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EFFECTS OF SPEED, AGILITY AND QUICKNESS (SAQ) TRAINING ON ANAEROBIC ENDURANCE AND FLEXIBILITY OF NOVICE TENNIS PLAYERS

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Abstract:
This study aims to analyse the effects of SAQ training on anaerobic endurance and flexibility of novice tennis players, selected subject from Ramanathan Krishnan Tennis Academy, Trivandrum, Kerala, India. Totally twenty participants were selected and randomly divided them into two groups (n=10) namely SAQ training group (age: 10.80 ± 0.78 years, height: 147.90 ± 2.60 cm and weight: 39.95 ± 1.51 kg) and control group (age: 11.10 ± 0.73 years, height: 147.30 ± 2.79 cm and weight: 40.12 ± 2.23 kg). After 12 weeks training, all subjects had tested their anaerobic endurance and flexibility according to Tennis Specific Agility Endurance Test and V-Sit and Reach Test. The data were analyzed by SPSS software, Paired-'t' test was used to determine the difference between pre and post mean scores of experimental and control groups and experimental group had improved more significantly ($p<0.05$) than the control group. The study suggests that SAQ training is more beneficial for anaerobic endurance and flexibility of novice tennis players.

Keywords: SAQ training, tennis players, anaerobic endurance, flexibility

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1. Introduction

Tennis is one of the popular anaerobic sports where the prevailing glycolytic or glycogenolytic metabolic processes provide energy during the game. There is a general consensus that the average work intensity is in the range of 60 to 70percentile of the maximum oxygen intake during a tennis match. Observing the time parameters of the play, it is seen that the players usually don't get sufficient time to fully recover from the points. This lack of time for recovery leads to deterioration of the players' physical condition in the larger context of the annual calendar of tennis matches and competitions. Thus, though tennis is an anaerobic sport, good aerobic capacity is a must in order to provide the players with high levels of cardio-respiratory endurance which would enhance their performance in a consistent manner and would consequently lead to sporting success (Barbaros T. et al., 2011).

There are repeated bouts of high-intensity activity during tennis matches. Typically, the rally lasts around 6 seconds and rarely over 10 seconds even while playing on a clay court (Smekal G. et al., 2001). The players have the luxury of resting up to 25 seconds between the points, and 90 seconds at the changeover. Therefore, the overall physical requirement is more akin to a moderate-intensity exercise that is prolonged (such as distance running) than a true sport involving multi-sprints (Bergeron MF et al., 1991).

The tennis player will, on average, move around 3 meters for each shot and around 8 to 12 meters while scoring each point (USTA, 2016). Therefore, it is certain that quickness and good speed throughout the court are very necessary in order to attain most of these shots. Around 48 percentage of a player's movement is the sideways motion during a match, and so agility i.e. the ability to shift direction quickly while maintaining control is equally essential. The regular training programme of tennis must be based on the solid aerobic endurance of the player in order to maintain a high rate of work for the entire game which may last for several hours. Also, anaerobic endurance is an essential parameter so that power in each shot within a rally as well as over each rally can be maintained at the same high level.

Tennis is considered an anaerobic sport because of the sprinting, changing directions, stopping and the explosive movements involved in it. Also, most points rarely require longer than 90 seconds. Simultaneously, it is essential for the tennis players to develop aerobic conditioning in order to have a quicker recovery period between points; as this enables them to last through a 3-hour match or a longer period. Conditioning of flexibility and strength are also very important and need to be improved along with anaerobic and aerobic fitness.

The definition of the term flexibility is taken as the degree of extensibility of the structures of soft tissue that surround the joint, which include muscles, connective tissue and tendons. The players of the sport of tennis are usually very flexible in terms of external rotation of the shoulder, but on the side that is dominant (Chandler T. J. et al, 1990; Ellenbecker T. S., 1995). In order to address this imbalance in flexibility, it is recommended to do specific stretches for the back of the shoulder. But it is generally not recommended to do exercises that stress the front of the shoulder, usually by placing the arms around the body (Ellenbecker T. S. et al, 1993).

The factors affecting flexibility are inclusive of tissue temperature, neuromuscular components, and heredity. With regard to heredity, the physical condition of the body determines overall potential of flexibility. Though usually, people tend to be physically relatively inflexible, there is a small percentage of them who are hyper-flexible. Hereditary traits and the design of the body that affect flexibility potential include the shape as well as the orientation of joint surfaces, along with the physiological dimensions of the joint muscles, capsule, ligaments and tendons. Additionally, some regions of the body of the player could be very tight and inflexible due to the nature of the movements during the playing of tennis. These include the lower back, hamstrings and muscles at the back of the shoulder. Simultaneously, other areas in the player's body may be overly flexible, especially the front of the shoulder due to external rotation. These result from many years of playing the sport (Chandler T. J. et al, 1990).

The SAQ exercise is a training method that has been commonly used by athletes, both beginners and advanced, in recent times. According to Mario et al. (2011), SAQ is an acronym of the transitional Speed, Agility and Quickness. Palaniswamy and Velmurugan (2012) noted that SAQ exercises incorporated in the modern training system produced, within a single training programme, the integrated effects of many physical capacities. Also, Remco et al. (2009) contend that training systems integrated with SAQ are designed for improvement of compatibility of acceleration between the hand and the eye along with the explosive power and the response speed.

Training in SAQ is thought to enable football players to improve their reaction to stimuli, along with improvement in acceleration, effective movements in multiple directions and changing direction or stopping quickly to make a play in an efficient, smooth, fast and repetitive manner (Polman et al., 2009). A typical SAQ session usually consists of explosive movements aiming towards progressing from fundamental patterns of movement to specific movements that are highly positional. Therefore, this form of training is supposed to enhance the adaptation of movement mechanics, frequency and length of steps along with increased hip height aimed at increased agility, speed and quickness (Pearson and International, 2001).

2. Methods

2.1. Participants

All the participants in this study were selected from Ramanathan Krishnan Tennis Academy, Trivandrum, Kerala, India. All are male novice tennis players with one to two years of playing experience. Totally twenty participants were selected and randomly divided them into two groups (n=10) namely experimental group (mean ±SD: age: 10.80 ± 0.78 (range 10 to 12 years), Height: 147.90 ± 2.60 cm and Body Weight:39.95 ± 1.51 kg) and control group (mean ±SD: age: 11.10 ± 0.73 (range 10 to 12 years), Height: 147.30 ± 2.79 cm and Body Weight:40.12 ± 2.23 kg) respectively (Table 1). Participants provided instructions regarding the SAQ training and all are willing to participate in the training.

Table 1: Anthropometric characteristics of the examined groups (Mean and Standard deviation)

Groups	Age (years)	Height (cm)	Body Weight (kg)
SAQ	10.80 ± 0.78	147.90 ± 2.60	39.95 ± 1.51
Control	11.10 ± 0.73	147.30 ± 2.79	40.12 ± 2.23

2.2 Design

Participants were tested on the selected physical variables like anaerobic endurance and flexibility. Anaerobic endurance is assessed with Tennis Specific Agility Endurance Test and flexibility was measured V Sit and Reach Test. Before the training programme, all are subjected to pre-test and further, Experimental group (SAQ Training) was underwent for a period of 45 to 60 minutes, three days in a week for 12 weeks. Control group participants were doing their regular training programme and not involved in any specified training. After the training period, all the participants were subjected to the post-test.

2.3 Materials

2.3.1 V-Sit and Reach Test

The selected subject removes his shoes and then sits on the floor with the legs on either side of the measuring line while the soles of the feet are placed immediately behind the baseline. The hands are held together and placed on the measuring line with thumbs clasped and palms facing down. While a partner holds his legs flat, the subject slowly reaches forward as far as possible with his fingers on the baseline and feet flexed. After a total of 3 practices try, the student holds the fourth reach for 3 seconds while the distance is noted down.

2.3.2 Tennis Specific Agility Endurance Test

The Tennis Specific Agility Endurance test involved running quickly to touch5cones that were placed on the court. The first cone is in the middle of the net, the next two cones at the right and left of the back corners of the baseline and last two cones at the right and left of the back corners of the service boxes. The subjects started from the centre mark on the baseline and then ran to touch each of the cones and always return back to the starting point. Each subject individually performed a single test. The best score was selected out of the five recorded scores.

2.4 Procedure

SAQ training group participants were required to take training 12 weeks to three times a week. The SAQ continuum (Mechanics, flexibility, innervation, and accumulation of potential, explosion, expression of potential and cool down) is the sequence and progression of components that make up an SAQ training session. The progressive elements include tennis-specific skill training, running and drills including ball work. Participants undertook their practice on a synthetic tennis court. Control group participants underwent regular training programme without any specified training programme.

2.5 Statistics

Descriptive statistics such as mean and standard deviation was used. To compare the effects of SAQ training between the control group and experimental group on physical variables, paired 't'-test was used and the level of significance was set at 0.05. SPSS 20 statistical software package was used to analyse the data.

3. Results

Table 2: Descriptive Statistics and t-test Results on SAQ Group for Anaerobic Endurance and Flexibility

Variables	Pre-test		Post-test		95% CI for Mean Difference	df	t-ratio	Sig.
	Mean	SD	Mean	SD				
Anaerobic endurance	21.11	1.48	19.52	1.39	1.22,1.96	9	9.70*	0.000
Flexibility	23.40	3.13	25.00	3.09	-2.20, -0.99	9	6.00*	0.000

*p< 0.05

In the table 2, the results of the paired-sample t-test show that mean SAQ training differs pre-test Anaerobic endurance (Mean ±SD= 21.11 ± 1.48) and post-test (Mean ±SD= 19.52 ± 1.39) at the 0.05 level of significance (t = 9.70, df = 9, sig = 0.000, p< 0.05, 95% CI for mean difference 1.22 to 1.96). On the mean difference of anaerobic endurance in pre-test and post-test was 1.59. In the case of flexibility, the pre-test (Mean ±SD= 23.40 ± 3.13) and post-test (Mean ±SD= 25.00 ± 3.09) at the 0.05 level of significance (t = 6.00, df = 9, sig = 0.000, p< 0.05, 95% CI for mean difference -2.20 to -0.99). On the mean difference of flexibility in the pre-test and post-test was 1.60. These results showed statistically significant differences, at the 0.05 significant level, in pre-test to post-test scores for anaerobic endurance and flexibility of SAQ training group.

Table 3: Descriptive Statistics and t-test Results on Control Group for Anaerobic Endurance and Flexibility

Variables	Pre-test		Post-test		95% CI for Mean Difference	df	t-ratio	Sig.
	Mean	SD	Mean	SD				
Anaerobic endurance	21.31	1.31	21.13	1.62	-0.40, 0.76	9	0.69	0.502
Flexibility	22.80	3.11	23.60	3.37	-1.95, 0.35	9	1.56	0.153

*p< 0.05

In the table 3, the results of the paired-sample t-test show that mean SAQ training differs pre-test Anaerobic endurance (Mean ±SD= 21.31 ± 1.30) and post-test (Mean ±SD= 21.13 ± 1.62) at the 0.05 level of significance (t = 0.69, df = 9, sig = 0.502, p> 0.05, 95% CI for mean difference -0.40 to 0.76). On the mean difference of anaerobic endurance in pre-test and post-test was 0.18. In the case of flexibility, the pre-test (Mean ±SD= 22.80 ± 3.11) and post-test (Mean ±SD= 23.60 ±3.37) at the 0.05 level of significance (t = 1.56, df = 9, sig = 0.153, p> 0.05, 95% CI for mean difference -1.95 to 0.35). On the mean difference of flexibility in pre-test and post-test were 0.80. These results showed statistically no significant differences in pre-test to post-test scores for anaerobic endurance and flexibility of control group.

4. Discussion

The study's aim was to identify the effect of 12-week SAQ training programme on anaerobic endurance and flexibility in novice tennis players between the age group of 10- 12 years. Findings of this study revealed that there was a significant difference between the experimental group (SAQ training) and control group in flexibility and anaerobic endurance. This showed that SAQ training was a more effective method to enhance the physical components among the players. SAQ training is an important method for the improvement of physical variables especially speed and quickness etc (Bloomfield et al. 2007).

The study showed that there is a significant improvement in flexibility among the novice tennis players who had subjected SAQ training. Gleim and Mchugh (1997) opine that flexibility is an integral component of fitness. Sporis et al. (2010) reported that flexibility development is happened mainly during the period of 8 to 12 years, during this time (late teenage years) flexibility was in the peak values. In this study, the participants are between the age group of 10-12 years, because of that the SAQ had a significant improvement in flexibility. Also, this study was supported with Polman et al., (2004) who found SAQ training in female soccer players had a positive result on the flexibility of the lower back and hamstring muscles. According to Reilly and Benton (1995), regional female tennis players had more flexibility than the club players; it is due to the physical training programme obtained by the female players. This study was not supported with Milanovic et al., (2014) because he reported that there is no improvement in lower back and hamstring flexibility while performing SAQ training in soccer players, it may be due to the age group of participants who were subjected to his study.

Anaerobic endurance is a form of endurance characterized by the absence of oxygen. This study showed that there is a significant difference between experimental and control group during anaerobic endurance. These results support the findings of MacDougall et al. (1998) and Creer et al. (2004) these studies report that endurance was improved significantly during the training. According to MacDougall et al. (1998), seven week training was improved the endurance among the healthy college students. Creer et al. (2004) were also observed the positive impact on endurance in assigned trained male cyclists. To determine the effect of SAQ training on anaerobic endurance a V-sit and reach test was performed. From the results, we note it down that from pre-test to post-test there was significantly higher between the SAQ training group. These results recommended that if the physical training is included in the tennis training programme the players improved their playing abilities.

5. Conclusions

The present study displayed a significant difference between the experimental and control groups between the ages of 10 to 12 years. The outcome of the study also expresses about the SAQ exercise and its beneficial effects. The experimental group was shown significant improvement in anaerobic endurance and flexibility. The results imply the overall importance of anaerobic endurance and flexibility for tennis among the novice tennis players. These finding also emphasized the age group of the participants. Age group showed has a high impact on flexibility. This study suggested that SAQ training can be applied in future young tennis for the better performance.

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