

## THE EFFECTS OF TABATA PROTOCOL ON VERTICAL JUMP AMONG 14-16 YEAR-OLD MALE TENNIS PLAYERS

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### ABSTRACT

The purpose of the present study is investigating the effects of Tabata protocol on vertical jump among 14-16 (n=20 male) year-old tennis players.

After vertical jump measurements (cm) of athletes were taken, they were separated into two groups of 10 randomly as experiment1 and experiment2. Experiment1 group conducted technical tennis training three days a week for 6 weeks, while experiment2 group conducted Tabata protocol consisting of 8 exercises, each of which takes 4 minutes, in addition to the same technical training conducted by experiment1 group. Obtained data were analysed on SPSS 16 program using descriptive statistics, Mann Whitney-U and Wilcoxon Signed tests. Before the training program, there wasn't a statistically significant difference between vertical jump measurements of experiment1 and experiment2 groups (p=0.110), while there was a statistically significant difference between the same measurements after the training program (p=0.02). Vertical jump scores, which were similar before the training program, varied significantly after 6-week application of Tabata protocol.

Consequently, the findings showed that this protocol conducted in addition to the technical tennis training had positive effects on athletes' vertical jump measures.

**Key Words:** Anaerobic, Tabata, Exercise

### 14-16 YAŞ GRUBU ERKEK TENİŞÇİLERDE TABATA PROTOKOLÜNÜN DİKEY SIÇRAMAYA ETKİSİ

Bu çalışma Tabata protokolü'nün, 14-16 (n=20 erkek) yaş grubu erkek tenisçilerde dikey sıçramaya etkisini incelemek amacıyla planlanmıştır.

Sporcular dikey sıçrama özellikleri (cm) ölçüldükten sonra rastgele yöntemle 10' ar kişilik deney1 ve deney2 grubu olarak iki gruba ayrılmıştır. Deney1 grubuna 6 hafta süresince, haftada üç gün tenis teknik antrenmanı yaptırılırken, deney2 grubuna aynı teknik antrenmana ek olarak, 4 dklık 8 egzersiz den oluşan, Tabata Protokolü uygulanmıştır. Elde edilen veriler SPSS 16 programında tanımlayıcı istatistikler hesaplanarak, Mann Whitney-U ve Wilcoxon Signed testleri ile analiz edilmiştir. Deney1 ve deney2 grubu dikey sıçrama antrenman programı öncesi test sonucunda (p=0,110) anlamlı farklılık bulunamamışken antrenman programı sonrası testler arasında (p=0,02) anlamlı farklılık bulunmuştur. Antrenman programı öncesi benzer olan dikey sıçrama özelliği 6 haftalık Tabata Protokolü sonrasında anlamlı bir değişiklik göstermiştir.

Sonuç olarak; Tenis teknik antrenmanının yanı sıra uygulanan bu protokolün sporcuların dikey sıçrama değerleri üzerinde olumlu etkileri olduğunu göstermiştir.

**Anahtar Kelimeler:** Anaerobik, Tabata, Egzersiz

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## INTRODUCTION

Success in tennis requires technical skills, physical readiness, preserving these competencies, correct psychological approach and a good court tactic. Success in today's modern tennis requires high techniques and skills. Since tennis involves all of strength, short fast runs and resistance exercises within the game, its physiological requirements are pretty complicated. Due to these features, debates on training programs are ongoing among many sports scientists, tennis trainers and players, which focus on the question of whether aerobic or anaerobic energy system is more prominent in tennis.

The athletes can develop their speed, agility and strength features within high intensity accelerations and slowing, changing direction, jumps and shots within the game with good aerobic fitness, which they should combine with a developed anaerobic capacity<sup>7</sup>. The athletes need to develop their repetitive strength producing skills for swift court movements and explosive shots, which will come along with achievement in the matches naturally. Moreover, technical and tactical skills are determinants of tennis performance<sup>11</sup>.

Tennis players need to react to their opponents' movements as fast as possible. Reaction time, acceleration and agility are very important. Especially pace is the indicator of strength and it is applied in specific movements and techniques. The movements used in tennis, which are mentioned above, require maximal strength and high strength development. The shortness of ground contact time during sprints and changing directions should be taken into consideration (100 msn), and therefore all explosive movements in tennis involve the stretch-shortening cycle (SSC).

During SSC, the muscle first contracts eccentric then concentric<sup>3</sup>.

The benefits of plyometric training for the development of this mechanism are presented in the related literature. Plyometric training has an important place in vertical jump, agility, strength and sport-specific performance<sup>9, 10</sup>.

High intensity interval training (HIIT) consists of comparatively short interval load sessions conducted on the 90% or above of the maximal oxygen use. Depending on the intensity of training, the duration of a single HIIT can range between several seconds to minutes. 4-6 weeks of HIITs increase the high intensity exercise performance, muscle buffer capacity, fat burning rates and aerobic capacity<sup>1,8</sup>.

Tabata was developed in Tokyo, Japan in 1996 at the Japan's National Institute of Fitness and Sports National Institute at the helm of Dr Izumi Tabata. Dr Tabata reported that oxygen consumption capacity of subjects increased at 14% and there was a 28% increase in their anaerobic capacity. This training protocol consists of four-minute intervals 8 sets of 20-second very high intensity work at the 170% of  $VO_{2max}^2$  and 10 seconds of rest. A well-trained athlete can increase their performance at 2% within 7 weeks by conducting this method 3 days a week<sup>14</sup>.

High intensity interval training (HIIT) has become an increasingly popular form of exercise due to its potentially large effects on exercise capacity and small time requirement<sup>6</sup>. High intensity interval training was reported to develop aerobic resistance performance<sup>1, 8, 13</sup>. In this context, the purpose of the present study is investigating the effects of HIIT on vertical jump, which is an indicator of anaerobic performance, which is very important for tennis players.

## MATERIAL AND METHOD

The total of 14-16 years old 20 male athletes participated in the present study and the measurements were taken at Atasehir Tac Sport Facilities.

On the first day, vertical jump test was applied on 20 male tennis players, who participated in the present study, and the measurements were recorded. Then these athletes were separated into two groups as control and experiment groups. Technical tennis training was conducted on the control group 3 days a week for 6 weeks, while experiment group conducted Tabata protocol consisting of 8 exercises, each of which takes 4 minutes, in addition to the same technical training conducted by experiment1 group. Every exercise was conducted with 20 sec load and 10 sec rest cycle. Post-test measurement of both control and experiment groups were taken after 6 weeks and pre-test and post-test measurements were compared on SPSS program. The effects of Tabata Protocol on vertical jump among 14-16 year-old male tennis players were investigated with obtained data.

### Body Weight

Body weight (kg) was measured with Simbo brand digital scale and the height (cm) was measured with a metal tape measure. The training program was scheduled for 3 days a week for 6 weeks.

### Tabata Protocol

1. Squat

2. Push-up
3. Side jump
4. Medicine ball pass, both arms on the floor
5. Commando dance
6. Plank
7. Skip rope
8. Burpees (Push-up + jump)

### 2.3.2. Vertical Jump Test

In order to conduct the test, a measurement table was used, a measurement system was marked on the wall, and a piece of chalk was used to record the measurements. The athletes touched the highest point they could with their arms stretched up. This is called the standing reach height. In this position, the athlete's feet are completely in touch with the floor. Then the athletes tried to reach the highest point by jumping. The difference between the standing reach and jump reach provides the test score. The athletes were asked to jump at least twice and their best score was recorded for the analyses.

### Data Analysis

The significance of the difference between pre-test and post-test scores was analysed with Wilcoxon signed rank test, and the significance of the difference between two groups was tested with Mann Whitney-U test on SPSS 16 program.

## FINDINGS

Table 1. Descriptive Statistics For Experiment 1 Group

Descriptive Statistics					
	n	min	max	mean	SD
HEIGHT (cm)	10	157	170	163.71	3.861
WEIGHT (kg)	10	51	60	56.14	3.288
AGE (years)	10	14	16	15.71	1.254
TRAINING AGE (years)	10	2	3	2.29	0.488

Height, weight, age and training age values for experiment 1 groups are presented in Table 1.

**Table 2.** Descriptive Statistics For Experiment 2 Group

Descriptive Statistics					
	n	min	max	Mean	
HEIGHT (cm)	10	155	169	162.71	4.990
WEIGHT (kg)	10	50	56	52.14	5.336
AGE (years)	10	14	16	15.14	1.069
TRAINING AGE (years)	10	2	3	2.57	0.535

Height, weight, age and training age values for experiment 2 groups are presented in Table 2.

**Table 3.** Pre-test and post-test vertical jump scores analysis of groups (Wilcoxon Signed Rank Test)

GROUP	n	min	max	Ort	SD	p
VERTICAL1 PRE TEST	10	10	28	36	31.2	0.07
VERTICAL1 POST TEST	10	10	28	36	31.7	
VERTICAL2 PRE TEST	10	28	35	31.5	2.635	0.01
VERTICAL2 POST TEST	10	31	37	34	1.7	

According to the findings presented in Table 3, there isn't a statistically significant difference between the pre-test and post-test vertical jump scores of experiment1 group ( $p>0.05$ ). This finding suggests that technical tennis training conducted by experiment1 group didn't have any significant effect on subjects' vertical jump performance.

Secondly, there is a statistically significant difference between pre-test

and post-test scores of experiment2 group, and the subjects' vertical jump performance increased at a significant level with the training program followed by experiment2 group ( $p=0.01$ ).

This finding suggests that Tabata exercise system conducted by experiment2 group had a positive effects on subjects' vertical jump performance.

**Table 4.** Comparison of pre-test and post-test scores of experiment1 and experiment2 groups.

Measurements	n	p
Vertical Jump Pre-Test	20	0.11
Vertical Jump Post-Test	20	0.02

As the findings in Table 4 suggests, pre-test scores of experiment1 and experiment2 groups were compared and the p value was calculated as  $p=0.11$ . Since  $p>0.05$ , there wasn't a statistically significant difference between pre-test scores of experiment1 and experiment2 groups. This finding shows that, vertical

jump performances of both groups were similar before the training program. After the 6-week training program, vertical jump scores of experiment1 and experiment2 groups were compared again and the p values was calculated as  $p=0.02$ . Since  $p<0.05$ , there was a statistically significant difference between post-test vertical jump scores of



experiment1 and experiment2 groups. These findings also show that Tabata protocol followed with technical tennis

training has a positive effect on vertical jump performance of athletes.

## DISCUSSION AND CONCLUSION

According to the findings, there wasn't a statistically significant difference between pre-test and post-test vertical jump scores of experiment1 group at  $p>0.05$  level. On the other hand, there was a statistically significant difference between pre-test and post-test scores of experiment2 group at  $p<0.05$  ( $p=0.01$ ) level, which suggested the protocol had an effect on vertical jump performance.

There wasn't a statistically significant difference between pre-test scores of experiment1 and experiment2 groups at  $p>0.05$  level. This finding indicates that, before the training protocol, vertical jump performances of two groups were similar. However, there was a statistically significant difference between the post-test scores of two groups at  $p<0.05$  ( $p=2.01$ ) level. This finding suggests that Tabata protocol besides technical tennis training followed by experiment2 group had a positive effect on vertical jump performance of the subjects. Atabek et al. (2010) studied the effects of training on jump performance among children of different age groups, and compared these effects in terms of gender. The total of 173 trained and untrained children at ages 11, 12 and 13 participated in their study and took squat jump (SJ), active jump (AJ) and multiple jump (MJ) tests. Their findings on the comparison of trained and untrained children showed that there were significant differences in SJ, AJ and MJ values among 11 year-olds; MJ values among 12 year-olds and AJ and MJ values among 13 year-old boys. As for the girls, there were significant differences in SJ, AJ and MJ values of 11 and 12 year-olds; and SJ and MJ values of 13 year-olds ( $p<0.05$ )<sup>1</sup>.

Diallo et al. (2001) studied the effects of plyometric exercises on jump

performance among children. They reported that squat jump, active jump and 15 sec multiple jump values of their experiment group, who followed the plyometric exercise program, increased at a significant level compared to their control group<sup>3</sup>. Fernandez et al. (2015) studied the effects of 17-day HIIT program in addition to normal tennis training among 12 healthy male tennis players. They recorded the their subjects' physical performance, 20m sprint, jump (cmj) and fast sprint values every 5 days (pre & post-test). They reported that there weren't significant differences in jump and 20m sprint values. They explained the weak development in jump (cmj) and 20m sprint performance with the lack of focus on speed-strength training. They recommended that drills developing explosive strength should be included in the training protocol<sup>4</sup>. Fernandez et al. (2016) studied the effects of 8-week plyometric training on physical performance among 12-13 year-old young tennis players. They reported significant developments in all the parameters they studied<sup>5</sup>. Significant changes in jump variables reported in these studies mentioned above are in agreement with the findings of the present study. Different training practices can result in different effects. Findings of the study conducted by Kotzamanidis (2006) are also in agreement with the present study. Kotzamanidis studied the effects of 10-week plyometric training among 11 year-old boys and reported that squat jump values of the experiment group were higher than the control group<sup>6</sup>. The findings of the present study show that Tabata protocol followed besides technical tennis training developed athletes' vertical jump performance at a statistically significant level. Findings of the similar studies in the related literature are also in agreement

with the findings of the present study. The significant differences in the studied parameter suggest that quick power

performance can also be developed with this protocol.

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