IN WHICH INDICATORS CAN THE DIFFERENCE BETWEEN EFFECTIVITY OF STATIC AND DYNAMIC STRETCHING OF YOUNG VOLLEYBALL PLAYERS BE NOTICED?

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Abstract

The aim of the study was to compare the effect of static (StatS) and dynamic stretching (DynS) methods on indicators: E-test (ET),, 4x10 meter shuttle run, run to cones (RC), medicine ball throw (2 kg), sit and reach test (SR) of young volleyball players (n = 10, age = 15.4±0.5 years, height = 177.5±4.7 cm, weight = 63.6±5.7 kg) during the period 2016/2017. Statistical analysis has shown higher levels (t = 2.943, p < 0.05, d = 0.66) in RC indicator when the dynamic stretching was applied. We did not notice any statistical difference (p > 0.05) in other parameters when we compared effect of static and dynamic stretching.

Key words: *flexibility, speed, warm-up.*

Introduction

Warm-up is one of the most important part of training. Its quality activates our organism (body temperature increases as well as the heart rate) and prepares us on training process (Meisner, 2002; Czichoschewski et al., 2005; Kremnický, 2014; Kremnický & Kremnická, 2016). It also activates our psychological spryness (Pearson, 2006). The static stretching, dynamic stretching, post-isometric relaxation (PIR) and progressive stretch methods are the most common stretching methods, which are used in the first part of training process – specifically in warm-up part (Alter, 1999; Verstegen & Williams, 2004). Authors present that suitable stretching prepares athletes on sport performance and prevent them against injuries (Nelson & Kokken, 2007; Ylinen et al., 2008).Their research was supported in research by Misárošová (2003), where she experienced the positive effects of static stretching in the upper limb area in young swimmers.

The positive influence of interventional exercises and static stretching on the development of joint mobility was also noted by the authors Mandzák & Slováková (2018) on the participants of 512 children tested. Šebej (2001) presents that mobilisation exercises increase joint mobility and synovial fluid which nourishes the cartilage is loosened. This fluid also regenerates the cartilage. Yamaguchi & Ishii (2005) present that the statistic stretching, which lasts for 30 seconds, does not improve nor decrease muscular performance and the dynamic stretching improves the muscular performance. O'Connor, Crowe & Spinks (2006) denoted that the performance of the lower limbs increased only after the static stretching lasting for 15 minutes. They also present the fact that this type of warm-up has very positive effects on anaerobic performance. Ogura et al. (2007) examined if the duration of the static stretching may have influenced maximal voluntary contraction. 10 men participated on the research in which they passed two various duration of static extension (tightening) of the muscle in hamstring mass of dominant lower limb (one for 30 s and the second for 60 s). No static status of extension was used as the control status. The value of maximal voluntary contraction (MVC) was significantly decreased with static extension lasting for 60 s in comparison with control status and extension lasting for 30 s (checking - control: 287.6±24.0 N; 30 seconds: 281.8±24.2 N; 60 seconds: 262.4±36.2 N). There was no significant difference between the checking and static extension lasting for 30 s. For that reason, authors made a conclusion that the short duration of static stretching (in our case 30 s) has no negative effect on muscle strength production. Pinto et al. (2014) present very similar results in which they found out that the muscle performance can decrease in multipoint case after the average duration of static stretching lasting for 60 s.

It has insignificant effect in the static stretching of short duration lasting for 30 s. Burkett, Phillips & Ziuraitis, 2005; Cramer et al., 2005; Unick et al., 2005 present that there is not any strength decrease or decrease of explosive muscle strength after the static stretching. Bean (2005) a Pearson (2006) present that static stretching does not decrease the athlete´s injury, but it does decrease the performance. Opinions of Behm & Kibele (2007) and Behm & Chaouchi (2010) are different and their point of view on using of static stretching is sceptical. They present that the athlete´s performance decreases after application of static stretching. More other researches support this theory of unsuitability of static stretching and there was mentioned the fact, that not only the performance decreases in sprint speed (Fletcher & Annes, 2007) but also the muscle strength (Cramer et al., 2004), muscle endurance (Nelson et al., 2005) and at last, the fatigue increases (Trajano et al., 2015). Some researches indicate that dynamic stretching instead of static or no stretching can be very effective technique to increase the muscle

performance during the routine before the beginning of the competition (Sekir et al., 2010; Hammami et al., 2018).

Dynamic stretching improves muscle strength (Sekir et al., 2010), sprint (Haddadet et al., 2014) and jumps (Faigenbaumet al., 2005; Ryan et al., 2014) as well as flexibility (Herdaet al., 2012; Mandzáková, 2009; Ryan et al., 2014). Loughran et al. (2017) also present that the static stretching decreases sprint speed in 40 m run in 1.1% and in 20 m run in 1.0%. Static stretching decreases jump height in 10.6% and jump performance in 6.4%. When dynamic stretching followed static tightening, sprint speed in 20 m run improves in 1.0% and in 40 m run in 0.7% ($p < 0.05$). The protocol of static and dynamic stretching improves jump height in 8.7% ($p < 0.01$) and performance in 6.7% ($p < 0.01$).

According to mentioned results, authors sum up and made conclusion that dynamic stretching should follow static stretching to eliminate and remove any performance deficits caused by static stretching.

There were not examined any significant differences in measured indicators between static and dynamic stretching in previous research (Popelka & Pivovarniček, 2018), but we finally decided to examine this problem in detail. The study compares the effect of static and dynamic stretching on indicators examined in following tests: E-test (ET), 4x10 meter shuttle run, run to cones (RC), medicine ball throw (2 kg), sit and reach test (SR) of the young volleyball players.

Methods

Participants
The sample consisted of the young volleyball players in competition year 2016/2017 (n = 10, setters = 2, hitters = 3, defensive specialists = 2, libero = 1; age 15.4±0.5 years; height= 177.5±4.7 cm; weight= 63.6±5.7 kg). The University Ethics Committee has approved research. Measurements were performed in accordance with the ethical standards of the Helsinki Declaration and ethical standards in the field of scientific research in sport (Harris & Atkinson, 2011).

Organizing
The research was realized in competitive year 2016/2017 from 23 January 2017 up to 31 March 2017. The measurements of examined indicators were realized in the training hall each Monday (static stretching) and each Wednesday (dynamic stretching). Each volleyball player attended 10 indicators measurements after static stretching and 10 indicators measurements after dynamic stretching. The level of speed abilities, explosive strength and flexibility were counted as the mean level from 10 measurements of static stretching and 10 measurements of dynamic stretching. Respondents practised warm-up by jogging and particular stretching method under the examinator´s supervision. Each stretching had the same order of exercises. The test, which participants had to follow, was orally explained and demonstrated.

Measuring process
The following tests were used in the research:

- E-test (ET) was used to detect special speed. The score of one measurement was the time in seconds (s) with accuracy of 0.1 s for which the examined person was able to run over the track in „E" shape in the shortest time.
- 4x10 meter shuttle run test was used to detect the run with direction changes. The result of one measurement was time in seconds (s) with accuracy of 0.1 s for which the examined person was able to run specific distance in the shortest time.
- The run to cones test (RC) was used to detect speed abilities (acceleration and reaction speed) and orientation abilities. The score of one measurement was time in seconds (s) with accuracy of 0.1 s for which the examined person was able to touch 3 marked balls (from 1 to 5 on the circle).
- The medicine ball throw test (2 kg, H2) was used to detect explosive strength of upper limbs. The score of one measurement was distance of throw of the medicine ball in metres (m) with accuracy of 0.1 cm.
- The sit and reach test (SR) was used to detect flexibility. The score of one measurement was the reach of middle fingers of the hand in forward bend in centimetres (cm) which was registered on examined sit and reach box with accuracy of 0.1cm. Larger (the plus) number meant greater overhang – better flexibility.
- We diagnosed the current level of examined indicators after static and dynamic stretching methods application by following tests:
- Static stretching:
- Stretching duration is 10-15 seconds.
- 5-10 seconds of rest was inserted in between the individual exercises.
- Each exercise was repeated twice.
- The intensity level of stretches was kept to 1–3 with slight pain
- Dynamic stretching:
- The intensity of the exercise followed the basic methodology of dynamic stretching i.e. 8 repetitions in 5 seconds.
- 2-5 seconds of rest were inserted in between the individual exercises.
- Each exercise was repeated 8 – 10 times.
- The intensity level of stretches was kept to 1–3 with slight pain.

Data analysis
The study used a periphrastic characteristics of descriptive statistics – Mean (*M*) and Median (*Me*) from position measures and Standard Deviation (*SD*) for variability measures. The normality of data distribution was verified by Shapiro-Wilk's test. The Independent-Samples T Test was used to determine the significance of static and dynamic stretching differences for the level of the examined

indicators. Non-parametric Mann-Whitney U Test was used in case of normality denial. In parametric test was used Cohen coefficient *d* for determination of effect size, which was interpreted as follows: *d* = 0.20, small effect; *d* = 0.50, medium effect; and *d* = 0.80, large effect (Cohen, 1988). In nonparametric test was used coefficient *r* (Corder & Foreman, 2009) for determination of effect size, which was interpreted as follows: *r* = 0.10, small effect; *r* = 0.30, medium effect; and *r* = 0.50, large effect (Cohen, 1988). The probability of a type I error (*α*) was set at 0.05. Statistical analysis was carried out with IBM® SPSS® Statistics V19 (Statistical Package for the Social Sciences) software.

Results

The aim of the study was to compare the effect of static and dynamic stretching methods on following physical indicators of the young volleyball players: E-test (ET), 4x10 meter shuttle run, run to cones (RC), medicine ball throw (2 kg) and sit and reach test (SR).The level of examined indicators after applied static and dynamic stretching methods was counted as the mean level (Table 1) from 10 measurements of static stretching and 10 measurements of dynamic stretching in each volleyball player (n = 10).

The statistical analysis has shown significant difference and higher level in ($t = 2.943$, $p < 0.05$, $d = 0.66$) after the application of dynamic stretching in comparison with static stretching.

There was not any significant difference ($p > 0.05$) in the other indicators (ET, 4x10, H2 a PS) when comparing the effect of static and dynamic stretching methods, However, better results were examined after dynamic stretching.

Table 1. Statistical analysis of the difference between the effects of static and dynamic stretching on the level of examined indicators.

Comparison of the effect of static and dynamic stretching					
Indicator	Difference		Statistical analysis		
	StatS	DynS	Independent-Samples T Test and Mann-Whitney U Test	Effect size (ES)	
				ES value	ES level
ET (*M*±*SD*)	16.3±1.0 s	16.0±1.1 s	t = 2.098, p > 0.05	*d* = 0.47	small
4x10 (*M*±*SD*)	13.0±1.3 s	12.5±1.3 s	t = 1.326, p > 0.05	*d* = 0.30	small
RC (*M*±*SD*)	8.1±1.0 s	7.7±1.0 s	t = 2.943, p < 0.05	*d* = 0.66	medium
H2 (*M*±*SD*)	10.50±2.30 m	11.21±2.23 m	t = 0.459, p > 0.05	*d* = 0.10	small
SR (*Me*)	10.6 cm	11.0 cm	U = 44, Z = -0.454, p > 0.05	*r* = 0.10	small

StatS – static stretching; DynS – dynamic stretching; M – Mean; SD – Standard Deviation; Me – Median; ET – E-test; 4x10 –4 x 10 m shuttle run; RC – run to cones; H2 – medicine ball throw 2 kg; SR – sit and reach test; s – second; m – meter; cm – centimetre

Discussion

The aim of the study was to detect and compare the effect of static and dynamic stretching methods on speed abilities, explosive strength and flexibility of the young volleyball players (n = 10) during competitive period. The opinion of studies, which are interested warm-up problem and its effect on athlete´s endurance, are different. Some studies present that athletes achieves better endurance after dynamic stretching (Behm & Chaouchi, 2010; Ryan et al., 2014; Hammami et al., 2018), on the other hand, studies by Burkett, Phillips & Ziuraitis, 2005; Cramer et al., 2005 present that static stretching is as effective warm-up method as dynamic stretching.

Results our studies have shown that there is no significant difference between static and dynamic stretching in 4 x 10 m shuttle run test and E-test. Our detection differ from the other researches (Alikhajeh et al., 2012) which present, that dynamic stretching of moderate intensity significantly increases and improves short-term endurance in task fulfilling. This endurance decreases when the fatigue starts to show. Loughran et al., 2017 present, that static stretching decreases sprint and that is why they recommend dynamic stretching to eliminate and remove any endurance deficit caused by static warm-up, which is similar to our results. Authors also present, if dynamic stretching follows static stretching, the speed in 20 m run will improve in 1% and in run on more than 40 m in 0.7%. Our results, which focused on speed abilities of the lower limbs, are similar to study of Yamaguchi & Ishii (2005). Authors present that static stretching lasting for 30 seconds do not improve or decrease muscle performance. Curry et al. (2009) did not find any statistical difference between static and dynamic stretching, however they reflect and point on the fact, that dynamic stretching has greater use to achieve and reach better performance in case of strength exercises when comparing with static stretching.

We were also focused on examination of explosive strength of upper limbs and torso despite the effect of dynamic and static stretching methods on speed abilities. Our results in medicine ball throw (2 kg ball) are similar with study of Faigenbaum et al. (2006) and Christensen et al. (2016), who did not find any significant difference in medicine ball throw when comparing the effect between static and dynamic stretching. On the other hand, researches by McMillian, Moore & Hatler (2006) present that the group of players achieved better endurance after dynamic warm-up with medicine ball than the

group that did only static warm-up. Faigenbaum et al. (2005) a McMillian et al. (2006) realized researches in which they examined the effect of static and dynamic stretching methods on strength performance and agility. Their results showed that the athletes achieved significantly better results after dynamic stretching. We attained the knowledge that, participants achieved the mean performance 7.7 ±1.0 s in run to cones, what is significant difference 0.4 s($t = 2.943$, $p < 0.05$, $d = 0.66$ – medium effect).

We did not detect any significant difference in effect of static and dynamic stretching methods on flexibility. Faigenbaum et al. (2005) did not find neither that dynamic stretching had significant effect on flexibility when comparing with the effect of static stretching on flexibility. Lots of researches refer and point to the fact, that dynamic stretching improves flexibility more than static stretching (Herda et al., 2012; Ryan et al., 2014).

We are aware of the fact that our results did not confirm significant differences between static and dynamic stretching methods in : E-test (ET),4x10 meter shuttle run, medicine ball throw (2 kg) and sit and reach test (SR), however, dynamic stretching had positive impact on performance. Participants achieved better results in v E-test, specifically in 0.3 s, in 4x10 m shuttle run in 0.5 s and in medicine ball throw in 71 cm after dynamic stretching. Statistical difference has shown only in run to cones test after dynamic stretching. Despite the fact that we did not found any significant differences between static and dynamic stretching, we assume that dynamic stretching has greater use to achieve better performance. Our research lasted longer than we expected, what number of tests caused. The initial number of participants was 16, but only 10 were included because 6 of them got sick. We have to add that the rest 10 participants were ill too during the measurement period (flu, muscle injuries etc.), what could influence research´s results. The low number of participants mean the increase of β level and small influence of the statistical test ($S = 1 - \beta$). We recommend realizing the measurements in short time period as the prevention against illness status and injuries of examined participants. We assume that the limit of our research was number of tests and the fact that participants did not perform tests with using all their physical and psychological strength during the period. We can objective results in the future research by tests elimination.

Conclusion

Statistical analysis did not confirm significant differences between static and dynamic stretching methods in following indicators: E-test (ET), 4x10 meter shuttle run, run to cones (RC), medicine ball throw (2 kg), sit and reach test (SR), but dynamic stretching had more positive effect on performance. Statistical analysis confirmed significant difference only in one test, run to cones, after dynamic stretching. We recommend examine with higher number of participants, test participants in short time period and use less tests as we did. We have to be very careful when making interpretations and generalizations. We have to take into consideration the number of examined sample (n = 10) and limits of our study. We have to be also circumspect because our participants were young athletes who are used to having regular and intensive training. Population that did not use to have (or did not get used to having) intensive training can achieve different results´ performance in presented ways of warm-up. There is necessity to examine the problem of organism´s warm- up before the load in further and detail way.

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