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COMPARATIVE ANALYSIS OF DIFFERENCES IN EXHIBITING FLEXIBILITY IN YOUNG FOOTBALL PLAYERS AND KARATE PRACTITIONERS (KARATEKA)

Šunje Enes[1], Čolakhodžić Ekrem[2], Novaković Rijad[1], Alić Džafer[2], Redžić Enaid[1]

[1] Doctoral study in the field of kinesiology, Faculty of Education, Džemal Bijedić University of Mostar
[2] Faculty of Education, Džemal Bijedić University of Mostar

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Abstract
The athlete's ability to achieve the maximum amplitude of movement in certain sports can be crucial for achieving a top result. Most theorists consider flexibility to be one of the essential motor skills of humans. Flexibility is defined as the ability of the locomotor apparatus to realize movements of optimal amplitude in a certain joint. The goal of this research was to determine the differences in flexibility between football players and karate practitioners (karateka) between the ages of 12 and 14 years, in chronological order. The purpose of this paper is to determine the differences in flexibility between football players and karateka based on the obtained results, and to further determine whether and within which variables of flexibility karateka are more dominant than football players. This research will complete the findings and fill the knowledge gaps that exist about flexibility. The importance of this research is reflected in that it will gather relevant information about the status and differences in flexibility between football players and karateka within the specified age group. The research was carried out on a sample of 40 respondents who make up two subsamples, football players (n=20; age 12.70 ± 0.86) and karateka (n=20; age 12.95 ± 0.82). Tests were applied to determine height and body mass, as well as to determine flexibility (10 variables). The obtained results were processed in the program package IBM SPSS Statistics 26.0. Descriptive parameters were calculated for all collected data, normality of distribution was determined, while differences in tests were determined by T-test for independent samples. The results showed that in terms of body height and mass, there are no statistically significant differences between young football players and karateka, nor in the ability to lower a stick behind the back (MFLISK). In all other flexibility tests (deep front bend off an elevated platform/block, deep bend with legs apart, side split, active straight leg raise while lying on the back (degrees) for both legs, leg raises while lying on the chest, leg raise while lying on the side) a statistically significant difference was obtained at the significance level of .99% ($p \leq 0.01$), and all in favor of karateka. We can conclude that the level of flexibility is higher in karate practitioners compared to football players, which was to be expected. The main discovery of this study is the existence of statistically significant differences in almost all flexibility variables, where better values were shown in favor of karatekas, except for the back stick raise test, where no statistically significant difference was found between football players and karateka. The research can serve other researchers who will deal with similar issues, and the findings of this research will complete the mosaic of research regarding flexibility in karate and football. The obtained results will benefit sports teams, researchers, trainers and physical education professors, as a relevant indicator of the importance and significance of flexibility development and flexibility training in sports.
Key words: flexibility, football, karate,

INTRODUCTION

Most sports activities require reaching the optimal range of motion in the joints. In certain sports, it is necessary that this amplitude be maximal, sometimes so large that it far exceeds the capabilities of the average person. The athlete's ability to achieve the maximum range of motion in certain sports can be crucial for achieving great accomplishments. That is why most theoreticians consider flexibility (suppleness or mobility) to be one of the essential motor skills of a person (Čolakhodžić, Rađo, Alić, 2016). Flexibility is defined as the ability of the locomotor apparatus to realize movements of optimal amplitude in a certain joint (Alter, 1996). One of the important characteristics of flexibility is that it decreases with age, especially if it is not systematically maintained, and the other is that it does not have a general property, i.e. optimal flexibility in one joint does not imply the same level of flexibility in other joints. The ability to perform movements with maximum amplitude, in one or more joints, does not only depend on motor skills, but also on some morphological features (type and structure of joints and elastic connections - tendons and ligaments), and flexibility as an elementary prerequisite for good and high-quality performance of movements. This statement is valid for football as well as for most team and individual sports, especially martial arts. Only an optimally prepared and flexible athlete can use his/her potential in other motor skills to the maximum extent, especially in all types of explosive power (speed, jumping, kicking and throwing) and agility, as well as preventively act on the possibility of occurrence and character of some injuries. Likewise, in addition to explosiveness, speed and precision, karateka must have highly developed flexibility, especially of the pelvic girdle and lower extremities, to be able to explosively perform strong kicks, while avoiding injuries to self. Considering that highly dynamic movements prevail in football, often acyclic, which in addition to fast and strong musculature require great elasticity,

extensibility and the ability to relax the active musculature, and since numerous studies have shown the importance of flexibility training in the prevention of injuries (Witvrouw et al., 2003; Nikolaidis, 2012; Vučetić, Šoš, Rocak, 2003), a program to optimize the level of flexibility of individual regions should be a part of every training plan. Flexibility, which is not given enough importance in the training of football players, should be developed gradually, but at the same time in all muscle groups that participate in typical and atypical movement structures of the football game. In order to ensure the prevention of injuries, we must also emphasize other muscles that are not dominant in the football game. The same applies to all other sports. Only with such an approach and orientation will we reduce the possibility of injuries to a minimum. Most of the previous research on flexibility, both in football and in karate, refers to the influence of flexibility on certain specific activities and actions during a game, that is, a sports fight. It is common for children to train 2 sports at the same time in younger age categories, primarily due to the influence of parents to make children as versatile and active as possible, without knowing the structure of movement in the selected sports and the importance of the influence of motor skills and morphological characteristics in them. Very often there are situations in which a child trains football and karate at the same time, where in most cases it happens that he "fails" karate in the sense of not maintaining flexibility during football training, which leads to stiffness of the musculature of the pelvic girdle and legs, and as a result decreasing efficiency of kicking. The goal of this research was to determine the level of flexibility in football players and karateka aged 12-14, and to determine the differences in the level of flexibility between team and individual sports, more specifically between football and karate at this age.

METHODOLOGY

Respondents sample

The research was conducted on a sample of 40 male respondents chronologically aged 12-14 years, who were then divided into two subsamples, football players (n=20; average age 12.70 ± 0.86 years) and karate practitioners (n=20; average age 12.95 ± 0.82 years). The interviewees are members of the Football Club "Sport Prevent" football school in Bugojno, and members of the Karate Club "Futura" karate school and Martial Arts Club "Iskra" from Bugojno.

Sample variables

When selecting variables, the results of previous research were used, and the tests used cover all muscle regions and are used to assess flexibility in sports (Dopsaj, 1994; Sporiš, Vučetić, Jovanović, Jukić and Omrčen, 2011; Vučetić, Šoš and Ročak, 2003; Čolakhodžić, Skender, Pokvić, 2016; Čolakhodžić, Skender, Đedović, Palić, Ademović, 2018; Božić, Pažin, Berjan, Planic, and Ćuk, 2010), and those variables were selected for which metric characteristics were determined, and which are appropriate for this age category. The selected variables in this research will hypothetically cover the area of motor ability, flexibility (9 variables) and the area of morphological characteristics (2 variables), Body height (cm) - AVIS and Body mass (kg) – AMAS.

To assess flexibility: MFLISK – lowering a stick behind the back (cm); MFLPRK – deep front bend off an elevated platform/block (cm); MFLBOS – side split (degrees); MFLPLK – active straight leg raise while lying (degrees) for both legs; MFLZLP – leg raises while lying on the chest (degrees) right and left leg; MFLOLB – leg raise while lying on the side (degrees) for right and left leg; MFLPRR – deep bend with legs apart (cm). Before the measurement, the subjects warmed up for 15-20 minutes. The rest between the two tests was long enough, so that fatigue from the previous test did not affect the performance of the next test. The measurement was done in the sports hall, in the morning hours, the light and temperature were optimal for work.

Methods for data analysis

The processing of the obtained results was done in the program package IBM SPSS 26.0 for Windows. Central and dispersion parameters were calculated for all collected data. The differences in flexibility between the groups of respondents were determined by the T-test for independent samples, which aimed to determine whether there is a statistically significant difference in the arithmetic means of the groups.

RESEARCH RESULTS

Table 1 shows the descriptive values of the tested variables in football players and karateka. As for the morphological characteristics, we observe that the average height of football players is AVIS=159.8 ±7.9 cm, and the mass AMAS = 52.8 kg ± 6.59. Descriptive parameters of flexibility in a group of football players showed the following values: MFLISK back stick raise test = 89.00 cm ± 11.99; deep bend from an elevated platform - MFLPRK =

4.90cm ± 4.86; side split - MFLBOS = 94.70 ± 13.67; leg raise while lying on the back with the right leg - MFLPLKD = 69.40° ± 10.75; leg raise while lying on the back with the left leg is 2.55° greater - MFLPLKL = 71.95 ± 7.30. Reversed leg raise while lying on the chest for the he right leg - MFLZLP_D = 27.75° ± 4.72; and for the left leg it is greater by 0.5° and amounts to - MFLZLPL = 28.25 ± 3.72; leg raise while lying sideways with the right leg - MFLOLBD = 57.50° ± 9.10; and the deviation lying sideways and raising left leg has higher values by 3.75° and amounts to - MFLOLBL = 61.25° ± 9.58; deep bend with legs apart test - MFLPRR = 34.90 ± 7.85. As for the tests with both legs, it is noticeable that the values are slightly higher with the left leg compared to the right. The presented descriptive values of the variables in karate practitioners show that the average body height is *AVIS* = 162.62cm ± 6.33, and the body mass is *AMAS* = 55.91kg ± 8.84. The following values were obtained in the flexibility tests of karateka: Average value of *the MFLISK* back stick raise test = 85.48cm ± 17.30; deep bend from an elevated platform *MFLPRK* = -4.30cm ± 7.168; then the side split *MFLBOS* = 119.45° ± 16.34. The following results were obtained in the right and left leg forward raise test: *MFLPLK* - D = 91.60° ± 10.41; L = 89.55° ± 11.91 where we see that the value of the test with the right leg is 2.05° higher than with the left. As for the reversed leg raises, the values for raising the right leg are higher by 1° than the left, so we have *MFLZLP* – D = 34.50° ± 4.261, L = 33.50° ± 4.007. The mean value in the leg raises while lying sideways test are *MFLOLB* – D = 83.70° ± 9.31, and L = 81.80° ± 10.531 where we see that the value is higher for the right leg by 1.9°. The deep bend with legs apart test showed that the mean value is *MFLPRR* = 61.46cm ± 12.28. Regarding the tests with both legs, slightly higher values are noticeable with the right leg compared to the left, which is the opposite in relation to football players

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Table 1.-Display of the value of the results of descriptive statistics for football players

Variables	Football players (n=20)					Karate fighters (n=20)				
	Min.	Max.	Mean		Std. Dev.	Min.	Max.	Mean		Std. Dev
			Stat.	Std. Err.				Stat.	Std. Err.	
AVIS (cm)	146.20	174.60	159.80	1.78	7.96	148.90	174.60	162.62	1.41	6.33
AMAS (kg)	41.80	67.60	52.80	1.55	6.95	40.70	76.40	55.91	1.97	8.84
MFLISK (cm)	69.80	110.60	89.00	2.68	11.99	51.70	117.40	85.48	3.87	17.30
MFLPRK (cm)	-1	14	4.90	1.08	4.86	-20	6	- 4.30	1.60	7.16
MFLBOS (degrees)	70	125	94.70	3.05	13.67	90	150	119.45	3.65	16.34
MFLPLKD (degrees)	50	85	69.40	2.40	10.75	70	115	91.60	2.32	10.41
MFLPLKL (degrees)	60	85	71.95	1.63	7.30	70	112	89.55	2.66	11.91
MFLZLPD (degrees)	20	35	27.75	1.05	4.72	25	40	34.50	.95	4.26
MFLZLPL (degrees)	20	35	28.25	.83	3.72	25	40	33.50	.89	4.00
MFLOLBD (degree)	40	70	57.50	2.03	9.10	60	97	83.70	2.08	9.31
MFLOLBL (degree)	40	75	61.25	2.14	9.58	60	105	81.80	2.35	10.53
MFLPRR (cm)	23.00	52.30	34.94	1.75	7.85	38.40	91.60	61.46	2.74	12.28

Table 2 shows in its first part the result of the level of significance of Levene's Test *for Equality of Variance,* and as we can see that its value is statistically greater than 0.05, which tells us about the equality of variance in these groups, i.e. that these two groups are comparable and that we can proceed with the process of determining the differences between the groups. Analyzing the results of the T-test from Table 2, in which the differences of the arithmetic means between the groups of football players and karateka were tested, it can be seen that there are no statistically significant differences in terms of body height and mass, as well as in the back stick raise test, because the values of the coefficient of significance are higher than the theoretical limit *p=0.05*. *AVIS* variable (t=-1.237 with significance coefficient p=0.224), *AMAS variable* (t= -1.234 with significance coefficient p=0.225), *MFLISK variable* (t= 0.748 with significance coefficient p=0.459). In all other variables pertaining to flexibility, there is a statistically significant difference between the groups: variable *MFLBOS* (t= -5.193 with significance coefficient p=0.000), variable *MFLPLKD* (t= -6.634 with significance coefficient p= 0.000), variable *MFLPLKL* (t= - 5.633 with a significance coefficient P=0.000), variable *MFLZLPD* (t= -4.746 with a significance coefficient p=0.000), variable MFLZLPL (t= -4.000 with a significance coefficient p=0.000), variable *MFLOLBD* (t=-8.996 with a

significance coefficient p =0.000), variable *MFLOLBL* (t=-3.554 with significance coefficient p=0.001), variable *MFLPRR* (t=-8.131 with significance coefficient p=0.000), variable *MFLPRK* (t= 4.333 with significance coefficient p=0.000).

Table 2.- T-test for independent samples between football players and karate practitioners

Variables	Levene's Test for Equality of Variance		t-test for equality of means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Err. Diff.	95% Confidence Interval of the Diffe.	
								Lower	Upper
AVIS (cm)	1,640	.208	-1.237	38	.224	-2.81500	2.27540	-7.42130	1.79130
AMAS (kg)	.954	.335	-1.234	38	.225	-3.10500	2.51662	-8.19964	1.98964
MFLISK (cm)	3,568	.067	.748	38	.459	3.52500	4.70949	-6.00886	13.05886
MFLBOS (degrees)	.668	.419	-5.193	38	.000	-24,750	4,766	-34,398	-15.102
MFLPLKD (degrees)	.404	.529	-6,634	38	.000	-22,200	3,346	-28,975	-15,425
MFLPLKL (degrees)	3.193	.082	-5,633	38	.000	-17,600	3.125	-23,925	-11,275
MFLZLPD (degrees)	.921	.343	-4,746	38	.000	-6,750	1.422	-9,629	-3,871
MFLZLPL (degrees)	.013	.911	-4,000	38	.000	-5,100	1,275	-7,681	-2,519
MFLOLBD (degrees)	.000	.985	-8,996	38	.000	-26,200	2,912	-32,096	-20,304
MFLOLBL (degrees)	.691	.411	-3,554	38	.001	-17,400	4,896	-27,311	-7,489
MFLPRR (cm)	3.134	.085	-8.131	38	.000	-26.52000	3.26158	-33.12273	-19.91727
MFLPRK (cm)	.106	.746	4.333	38	.000	9,150	2.112	4,875	13,425

DISCUSSION

The results show that in terms of height and body mass, no statistically significant differences were found between football players and karateka in the sampled age group (12-14 years). In the area of flexibility, it was observed that only in terms of back stick raise test, which defines the flexibility of the shoulder girdle, there are no statistically significant differences between these two groups. We assume that the reason lies in the fact that both football players and karateka do not pay much attention to the stretching and mobility of the shoulder girdle in their training process, because football players do not have a pronounced need for great mobility of the shoulder girdle (except when throwing the ball in from the sideline), as well as karateka, because in most cases they perform elements that require straight movements, i.e. straight blows with the hands. In all other flexibility tests, statistically significant differences are observed at the significance level of 99% (*sig ≤ 0.001)*, all in favor of karateka. We can look for the answer in the fact that the requirements for athletes are different in football and karate, as well as the training process itself. With football players, the most attention is paid to speed and agility, as well as explosive actions such as jumping, because they require extremely strong and powerful musculature of the lower

extremities that allow them to perform all the necessary actions during the game as quickly and efficiently as possible. It can be very risky for football players if in the training process, not enough attention is paid to the flexibility and stretching of the lower limbs, as due to the demands of the game, in which there are unexpected sudden movements, it can happen that the football player gets injured, where most often a stretch or a rupture of a muscle occurs. Therefore, in the training process, it is necessary to pay attention to the fact that, through appropriate application, optimal flexibility is developed in football players in order to prevent the possible occurrence of injuries. On the other hand, the demands that karate places on the athletes require, in addition to speed, explosiveness, balance and precision, extremely well-developed flexibility. Actions performed by karateka in their daily activities require a large amplitude of movement, so the need for great flexibility is inevitable. In order for karateka to successfully perform kicks, especially round kicks, great attention is paid to flexibility in the training process. The results of this and other research on the same or a similar sample of variables (Dopsaj, 1994; Ostojić, 2018; Kovač, Vuković, 2014; Čolakhodžić, Skender, Pokvić, 2016; Čolakhodžić, Skender, Đedović, Palić, Ademović, 2018) give us guidelines for what needs to be emphasized in the training cycle for both football players and karateka. For a football player to successfully respond to the demands of the game, among other things, it is necessary to develop and maintain flexibility at an optimal level, which will enable the successful completion of tasks without the risk of injury (Ekstrand, Hägglund, Waldén, 2011). In the training process, 10-15 minutes of passive stretching should be set aside for football players in the final part of training to successfully maintain flexibility at an optimal level. In karate, most movement activities require a large amplitude of movement, which was shown in the distribution of results for each variable of flexibility, so we can only state that it is important, in addition to other motor skills, to continue developing and maintaining flexibility at the level that karate requires of them. The value of the work is reflected in the fact that we have established the state of flexibility of football players and karateka aged 12-14, and defined what the different groups of athletes need to further develop and maintain, all with the aim of performing movement activities specific to these sports as successfully and simply as possible, without risk of injury. The results of this research in a scientific sense cannot be generalized, while in an applied sense they provide us with certain feedback, related to the area from which the tested athletes come, and the need for additional research in this area is clearly indicated.

CONCLUSION

Looking at the results of this research, we conclude that there are statistically significant differences in flexibility between football players and karateka of this age and that the level of flexibility is higher in karate practitioners than in football players. This research will benefit us in completing our knowledge about flexibility. The importance of this research is also reflected in obtaining relevant information about the flexibility status of football players and karateka aged between 12-14 years. The results indicate the existence of statistically significant differences in almost all flexibility variables, where better values were shown in favor of karateka, except for the back stick raise test, which defines the flexibility of the shoulder girdle, where no statistically significant difference was found between football players and karateka. Also, in the morphological variables of height and body mass, there is no statistically significant difference, which tells us about the same age characteristics of the sample. The research can be useful to other researchers who will deal with similar issues, and the findings of this research will be part of the mosaic in finding answers that benefit football players and karateka in terms of flexibility, which will be useful to sports institutions, sports teams, researchers, coaches and teachers of physical education, as well as athletes themselves and parents of future footballers and karateka.

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CORRESPONDING AUTHOR:
Full Prof. Ekrem Čolakhodžić, PhD.,
Džemal Bijedić University of Mostar, Faculty of Education;
URSC Midhat Hujdur – Hujka, 88104 Mostar
Bosnia and Herzegovina
ekrem.colakhodzic@unmo.ba