ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 12, Issue, 07, pp. 57574-57577, July, 2022
https://doi.org/10.37118/ijdr.24842.07.2022

RESEARCH ARTICLE OPEN ACCESS

INFLUENCE OF TENNIS SPECIFIC ENDURANCE TRAINING ON MAXIMAL OXYGEN UPTAKE ANDREPEATED SPRINT ABILITY WITH CHANGE OF DIRECTION IN MALE TENNIS PLAYERS

***[1]Sathishkumar, D. and [2]Mahendiran, P.,**

[1]PhD Scholar, Department of Physical Education, Annamalai University, Tamilnadu
[2]Assistant Professor, Department of Physical Education, Annamalai University, Tamilnadu

ARTICLE INFO

Article History:
Received 03rd April, 2022
Received in revised form
11th May, 2022
Accepted 27th June, 2022
Published online 28th July, 2022

Key Words:
Repeated sprint ability,
Maximal oxygen uptake,
Tennis, Players.

***Corresponding author:* Sathishkumar, D.,**

ABSTRACT

The purpose of the present study is to assess the influence of tennis specific endurance training for eight weeks on maximal oxygen uptake and repeated sprint abilitywith change of direction – total time, mean time & fatigue index in male tennis players. Twenty (20) male tennis players were selected at random as subjects, who volunteered to participate in this study. All players were classified randomly into two groups tennis specific endurance training group (EG) (n = 10) and control group (CG) (n = 10). These players were selected from National Tennis Academy, SIPCOT, Ranipet, Tamilnadu during the academic year 2018 – 2019.Maximal oxygen uptake and repeated sprint ability with change of direction (RSACD) – total time, mean time and fatigue index was selected as criterion variables. The eight weeks of tennis specific endurance training was supplemented to EG and CG carried out their regular training. The result of the study revealedthat EG from pre to post test showed significant improvement in maximal oxygen uptake(F (1, 18) = 36.86, p = 0.000) and RSACD – total time (F (1, 18) = 11.71, p = 0.003), mean time (F (1, 18) = 11.71, p = 0.003) & fatigue index (F (1, 18) = 7.133, p = 0.016) but the CG failed to show significant changes (p> 0.05). It is concluded that eight weeks of tennis specific endurance training is likely to improvemaximal oxygen uptake and RSACD – total time, mean time, & fatigue index in tennis players. This study also displayed the effectiveness of 30-15 IFT audio which can also be used for trainingand it is evident inimproving the maximal oxygen uptake and RSACD – total time, mean time, & fatigue index in tennis players.

Citation: ***Sathishkumar, D. and Mahendiran, P.*** "Influence of tennis specific endurance training on maximal oxygen uptake andrepeated sprint ability with change of direction in male tennis players*", International Journal of Development Research*, 12, (07), 57574-57577.

INTRODUCTION

During a tennis game players require both aerobic and anaerobic fitness to perform efficiently. Tennis is intermittent sports which constitutes several bouts of high intensity exercise followed by recovery. Fitness of a tennis player is an important factor to exhibit greater efficiency during a match. Earlier studies proved that fitness and match performance are closely related but the significance of technical and tactical skills are considered the predominant performance factor (Smekal*et al*. 2001). Therefore, it seems difficult to maintain both fitness and technical skill simultaneously which is an important feature for success of tennis players (Mendez-Villanueva*et al*. 2007). High intensity training has been shown to be effective in improving fitness but to improve technical and tactical skill costs extra duration to acquire. This issue can be sorted out by applying sports specific training which that enhances overall domine of the players (Harrison *et al*. 2015).Therefore, the purpose of the present study is to assess the influence of tennis specific endurance training for eight weeks on maximal oxygen uptake and repeated sprint ability with change of direction in male tennis players.

METHODS

Subjects: Twenty (20) male tennis players were selected at random as subjects, who volunteered to participate in this study. All players were classified randomly into two groups tennis specific endurance training group (EG) (n = 10) and control group (CG) (n = 10). These players were selected from National Tennis Academy, SIPCOT,

Ranipet, Tamilnadu during the academic year 2018 – 2019. The selected subjects gave their willingness to participate in this study.

Variables and test: In the current research standardized tests and procedures were used to assess the selected criterion variables which are presented in Table 1.

Training Protocol: The experimental group was administered with tennis specific endurance training protocol 1 for twelve weeks on Monday and Friday. The EG commenced their session with 15 minutes of standard warm-up followed by tennis specific endurance training (Table 4).

This has to be performed before the next beep sound. After playing the forehand stroke at point 2 he makes 180° turns and sprints towards point 1 and playsthe backhand stroke when the assistant coach drops the ball next to the player at point 1, who hits it after a bounce (Figure 1). This has to be performed before the next beep sound. Players repeat the same procedure as performed previously. The objective is to cover the given distance and play the ball before the beep sound. As mentioned earlier the work duration is 30 seconds which was followed by passive recovery for either 30- or 15- seconds. If the player is in the midway during the course of the run from points 1 to 2 the exercise termination beep sound is produced.

Table 1. Variables and Tests

Sl. No	Variable	Methods/Tests/Equipment
1	Maximal oxygen uptake	30-15 Intermittent Fitness Test (28m version)
2	RSACD – Total time	12×30 m RSA
3	RSACD – Mean time	
4	Fatigue index	

Table 2. Tennis specific endurance training - Protocol 1

Week	Work rest ratio	Work duration (s)	Rest duration (s)	No. of Repetitions	No. of Sets	Rest between Sets (s)	The velocity of the run for 30 seconds using 30-15 IFT audio
1	1:1	30	30	10	4	300	10 km/h
2	1:0.5	30	15	8	4	300	10 km/h
3	1:1	30	30	10	4	300	11 km/h
4	1:0.5	30	15	8	4	300	11 km/h
5	1:1	30	30	10	4	300	12 km/h
6	1:0.5	30	15	8	4	300	12 km/h
7	1:1	30	30	10	4	300	13 km/h
8	1:0.5	30	15	8	4	300	13 km/h
9	1:1	30	30	10	4	300	14 km/h
10	1:0.5	30	15	8	4	300	14 km/h
11	1:1	30	30	10	4	300	15 km/h
12	1:0.5	30	15	8	4	300	15 km/h

In this tennis specific endurance training involves players moving in multidirectional movements along with tennis skills like forehand and backhand strokes into the target area while exerting maximum effort during mostly baseline play, were performed according to the procedures prescribed in Reid's study (2008). During the tennis specific endurance training, an experienced tennis coach continuously hand-fed tennis ball to the players to their running speed for 30 seconds followed by active recovery for 30 or 15 seconds. After playing each stroke the player has to run to the next corner to play the next stroke (Figure 2). However, the CG performed their regular training.

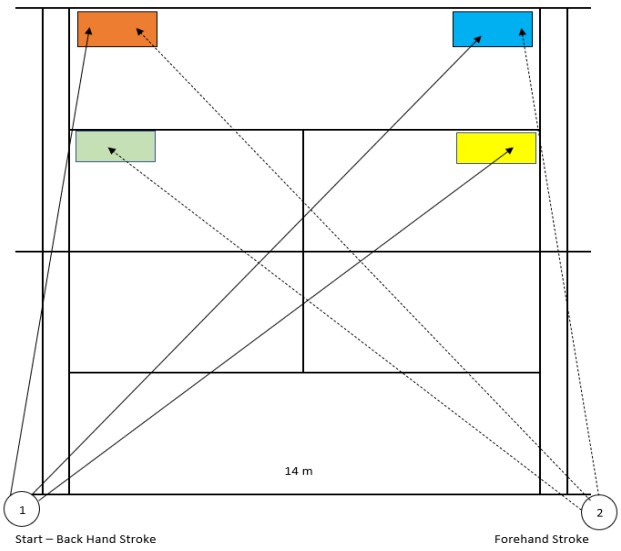

Figure 1. Position of Hand-Feed Tennis Ball to Players

Description of movement in tennis court : Starting with the beep sound player sprint to point 1 and play the forehand stroke when the coach drops the ball next to the player at point 2, who hits it after a bounce (Figure 1).

The player has to move towards the nearest point in the forwarding direction only not in the backward direction. He has to reach the point within the 30- or 15-second passive recovery duration. The player has to play the ball to the opponent's court which is highlighted in color (Figure 2). This will improve the accuracy and rallying ability of the players.

Table 3. Tennis Specific Endurance Training (HIIT) – Protocol 2

Week	Training Prescription	Total Time (min)
1	6 × 30s sprint / 30s rest 6 × 45s sprint / 45s rest	15
2		
3		
4	8 × 30s sprint / 30s rest 8 × 45s sprint / 45s rest	20
5		
6		
7	10 × 30s sprint / 30s rest 10 × 45s sprint / 45s rest	25
8		
9		
10	12 × 30s sprint / 30s rest 12 × 45s sprint / 45s rest	30
11		
12		

The experimental group was also administered with tennis specific high intensity interval training for twelve weeks on Wednesday. The EG commenced their session with 15 minutes of standard warm-up followed by tennis specific endurance training (high-intensity interval training) – Protocol 2 (Table 3). The players ran around the tennis court for 30 seconds and followed by 30 seconds of active recovery through walking. Tennis specific endurance training (Protocol 2) procedure incorporated a 1:1 work rest ratio and 48 hours of recovery were provided between each training session.

Statistical technique: The data collected from EG and CG on selected physical fitness and physiological variables were statistically analysed to examine the changes. A two-way repeated measure ANOVA with last factor repeated with equal was applied to examine the difference between groups and testing conditions. When the interaction was

significant simple effect was applied and Bonferroni pairwise comparison was applied. To elicit differences between the means more meaningful it was expressed with reference to the effect size suggested by Cohen (46) {Partial eta^2 (η_p^2): 0.01 to 0.05 - Small effect; 0.06 to 0.13 - Moderate effect; 0.14 and above - Largeeffect. All the statistical tests were calculated using the statistical package for the social science (SPSS) for windows (Version 16). The level of statistical significance was set at $p< 0.05$.

RESULTS

Maximal Oxygen Uptake: The repeated measures ANOVA on maximal oxygen uptake showed significant interaction effect (F (1, 18) = 17.477, p = 0.001) in tennis players. The simple effect within experimental group from pre to post test (F (1, 18) = 36.86, p = 0.000) and follow-up test which revealed a significant pairwise difference between pre to post test in experimental group [MD = 3.800, $p < 0.05$ & Partial Eta Squared = 0.672 (Large Effect)] but control group (F (1, 18) = 0.26, p = 0.875) failed to show significant difference between pre to post test [MD = 0.100, $p > 0.05$ & Partial Eta Squared = 0.001 (Small Effect)].

RSACD – Total time : The repeated measures ANOVA on RSACD – Total timeshowed significant interaction effect (F (1, 18) = 6.063, p = 0.024)in tennis players. The simple effect within experimental group from pre to post test (F (1, 18) = 11.71, p = 0.003) and follow-up test which revealed a significant pairwise difference between pre to post test in experimental group [MD = 0.040, $p < 0.05$ & Partial Eta Squared = 0.394 (Large Effect)] but control group (F (1, 18) = 0.004, p = 0.953) failed to show significant difference between pre to post test [MD = 0.001, $p > 0.05$ & Partial Eta Squared = 0.001 (Small Effect)].

RSACD – Mean time : The repeated measures ANOVA on RSACD – Mean timeshowed significant interaction effect (F (1, 18) = 6.063, p = 0.024)in tennis players. The simple effect within experimental group from pre to post test (F (1, 18) = 11.71, p = 0.003) and follow-up test which revealed a significant pairwise difference between pre to post test in experimental group [MD = 0.040, $p < 0.05$ & Partial Eta Squared = 0.394 (Large Effect)] but control group (F (1, 18) = 0.004, p = 0.953) failed to show significant difference between pre to post test [MD = 0.001, $p > 0.05$ & Partial Eta Squared = 0.001 (Small Effect)].

RSACD – Fatigue index: The repeated measures ANOVA on RSACD – fatigue index showed significant interaction effect (F (1, 18) = 4.826, p = 0.041) in tennis players. The simple effect within experimental group from pre to post test (F (1, 18) = 7.133, p = 0.016) and follow-up test which revealed a significant pairwise difference between pre to post test in experimental group [MD = 0.637, $p < 0.05$ & Partial Eta Squared = 0.284 (Large Effect)] but control group (F (1, 18) = 0.190, p = 0.668) failed to show significant difference between pre to post test [MD = -0.104, $p > 0.05$ & Partial Eta Squared = 0.010 (Small Effect)].

DISCUSSION

Maximal oxygen uptake is typically used as a major marker of cardiorespiratory fitness of tennis players. The maximal oxygen uptakevalues in elite male tennis players have ranged between 44 ml/kg/min and 69 ml/kg/min (Bergeron, Maresh, Kraemer, *et al*. 1991). In the present study maximal oxygen uptakewas recorded greater than 45 ml/kg/min and less than 50 ml/kg/min which is within the range of the elite male tennis players. The present study displayed significant improvement of 8.38% in maximal oxygen uptakedue to tennis specific endurance training, the results are similar to those reported in a previous study analysing the effect of high intensity interval training for six weeks displayed 4 to 6% improvement in the tennis players aerobic capacity (Fernandez – Fernandez *et al*. 2012). Maximal oxygen uptake showed significant improvement due to basketball specific endurance training (Chittibabu & Akilan 2013) and also in handball specific endurance training (Chittibabu 2013; 2014a). Improvement in maximal oxygen uptakeafter several weeks of high intensity interval training is primarily attributed on increased stroke volume, cardiac output and hematological adaptations (Nottin *et al*. 2002). Further, peripheral adaptations such as improved capillary, mitochondria density, and mitochondria enzyme reactions (Wagner 1991; Gibala *et al*. 2012). The ability to sprint repeatedly in quick succession is determined largely by aerobic capacity. In the present study repeated sprint ability with change of direction of 180° had significantly improved total time (1.12%) and mean time (1.06%) to tennis specific endurance training. The work rest ratio of 1:1 has influenced repeated sprints might have resulted in smaller restoration of phosphocreatine (Bishop, Girard, Mendez-Villanueva, 2011), less accumulation of lactic acid and quicker elimination of lactic acid (Jódar 2003) between bouts had facilitated to decrease total time, mean time and fatigue index. The aerobic capacity and repeated sprint ability with change of direction witnessed parallel improvement. The improvement in repeated sprint ability with change of direction has results are consistent with those obtained by Viaño-Santasmarinas, Rey, Carballeira, Padrón-Cabo (2018) and high intensity interval training also significantly improved the anaerobic capacity and also improved the decrement in speed in handball players (Chittibabu 2014b). The rate at which speed decline is measured through fatigue index. It is noted that high value represents high fatigue, which is harmful for tennis players performance (Naharudin & Yusof, 2013). In the present study fatigue index of tennis players significantly improved (20.89%) to tennis specific endurance training. The fatigue can be caused by metabolic and neuromuscular. Tennis specific endurance training resulted in greater metabolic response that enhance and assist during later bouts of repeated sprint (Millet *et al*. 2009; Girard *et al*. 2011). The contraction patterns in running & cycling have also been shown to influence the relative aerobic and anaerobic energy contributions to exercise performed in the severe intensity domain, affecting differentially the characteristics of the power–duration relationship in running and cycling (Weyand*et al*. 2006).

CONCLUSION

The eight weeks of tennis specific endurance training is likely to improvemaximal oxygen uptake and repeated sprint ability with change of direction- total time, mean time & fatigue index in tennis players. This study also displayed the effectiveness of 30-15 IFT audio which can also be used for training and it is evident in improving the maximal oxygen uptake and repeated sprint ability with change of direction- total time, mean time & fatigue index in tennis players.

REFERENCES

Bergeron, M.F., Maresh, C.M., Kraemer, W.J., Abraham, A., Conroy, B., Gabaree, C. 1991. Tennis: A physiological profile during match play. *Int J Sports Med*., 12(5): 474-9.

Chittibabu B, and Akilan N. 2013. Effect of sports specific endurance circuit training on peak anaerobic power and aerobic power of high school male basketball players during competitive season. *International Journal of Current Advanced Research*, 2(1): 48-50.

Chittibabu B. 2013. Effect of handball specific repeated – sprint training on aerobic capacity of male handball players. *International Journal of Physical Education, Fitness and Sports*, 2(4): 4-7.

Chittibabu B. 2014a. Estimation of relationship between maximal oxygen consumption and repeated sprint ability of male handball players. *International Journal of Physical Education, Fitness and Sports,* 3(2): 79-84.

Chittibabu B. 2014b. Effect of high intensity interval training on anaerobic capacity and fatigue index of male handball players.

International Journal of Physical Education, Fitness and Sports, 3(4): 18-23.

Fernandez-Fernandez J, Zimek R, Wiewelhove T, Ferrauti A. 2012. High-intensity interval training vs. repeated-sprint training in tennis. *Journal of Strength and Conditioning Research*, 26(1): 53-62.

Gibala MJ, Little JP, Macdonald MJ, Hawley JA. 2012. Physiological adaptations to low-volume, high-intensity interval training in health and disease. *J. Physiol.*, 590: 1077–1084.

Girard O, Mendez-Villanueva A, Bishop D. 2011. Repeated-sprint ability - Part I: Factors contributing to fatigue. *Sport. Med*., 41: 673–694.

Harrison CB, Gill ND, Kinugasa T, Kilding AE. 2015. Development of aerobic fitness in young team sport athletes. *Sports Med*., 45:969.

Jódar R. 2003. General overview about the validity of course navette test to estimate the VO_2 max in an indirect way. *International journal of medicine and science of physical activity and sport*, 3(11): 173-181.

Mendez-Villanueva A, Fernandez-Fernandez J, Bishop D, Fernandez-Garcia B, Terrados N. 2007. Activity patterns, blood lactate concentrations and ratings of perceived exertion during a professional singles tennis tournament. *Br J Sports Med*., 41:296–300.

Millet GP, Vleck VE, Bentley DJ. 2009. Physiological differences between cycling and running. *Sport. Med*., 39: 179–206.

Naharudin MN, Yusof A. 2013. Fatigue index and fatigue rate during an anaerobic performance under hypohydrations. *PLoS ONE*, 8: e77290–e77296.

Nottin S, Vinet A, Stecken F, N'Guyen L-D, Ounissi F, Lecoq A-M, *et al*. 2002. Central and peripheral cardiovascular adaptations to exercise in endurance-trained children. *Acta Physiol. Scand.*, 175: 85–92.

Smekal G, von Duvillard SP, Rihacek C, *et al*. 2001. A physiological profile of tennis match play. *Med Sci Sports Exerc*., 33:999-1005.

Viaño-Santasmarinas J, Rey E, Carballeira S, Padrón-Cabo A. 2018. Effects of high-intensity interval training with different interval durations on physical performance in handball players. *J Strength Cond Res*., 32(12): 3389-3397.

Wagner, P. D. 1991. Central and peripheral aspects of oxygen transport and adaptations with exercise. *Sports Med*. 11, 133–142.

Weyand PG, Lin JE, Bundle MW. 2006. Sprint performance-duration relationships are set by the fractional duration of external force application. *Am. J. Physiol. Integr. Comp. Physiol*., 290: R758–R765.

****