistical package IBM SPSS Statistics.

RESULTS

By analyzing the statistics of both groups, it was determined that the values of the means of all the variables indicate a better result in the final measurement. The variance coefficients, as the representatives of group homogeneity, indicate that for most variables the studied sample does not represent a homogenous group. For this research, what was of special interest was studying the groups individually, as well as comparing them, and so the analysis of each individual group was undertaken. The members, both of the control and the experimental group individually, represent homogenous groups based on the results of the tests which most of the students can, more or less, successfully perform. The problem of homogeneity only emerges where the tasks are such that a great number of students cannot perform them, so certain students make up a special sub-sample within the group they belong to. The aforementioned particularly refers to the tests BAH, SUP and FLB.

The T test for dependent samples for the control group (Table 1) has indicated that the participants of the control group achieved better results on the final than the initial measurements. For the FLB and SAR test, this difference is not statistically significant, while for the other tests a significance was noted at the level 0.05 (SBJ, SUP, BAH) and 0.01 (SHR and PLT). The T test for dependent samples for the experimental group (Table 2) showed that the experimental group realized better results on all the measured variables during the final measurement compared to the results achieved at the initial measurement, and this indicates the significance of these differences, which is at the 0.01 level. The significance of the difference for the variable SAR is at the 0.05 level.

Table 1. The differences between initial and final measurements of the control group

Variable	INI	FIN	T	p
FLB	1.73	1.82	-1.708	.089
PLT	16.46	15.71	3.944	.000*
SAR	18.12	17.93	.605	.546
SBJ	134.40	131.22	-2.445	.015*
SUP	17.10	17.95	-2.510	.013*
BAH	13.61	15.17	-2.317	.021*
SHR	26.41	25.88	2.864	.004*

Legend: INI – arithmetic mean of initial measurement; FIN – arithmetic mean of final measurement; T – t test for dependent samples; p – coefficient of difference significance; * - statistically significant differences.

Table 2. The differences between initial and final measurements of the experimental group

Variable	INI	FIN	T	p
FLB	1.67	2.22	-47.375	.000*
PLT	16.94	14.56	11.738	.000*
SAR	17.97	18.48	-2.142	.032*
SBJ	134.16	140.56	-9.350	.000*
SUP	17.05	19.97	-19.729	.000*
BAH	13.24	18.19	-11.903	.000*
SHR	26.92	24.78	11.172	.000*

Legend: INI – arithmetic mean of initial measurement; FIN – arithmetic mean of final measurement; T – t test for dependent samples; p – coefficient of difference significance; * - statistically significant differences.

This research is of particular importance for the existence or lack of any differences between the control and experimental group. In order to obtain these data, the T test for independent samples was used. The T test for independent samples used on complete sample of participants (Table 3) indicated that there is no statistically significant difference in the achieved results at the initial measurement. This data is of special importance for the further course of the research, bearing in mind the extent of the homogeneity of the groups which will undergo the experimental procedure. For this sample this is of special importance, knowing that we cannot homogenize this group any further, since in that case it would be necessary to regroup children from various classes, which is impossible in practice. The lack of any significant differences of the tested groups at the initial measurement (Table 3) is expected, bearing in mind that the sample included students of the same age, who took part in the same physical education classes.

Table 3. Differences between groups on initial measurement

Varijable	Mean K	Mean E	t	p
FLB	1.73	1.67	-1.339	0.245
PLT	16.46	16.94	1.540	0.124
SAR	18.12	17.97	-0.298	0.725
SBJ	134.40	134.16	-0.151	0.880
SUP	17.10	17.05	-0.137	0.891
BAH	13.61	13.24	-0.440	0.660
SHR	26.41	26.92	1.341	0.180

Legenda: Mean K – the arithmetic mean of the control group; Mean E – the arithmetic mean of the experimental group; t – t test for independent samples; p – coefficient of difference significance; * - statistically significant differences.

During the experimental program, which lasted for one year, for the students of the control group physical education classes were carried out in the usual manner by the classroom teacher. Physical education teachers worked with the students who were members of the experimental group, instead of their classroom teachers. Following the experimental program, final measurements were taken with the aim of comparing the results of the experimental and control group to determine the existence of possible differences (Table 4).

Table 4. Differences between groups on final measurement

Variable	Mean K	Mean E	t	p
FLB	1.82	2.22	11.072	0.000*
PLT	15.71	14.56	-3.420	0.000*
SAR	17.93	18.48	1.028	0.172
SBJ	131.22	140.56	5.190	0.000*
SUP	17.95	19.97	5.955	0.000*
BAH	15.17	18.19	2.658	0.002*
SHR	25.88	24.78	-3.148	0.000*

Legenda: Mean K – the arithmetic mean of the control group; Mean E – the arithmetic mean of the experimental group; t – t test for independent samples; p – coefficient of difference significance; * - statistically significant differences.

Table 4 presents the results of the T test for the experimental and control group at the final measurement. As can be seen from the aforementioned, there is a statistically significant difference for all the measured variables in favor of the experimental group, except for the variable SAR. The significance of the differences for the variables FLB, PLT, SBJ, SUP and SHR is at the 0.01 level of significance, while the significance of the variable BAH is at the 0.05 level.

DISCUSSION

Bearing in mind that all the participants were in the sensitive period motor skill development, it was expected that the T test for dependent samples for the control and experimental group in individual measurements would indicate that better results were achieved on the final measurement compared to the initial one. However, what is of key importance for this research is the existence of a difference between the groups of participants at the initial and final measurement, obtained by the T test for independent samples, which tells us that there are statistically significant differences between the control and experimental group of participants at the final measurement.

FLB: There is a statistically significant difference between the control and experimental group at the 0.01 level of significance ($p=.000$). The experimental group achieved better results. At the initial measurement the difference between the groups was not statistically significant.

PLT: There is a statistically significant difference between the control and experimental group at the 0.01 level of significance ($p=.000$). The experimental group achieved better results. At the initial measurement the difference was not statistically significant.

SAR: The difference for the studied variable was not statistically significant ($p=.172$), although the experimental group achieved a slightly better result, but without statistical significance. It should be mentioned that when analyzing the results of the initial and final measurement, a statistically significant improvement was noted for the experimental group at the 0.05 level of significance ($p=0.032$), while the progress of the control group is not statistically significant. The explanation for the lack of any significant difference among the groups at the final measurement for the course variable can be found in the fact that the control group had better results at the initial measurement (although not statistically significant), while the experimental group was better at the final measurement.

SBJ: It was determined that the control and experimental group differ in a statistically significantly manner at the 0.01 level ($p=.000$). The experimental group achieved better results. At the initial measurement the results were similar.

SUP: For the studied variable it was determined that the control and experimental group differ in a statistically significant manner at the 0.01 level of significance ($p=.000$), in favor of the experimental group which achieved better results. At the initial measurement the results were almost equal.

BAH: The control and experimental group differed in a statistically significant manner at the 0.01 level of significance ($p=.002$) in favor of the experimental group. At the initial measurement the results were similar.

SHR: There is a statistically significant difference between the control and experimental group at the 0.01 level ($p=.000$). The experimental group achieved better results. At the initial measurement the results were similar.

It should be pointed out that the positive effects of developing motor skills can be seen through the regular realization of the curriculum. Zurec (2009) carried out a study which indicated that obligatory physical education classes in the elementary schools of Slovenia are not enough to meet the children's need for regular physical activity, and our case indicates how the regular physical education classes have a positive effect.

CONCLUSION

Based on the obtained research results, the following conclusions were made:

At the *initial measurement* for all the studied variables no statistically significant differences were noted between the control and experimental group.

At the *final measurement* the experimental group of participants achieved statistically significant better results on the motor tests, except for the variable SAR.

Based on the realized study and the year-long experimental program within which physical education teachers carried out physical education classes instead of classroom teachers, and in accordance with the obtained research results, it can be concluded that the students from the experimental group over the course of the year-long program achieved statistically significant results on the tests of motor skills.

The experimental group of students were provided with more professional physical education classes which led to better results on the tests of motor abilities, compared to the students of the same age who were not influenced by the experimental program.

The practical importance of the paper has both a narrow and broad scope. In a more narrow sense, it can be seen in the significant improvement of motor skills compared to the physical education classes of the students in the control group. At the same time, we should mention that physical education classes carried out in the schools included in the program also gained in importance, since there was a significant change in the attitude towards these types of classes (of the parents, school authorities, other teachers, classroom teachers...). In a broader sense, the contribution of the research lies in the very participation of the government of the Republic of Srpska in the realization of this research and the willingness to treat physical education among younger school age children in the way, due to the importance of this period in human development, it deserves.

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SAŽETAK

Cilj ovog istraživanja je prikazati efekte eksperimentalnog tretmana u nastavi fizičkog vaspitanja kod djece uzrasta 10-11 godina. Eksperimentalni tretman je trajao u periodu 01.03.2010. do 01.03.2011. godine u 16 osnovnih škola Republike Srpske/BiH, koji je uključivao volontiranje 20 diplomiranih profesora fizičkog vaspitanja bez radnog iskustva u četvrtim i petim razredima osnovnih škola, koji su provodili nastavu fizičkog vaspitanja umjesto nastavnika razredne nastave, odnosno učitelja, koji u skladu sa zakonskim odredbama provode nastavu u navedenom uzrastu. Tretman je uključivao 1558 učenika i učenica iz gradskih i prigradskih sredina, od toga 1213 ispitanika je bilo u eksperimentalnoj, a 345 ispitanika u kontrolnoj grupi.

Svi učenici su testirani baterijom "Eurofit" testova, odnosno analizirano je sedam varijabli iz oblasti motoričkih sposobnosti. Tretman je odobren od strane Ministarstva porodice, omladine i sporta i Ministarstva prosvjete i kulture Vlade Republike Srpske, a realizovan je u skladu sa Nastavnim planom i programom u saradnji sa ova dva ministarstva, Fakultetom za fizičko vaspitanje i sport Univerziteta u Banjoj Luci i Republičkim pedagoškim zavodom.

Nakon izvršenog inicijalnog i finalnog mjerena eksperimentalne i kontrolne grupe učenika, došlo se do zaključka da su učenici eksperimentalne grupe postigli statistički značajno bolje rezultate u testovima motoričkih sposobnosti. Budući da je eksperimentalni tretman trajao godinu dana, i da su svi ispitanici testirani istim metodama u istim uslovima, a uvidom u poređene rezultate finalnog mjerena, može se reći da je rad diplomiranih profesora fizičkog vaspitanja u nastavi fizičkog vaspitanja mlađeg školskog uzrasta pozitivno uticao na razvijanje testiranih motoričkih sposobnosti učenika.

Ključne riječi: *nastavnik, nastava fizičkog vaspitanja, mlađi školski uzrast*

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Coresponding author:
Gorica Bilak - Moconja,
Master of Science in Physical Culture,
Senior Associate for School Sports in
the Ministry of Family, Youth and Sports,
Republic of Srpska, B&H

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