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SKILL-BASED CONDITIONING TRAINING IN YOUNG FEMALE VOLLEYBALL PLAYERS: IMPACT ON POWER AND CHANGE OF DIRECTION SPEED

Running head: Skill-based conditioning in volleyball

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Abstract

Skill-based training has been developed in order to combine the skill and conditioning elements in a coordinated approach. Our aim was to determine the effects of skill based conditioning training on power and COD speed in youth female volleyball players. Sixteen young female volleyball athletes (15±2 years) consented to participate in lower-body power and COD speed testing.Players were involved in six weeks skill-based conditioning training during in-season. There were no significant differences between pretraining and posttraining for Block jump and Spike jump. Moreover, there were no significant ($p > 0.05$) improvements in Standing broad jump also.However, compared with pretraining, there was a significant improvement in COD speed tests. Training induced significant ($p \leq 0.05$) improvements in 9-3-6-3-9 test ($p<0,001$) and Side steps 10x4.5 m ($p<0,001$).In conclusion, skill-based conditioning training appears to have stronger effects in improving COD speed compared to lover body power young female volleyball players. Volleyball coaches could use this information in the process of planning the in-season training.

***Key words*:** game-based, athletes, effects, volleyball

Introduction

Volleyball is an intermittent sport that requires players to compete in frequent short bouts of high-intensity exercise, followed by periods of low-intensity activity (Gabbett,et al., 2006).However, while well-developed physiological capacities are important for team sports, athletes are also required to have well-developed technical skill and decision-makingability.

Young players often find it hard to support the traditional fitness training, because of a lack of enjoyment and experience with this type of exercise (Wall &Côt, 2007). In recent years, an approach called skill-based training has been developed in order to combine the skill and conditioning elements in a coordinated approach (Gabbett,2002; Gabbet, 2003;Gamble, 2004;Nurmekivi et al.,2002; Sassi, Reilly, &Impellizzeri, 2004). It is an important consideration to optimize skill development in volleyball while still obtaining appropriate conditioning levels. In order to expose players to the intensity, decision making, speedand skill execution required in the competition setting, practice sessions need to replicate actual game events andphases of play. Small-sided games, as a part of skill-based training are a popular training method used to replicate technical skills and tactical awareness, whilst also representing the physiological demands typical of a competitive match (Gabbett et al., 2009). According to Sampaio et al, (2009) decrease in space and number of players in game allow greater self-recreation of players and greater intervention in game.

The use of skill-based conditioning games as training drills allows the simulation of movement patterns of team sports, while maintaining a competitive environment in which athletes must perform under pressure and fatigue (Gabbett, 2002). Skill-based conditioning training offers an additional challenge to team-sportathletes which is not present in non-skill related conditioning activities (Farrow, Pyne, &Gabbett, 2008).

Studies have assessed the specificity of skill-based conditioning in a limited number of team sports (e.g., volleyball, soccer, rugby league, and rugby union). Gabbet (2008) showed that skill-based conditioning games that simulate the physiological demands of competition in junior elite volleyball players offer a specific training stimulus. Gabbett, et al., (2006) have concluded that skill-based volleyball training improves speed and agility performance, spiking, setting, passing accuracy, spiking and passing technique, but has little effect on the physiological and anthropometric characteristics of players. They also stated that skill-based training programs should be supplemented with an appropriate amount of energy system training to enhance the physiological and anthropometric characteristics of talented junior volleyball players. Trajković, Milanović, Sporis, Milić&Stanković(2012) examined the effects of pre-season game based conditioning training in semi- professional volleyball players. The authors stated that selected program does not offer a sufficient stimulus for semi- professional volleyball players due to the fact that there were no significant differences between pretraining and posttraining for lower-body muscular power and agility.

According to author’s findings and experience, skill-based training could be a part of training programs in younger volleyball players where the intensity of training is not as high as in professional and elite volleyball players. However, studies investigating the effectiveness of

game-based training in female volleyball are limited. Therefore, more research is needed in order to confirm this theory. The aim of our research is to determine the effects of skill basedconditioning training on power and COD speed in youth female volleyball players.

Methods

Sixteen young female volleyball athletes consented to participate in lower-body power and COD speed testing, and the procedures involved in the study were in accordance with and approved by institutional ethics. Descriptive characteristics are presented in Table 1. All the participants provided written consent after being informed of the test protocol. The protocol of the study was approved by the Ethical Committee of the Faculty of sport and physical education, University of Nis, and according to the revised Declaration of Helsinki. Each player had at least 4 years of training experience, corresponding to 2-hour training sessions, and at least 1 competition per week.

Table 1. Descriptive characteristics of the subjects*

Age (y)	Training experience (y)	Body height (cm)	Body weight (kg)	Standing reach height (cm)
15±2	4±1	1.74 ± 0.08	61±3	222±8.48

*Data are reported as mean ± SD.

This study was designed to address the question of how skill-based conditioning training on affect jumping ability and COD speed gains, after a 6-week training program. Jumping ability, and COD speed test performance tests were performed before and after training program. The initial tests were completed on one day as part of a regular testing program. Before the initiation of the training program subjects were instructed about the proper execution of all the exercises that were to be done during the training period. None of the subjects had performed any strength or jump training before. They were instructed to avoid any strenuous physical activity during the experiment and to maintain their dietary habits for the whole duration of the study.

The players underwent physical tests assessment in an indoor stadium. During the testing, the air temperature ranged from 22°C to 25°C. Testing began at 10 am and finished by 1 pm. None of the participants had been injured 6 months before the initial testing as well as during the training program. There was no supplement addition to the diet of the players. Measurements were taken on Monday morning because the athletes had rested during the weekend. The testing session began with anthropometric measurements. The players were then instructed to assess lower-body muscular power and COD speed tests. Up to 3 trials were given on each jump, with a 1-minute rest between jump test trials. The participants were all tested during the in- season. Typical practice warm-up was completed before the testing sessions. This warm-up included 10 minutes of general activity (walk, jog, light stretching), followed by 10 minutes of dynamic activity that

increased in speed and intensity, followed by 3 to 5 minutes of rest before beginning the testing session. The players were encouraged to perform static stretching between trials. Body height and body weight were measured according to the instructions of the International Biological Program – IBP. Body height was measured with a GPM anthropometer (Siber&Hegner, Zurich, Switzerland) to the nearest 0.1cm. Body weight was obtained by TANITA BC 540 (TANITA Corp., Arlington Heights, IL) to the nearest 0.1kg.

Measures

Spike and block jump performances

For the standing reach, while wearing their normal volleyball footwear, players were requested to stand with their feet flat on the ground, extend their arm and hand, and mark the standing reach height while standing 90° to a wall. Players were encouraged to fully extend their dominant arm to displace the highest vane possible to determine their maximum standing reach height. The measurement of the standing reach height allowed for a calculation of the relative jump heights on each of the jumping tasks (absolute jump height (cm) – standing reach height (cm) = relative jump height) (Sheppard et al, 2009).

Spike (SJ) and block (BLJ) jump performances for volleyball players depend heavily on the height at which these skills are performed above the net and are determined by not only the capacity of the athlete to raise vertically his center of gravity, but also his stature and standing reach. In this particular case, specific tests would provide a further understanding of the training-induced adaptation. For the SJ, the standing reach was determined as the maximal distance between the fingertip of the attack hand and the ground, while standing 90° to a wall. The SJ was measured from a running lead (2- or 3-step approach) by using a basketball backboard marked with lines 1 cm apart. For the BLJ, the standing reach was determined as the maximal distance between fingertips of the block hands and the ground, while facing the wall. The BLJ jumps started from a standing position with the hands at shoulder level and arms raised from the start position without extra swing. All tests used the same observer who was situated on a volleyball referee stand placed 2 m from the backboard. Both jumps were recorded as the best of the 3 attempts (Stanganelli, Dourado, Oncken, Mançan, da Costa, 2008).

The standing broad jump was used for assessing the explosive power of the lower limbs. The players were instructed to stand behind a line and jump as far as possible—allowing arm and leg countermovement. The distance was measured from behind the line to the back of the heels at landing.

Change of direction speed (COD speed)

Sprint 9-3-6-3-9 m. The players started after the signal and ran 9m from starting line to the first line (the lines were white, 3 m long, and 5 cm wide). Having touched the line with one foot, they made either an 180 left or right turn. All the following turns had to be made in the same direction. The players then ran 3 m to second line, made another 180 turn, and ran 6 m forward.

Then, they made another 180 turn and ran another 3m forward, before making the final turn and running the final 9 m to the finish line.

10 x 4,5 m Lateral Shuffle Test. The Edgren Side-Step Test has used solely shuffling movements (Chu, Shiner, 2006; Harman, Pandorf, 2000; Tomchuk, 2011) and is a prominent field test. However, some tests differed from the original test and have reported their own versions (Chu, Shiner, 2006; Tomchuk, 2011.). It appears to be no consistent procedures for the ESST. The lateral shuffle test in this study was modified and ESST was chosen because it is the only test consisting entirely of lateral movements (Brughelli, Cronin, Levin, Chaouachi, 2008). The Lateral shuffle test used a 4,5 m distance with lines marked on both sides. The participants started the test straddling one of the lines. They moved laterally and crossed the last line before changing directions. The participants shuffled continuously for ten times. Participants were instructed not to cross their feet during the duration of the test, and a trial was discarded if a participant crossed his or her feet.

Training program

One cycle of six weeks was analyzed in in-season (2014). The schedule of the performed in-season beach volleyball training is shown in Table 2. The goals of the in-season conditioning were to increase the intensity of sport-specific training, and attention was given to volleyball skills and movement. None of the players was performing any additional resistance or aerobic training outside of the 3 volleyball training sessions. The duration of training sessions was recorded, with sessions typically lasting 80-100 min. For this purpose skill based exercise were selected based on previous experience and according to performance analysis in volleyball studies. After warm up, in the first part of sessions players were involved in technical drills and after that they were divided in smaller groups (2 vs. 2, 3 vs. 3) practising on smaller courts. In the end, players played a 4 vs. 4, 6 vs. 6 games, with constant changes where the winning team would always stay on the court. Although the duration of each individual rally in this drills was not controlled by the coach, total duration of the drill can be recorded to assist in inter and intra-session planning.

Table 2. Training sessions of skill based conditioning training program

Goal: in-season volleyball program	
Sessions 1–18 (Monday-Wednesday-Friday)	
Exercises	
Warm up	General activity + specific warm up with the ball (25 min)
Instructional drills for technique	20 min of drills that include low intensity movement and combine volleyball technique. Two drills were performed with 2 minute break between.
2 vs. 2, 3 vs. 3, 4 vs. 4 6vs. 6	Small-sided (3 vs. 3, 4 vs.4) games where the volleyball court was separated in two smaller (9 x 4.5 m) courts. Competitiondrills (2 vs. 2) with the majority of free balls to each side thrown by the coach. Teams rotate depending of the scoring. After one team reaches 15 points players take two minute break (40 min). Competitiondrills (6 vs. 6) with the majority of free balls to each side thrown by the coach. Teams rotate depending of the scoring.
Stretching	5 minutes of stretching for the muscle groups mainly involved in sessions

Data analysis was performed using the Statistical Package for Social Sciences (v13.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics were calculated for all the experimental data. In addition, the Kolmogorov–Smirnov test of the normality of distribution was calculated for all variables before the analysis. Changes in the lower-body muscular power and COD speed of players over the training period were compared using t-tests. The level of significance was set at $p \leq 0.05$ and all data are reported as means ± SD.

Results

Lower-body muscular power

The changes in Block jump, Spike jump and Standing broad jump are shown in Table 3. There were no significant differences ($p > 0.05$) between pretraining and posttraining for Block jump ($p=0.25$) and Spike jump ($p=0.65$). In addition, there was no significant ($p > 0.05$) improvement in Standing broad jump also.

Table 3. Lower-body muscular power and COD speed of young female volleyball players before and after 6 weeks of training

	initial	final	P value
Block jump	38.46 ±3.79	39.64 ±4.031	0.25
Spike jump	44.19 ±4.89	44.77 ±5.019	0.65
Standing broad jump	201.93± 2.93	203.21± 2.73	0.08
9-3-6-3-9 agility test	9.95±0.49	9.38±0.52	0.001*****
10 x 4.5 m Lateral Shuffle Test	16.20 ± 1.09	15.30 ± 0.93	0.001*****

***** Significant difference $p < 0.05$ between initial and final testing

COD speed

Compared with pretraining, there was a significant ($p \leq 0.05$) improvement in COD speed tests (Table 3). Training induced significant ($p \leq 0.05$) improvements in 9-3-6-3-9 COD speed test ($p<0,001$) and Side steps 10x4.5 m ($p<0,001$).

Discussion

This study investigated the effect of a skill-based volleyball training program on the measurements of power and COD speed in young female volleyball players. A significant improvement in COD speed was observed. However, there were no significant differences between pretraining and posttraining for lower-body muscular power.

In our study, results for Block jump and Spike jump test showed there were no significant difference between groups pre- to post-training ($p > 0.05$). In similar studies with young male subjects Gabbett et al. (2006) have concluded that skill-based volleyball training improves speed and agility performance, spiking, setting, passing accuracy, spiking and passing technique, but has little effect on the physiological and anthropometric characteristics of players. In addition, Gabbett (2008) stated that skill-based conditioning games have induced improvements in speed, vertical jump, spike jump, agility, upper-body muscular power, and estimated maximal aerobic power. Our results are similar to results found in Gabbett (2008) study. It has been suggested that traditional technical training, which uses blocked practice, provides greater short-term improvements (Shea & Morgan, 1979). However, using random practice could have longer-term performance benefits (Gabbett, 2008).

Significant improvements were found in COD speed tests. These findings are in line with the previous authors who reported significant decreases in time during agility tests following training (Gabbett2008; Gortsila, Theos, Nesic, &*Maridaki*,2013). Gortsila, et al. *(*2013) showed in their study that training on sand surface could be a useful and effective tool for improving agility in prepubescent female volleyball players. Aforementioned authors stated that the instability of the sand surface could be one of the explanationswhich contributed to the improvements of balance, which in turn improved agility. Less powerful spiking in female

volleyball compared to male could contribute significantly to the improvement in COD speed. Moreover, rallies in female volleyball are longer with many defensive actions during which players sprint, change direction, shuffle.

The results of this study indicate that there were no significant improvements in jumping performance. However, COD speed tests showed improvement in post testing compared to pre testing following a 6 week of skill-based conditioning training program. It cannot be concluded that young female volleyball players develop distinctive performance characteristics at this age and level. Therefore, more studies must be conducted in order to better understand this kind of training in female volleyball players and its' effects.In conclusion, skill-based conditioning training appears to have stronger effects in improving COD speed compared to lover body power young female volleyball players. Volleyball coaches could use this information in the process of planning the pre and in-season training. In this way, the training will be more specific and the transfer of training effects to game efficiency will be faster. Many coaches do not use the approach described in this article to the training process because they fear of insufficient stimulus that skill-based training could have in volleyball. However, this kind of study could provide practical application for coaches and sport researchers.

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