FACTA UNIVERSITATIS
Series: **Physical Education and Sport** Vol. 12, N° 1, 2014, pp. 41 - 49

Original research article

EFFECTS OF A TAE BO AEROBIC TRAINING PROGRAM ON THE FITNESS ABILITIES OF YOUNG WOMEN

UDC 796.015.132-055.2

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Abstract. *The objective of this study was to identify the effects of a Tae Bo training program on certain fitness abilities in young women. The participant sample comprised 60 young women aged 22-27, assigned to one experimental and one control group. The experimental Tae Bo training program lasted 8 weeks, with a frequency of four sessions a week. Each individual practice was 60 minutes long. A battery of 11 tests was used in order to assess the different fitness components. MANCOVA and ANCOVA analyses were used in order to determine the effects of the applied training program. The results obtained indicate that at the multivariate level, the training program had a statistically significant effect (p=0.00). At the univariate level, statistically significant differences were identified between the experimental and control groups at the final measurement, in the following variables: push-ups, sit-ups, semi-squats on the right leg, semi-squats on the left leg, forward bend with feet apart, and the Queen's College step test, at the p=0.00 level. Based on the obtained results, we conclude that the applied Tae Bo training program had positive effects in terms of enhancing certain fitness abilities, primarily the muscle endurance of arm and leg extensors as well as of torso flexors, cardio-respiratory endurance and flexibility in young women.*

Key words: *effects, physical fitness, training program, women.*

INTRODUCTION

Physical fitness refers to the ability to perform everyday activities without excessive fatigue (Heyward, 2010). According to Blair *et al.* (1989) and Blair, Kohl, & Barlow (1993), the level of physical fitness is significantly inversely proportional to the level of mortality in women, which means that the higher the women's fitness level, the lower their mortality rates. This is in accord with the indisputable evidence of the importance of physical activity for the primary prevention of cardiovascular diseases, diabetes, and some

Received February 04, 2014 / Accepted March 30, 2014
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forms of cancer in women (Brown, Burton, & Rowan, 2007). Some scholars identify four basic fitness abilities: cardio-respiratory endurance, muscle fitness, flexibility, and body composition (Kostić, 2009). Cardio-respiratory fitness is the ability to perform dynamic exercises of moderate to high intensity over an extended period of time and involving large muscle groups (Wallace, 2006). Like other fitness abilities, cardio-respiratory endurance declines as a result of the process of ageing. Graves, Whitehurst, & Findley (2006) find that between the ages 25 and 75 there is a decrease in VO_{2max} at around 1% per year. A low level of cardio-respiratory endurance presents a risk for the development of various diseases (Baur, Christophi, Cook, & Kales, 2012). Furthermore, a decrease in muscle fitness (strength and endurance), as well as in flexibility, leads to limited ability to perform everyday activities independently. Consequently, maintaining a moderate level of the aforementioned fitness skills is required in order to perform everyday activities successfully (Howley & Thompson, 2012). Developing fitness skills requires applying exercise programs appropriate to the fitness skills that we wish to develop. One exercise program developed with the goal of enhancing general health and increasing fitness skills is Tae Bo (Milenković & Veselinović, 2010). What characterizes this program is the use of certain techniques from martial arts for the aerobic segments of the practice (Kostić, 2009). As stated in Greer (2000), Roby (2010), Stojanović-Tošić & Pantelić, (2011), Tae Bo is a high-intensity aerobic exercise program which combines elements from taekwondo, karate, boxing, ballet and hip-hop. Tae Bo elements are combined into different choreographies following the instructor's concept, and are performed to music. Zenić, Rausavljević, & Berčič (2006) rank Tae Bo highly within the group of leisure-time physical activities as regards the development of cardio-respiratory abilities, strength, coordination and body composition maintenance, but also as a sport which carries a high risk of injury unless practiced correctly. Different studies have found positive effects of Tae Bo practice on various fitness skills (Boeva, Angelova, Ivanova, Margarita, & Serafimova, 2003; Milenković *et al.*, 2010; Roby, 2010; Stojanović-Tošić *et al.*, 2011; Mathunjwa, Semple, & Preez, 2013). Accordingly, further studies are needed in order to explore the positive effects of Tae Bo both scientifically and practically. The objective of the present study is to determine the effects of Tae Bo practice on different fitness skills of young women.

METHODS

Sample of participants

The participants in the study were 60 young women between the ages of 22 and 27, who were students at different faculties of the University of Niš, excluding the Faculty of Sport and Physical Education. The participants were assigned to one experimental and one control group, with an equal number of subjects in each. The experimental group underwent 8 weeks of the Tae Bo training program, whereas the control group did not take part in any organized form of physical exercise, continuing instead with their regular daily activities. Prior to the start of the program, all of the participants were given a medical examination by a sports medicine specialist to ensure they were healthy, able to participate in the testing, and able to sustain the strain that the practice entailed. The subjects' written consent was obtained, stating that their participation in the study was voluntary and that the results obtained may be published. Regarding the basic anthropometric data, the height and weight of all participants was measured, presented as the mean (AM) ± standard deviation (SD). The average height of the participants in the experimental group was 170.2±0.18 cm and

their average weight 59.13±5.93 kg, whereas the average height of the control group was 165.30±5.09 cm and average weight 58.67±5.88 kg.

Measures

The study used a battery of 11 tests for assessing fitness ability (Šadura, Hošek, Tkalčić, Čaklec, & Dujmović, 1974; Kurelić, Momirović, Stojanović, Šturm, & Radojević, 1975; Anspaugh, Hamrick, & Rosato, 1997; Corbin & Lindsey, 1997; Chatterjee, Chatterjee, & Bandyopadhyay, 2005; Radovanović, 2007). These included: push-ups, back extensions, sit-ups, one-leg semi-squats on the left leg, one-leg semi-squats on the right leg, hyperextensions on the bench, forward bend feet apart, shoulder flexibility, the Queen's College step test, systolic arterial blood pressure and diastolic arterial blood pressure.

A description of the applied Tae Bo training program

The experimental Tae Bo training program took place over 8 weeks, with a frequency of four sessions per week. Each practice had a duration of 60 minutes, and comprised three parts: the introductory, main, and final part. The intensity of the exercise was determined based on the tempo of the music. The introductory portion of the practice was around 10 minutes long, and consisted of general warm-up (i.e., increasing cardio-respiratory functions) and specific warm-up, using lower-intensity movements (yoga and breathing exercises). Large muscle group stretching (lower back, hips, thighs, shoulders, chest, and arms) was performed in order to minimize the possibility of injury (Nelson & Kokkonen, 2007). The main portion of the practice was approximately 40 minutes long. This part of the practice began by learning elements of the technique of the Tae Bo exercise program (punches and kicks, blocks, and moves), as well as elements of the choreography. Next, the elements learned were combined into choreography sequences. Once acquired, each Tae Bo choreography sequence was performed continuously over approximately five minutes with three repetitions. The tempo of the music accompaniment, between 122 and 155 beats per minute (bpm), followed. The moves used included: standard dance aerobics moves (side-to-side, step touch, V step, grapevine, shuffle), running, jumping, dance elements (mambo, cha-cha-cha, jazz square, twist), punches (jab, cross jab, hook, uppercut), kicks (front kick, back kick, side kick, knee kick, jumping snap kick from a basic or fighting stance), and blocks (front high block, outside middle block, inside middle block, low block). The final portion of the practice had an approximate duration of 10 minutes. It included gentle stretching of the engaged muscles, ligaments, and tendons, holding the final position for 20 to 30 seconds. The characteristics of the Tae Bo exercise program are shown in Table 1.

Table 1 The applied Tae Bo training program (characteristics)

Program duration	8 weeks
Individual practice duration	60 minutes
Weekly exercise frequency	4 times
Exercise intensity	60–85 % Hrmax
Practice structure	Warm-up (10min) Main part (40min) Relaxing and stretching (10min)
Music tempo during the main part of the practice	122-155 bpm

Statistical analyses of the data

SPSS 17.0 (SPSS Inc., Chicago, IL.) was used for the statistical analysis of the data. Each variable was presented as the mean (AM) and standard deviation (SD). To determine the changes in the variables between the initial and final measurements for the experimental and control groups, the univariate analysis of variance was used (ANOVA). To determine the effects of the applied Tae Bo exercise program at the multivariate level, the multivariate analysis of covariance was used (MANCOVA), whereas at the univariate level, the univariate analysis of covariance was used (ANCOVA) (Malacko & Popović, 2001). The interpretation of the results took into consideration the results from the final measurement; however, these included the neutralization of the results obtained at the initial measurement. The significance level up to 0.05 was considered statistically significant ($p \leq 0.05$).

RESULTS

The obtained results, shown in Table 2, indicate no statistically significant difference between the initial and final measurements of any of the variables; therefore, it can be concluded that the participants in the control group maintained almost the same level of fitness during the experimental treatment.

Table 2 The univariate analysis of variance for fitness ability in the control group between the initial and final measurements

Variable	Control group	AM	SD	F	P
PU	Initial	14.20	2.91	2.86	0.10
	Final	13.83	2.72		
BE	Initial	34.37	4.19	1.23	0.28
	Final	33.97	3.60		
SU	Initial	39.47	5.89	0.05	0.83
	Final	39.57	5.39		
SSRL	Initial	2.167	2.05	1.00	0.33
	Final	2.033	1.71		
SSLL	Initial	2.100	1.90	0.49	0.49
	Final	2.033	1.87		
DFBB	Initial	54.47	6.46	0.28	0.60
	Final	54.13	7.49		
FBFA	Initial	64.47	7.04	0.42	0.52
	Final	64.57	6.81		
SF	Initial	61.70	4.66	1.89	0.18
	Final	61.07	4.98		
QCST	Initial	38.28	2.99	0.95	0.34
	Final	38.65	2.78		
SBP	Initial	118.3	9.41	2.96	0.10
	Final	119.2	8.31		
DBP	Initial	77.17	4.86	0.39	0.54
	Final	76.83	5.33		

Legend: Push-ups – PU, Back extensions – BE, Sit-ups (SU), One-leg semi-squats on the right leg – SSRL, One-leg semi-squats on the left leg – SSLL, Hyperextensions on the bench – DFBB, Forward bend with feet apart – FBFA, Shoulder flexibility – SF, Queen's College step test – QCST, Systolic arterial blood pressure – SBP, Diastolic arterial blood pressure – DBP, F-test of equality of variances. *Difference significant at $p \leq 0.05$. The same coding is used in Tables 3 and 5 below.

The obtained results, shown in Table 3, indicate that during the experimental treatment statistically significant changes occurred within the following variables: push-ups, back extensions, sit-ups, one-leg semi-squats on the left leg, one-leg semi-squats on the right leg, hyperextensions on the bench, forward bend with feet apart, shoulder flexibility and the Queen's College step test.

Table 3 The univariate analysis of variance for the experimental group's fitness ability between the initial and final measurements

Variable	Group	AM	SD	F	p
PU	Initial	14.07	3.93	16.75	**0.00***
	Final	15.27	3.07		
BE	Initial	35.13	8.08	12.70	**0.00***
	Final	37.13	6.12		
SU	Initial	45.10	8.42	13.90	**0.00***
	Final	46.87	7.00		
SRL	Initial	3.133	3.50	66.36	**0.00***
	Final	4.633	2.91		
SLL	Initial	2.633	3.27	32.05	**0.00***
	Final	4.033	2.62		
DFB	Initial	55.33	6.40	21.11	**0.00***
	Final	56.70	6.14		
FBF	Initial	67.80	11.34	31.09	**0.00***
	Final	65.40	10.84		
SF	Initial	61.07	11.21	41.41	**0.00***
	Final	58.17	9.98		
QST	Initial	38.12	2.41	321.90	**0.00***
	Final	44.24	2.92		
SBP	Initial	117.5	9.35	1.15	0.29
	Final	118.2	7.93		
DBP	Initial	75.00	6.95	0.47	0.50
	Final	75.50	7.23		

*Difference significant at $p \leq 0.05$

The obtained results, shown in Table 4, indicate a statistically significant difference at the multivariate level between the experimental and control groups at the final measurement.

Table 4 The MANCOVA analysis of the effects of the applied Tae Bo program exercise at the multivariate level

Wilks-L	Rao's R	df 1	df 2	F	P
0.32	2.88	11	37	7.16	**0.00***

Legend: Wilks-L – Wilks'-lambda distribution, Rao's R – Rao's F approximation, df1 and df2 – degrees of freedom, F-test of equality of variances, *Difference significant = at $p \leq 0.05$

This difference represents the positive effect of the applied Tae Bo exercise program; therefore, we conclude that the applied program had a positive effect on a comprehensive transformation in the fitness ability of the participants in the experimental group.

Table 5 The ANCOVA analysis of the effects of the applied program of Tae Bo at the univariate level

Variable	Group	Adj. Means	F	p
PU	experimental	15.43	7.03	**0.00***
	control	13.67		
BE	experimental	36.65	0.20	0.65
	control	34.45		
SU	experimental	44.82	9.39	**0.00***
	control	41.61		
SRL	experimental	4.29	27.06	**0.00***
	control	2.38		
SLL	experimental	3.68	11.10	**0.00***
	control	2.39		
DFB	experimental	56.31	0.92	0.34
	control	54.53		
FBF	experimental	66.28	17.20	**0.00***
	control	63.68		
SF	experimental	58.57	0.00	0.92
	control	60.66		
QST	experimental	44.19	10.15	**0.00***
	control	38.71		
SBP	experimental	118.53	3.32	0.08
	control	118.80		
DBP	experimental	76.03	0.08	0.77
	control	76.30		

*Difference significant at $p \leq 0.05$

The results shown in Table 5 indicate statistically significant differences between the experimental and control groups at the final measurement for the following variables: push-ups, sit-ups, one-leg semi-squats on the right leg, one-leg semi-squats on the left leg, forward bend with feet apart and the Queen's College step test, where this difference is in favor of the experimental group. Changes in the variables listed indicate positive effects of the applied Tae Bo program on muscle endurance for arm extensor muscles, torso flexors, and leg extensors, as well as on increased flexibility and cardio-vascular endurance.

DISCUSSION

The results shown in Table 2 indicate that there was no change in fitness ability among the participants in this group during the experimental treatment. This outcome was expected since the control group was not involved in the applied training program. The results in Table 3 indicate that the experimental treatment caused positive changes in the fitness abilities of the experimental group. The changes included increased strength

and muscle endurance of the stomach, chest and back muscles. In addition, there was an increase in leg muscle strength and endurance, primarily the quadriceps, gluteal muscles, and hamstring. The results also identify a positive effect on flexibility. The most notable improvement, according to the obtained results, was in cardio-vascular endurance.

The results shown in Tables 4 and 5 indicate that the applied Tae Bo program was efficient in that it effected a positive transformation of the measured fitness abilities in women aged 22-27, primarily concerning muscle strength and endurance, cardio-respiratory endurance and flexibility. These results are in accord with the results of the study conducted by Stojanović-Tošić *et al.* (2011), who also found that Tae Bo had a positive effect on increasing cardio-respiratory endurance and aerobic capacity in young women. Considering that Tae Bo is an aerobic exercise program where martial arts elements are performed as stylized moves combined into a dance choreography, the obtained results regarding its effect on changes in fitness parameters can be compared to the effects of similar kick aerobic and dance aerobic programs. The identified positive effects on enhancing the studied fitness abilities, primarily cardio-respiratory fitness (aerobic capacity) and muscle endurance, are similar to the effects identified by Stojanović, Kostić, & Đorđević (2011). These authors identified that kick aerobic exercise programs had a positive effect on increasing cardio-respiratory fitness, back muscle and leg extensor muscle strength, and on improved flexibility in girls aged 16±0.5. Regarding the participants' age and the effects obtained in enhancing the maximum oxygen consumption, the results of our study are in accord with the results of studies on similar exercise programs (Kostić & Zagorc, 2005; Kostić, Đurašković, Miletić, & Mikalački, 2006; Pantelić *et al.*, 2007). In the study by Kostić *et al.* (2005), the participants were aged between 25 and 30, and two programs of dance aerobics were applied, with a different exercise range. Similarly to what we found for Tae Bo in our study, they identified a positive effect on the increase in aerobic capacity. The age of the participants in the study by Kostić *et al.* (2006) was between 20 and 25, and the experimental exercise program included dance aerobics of low, mid- and high intensity. Like ours, their study found an increase in the participants' aerobic capacity. The participants in the study carried out by Pantelić *et al.* (2007) were women between 22 and 25, and the experimental exercise program comprised dance aerobics and strength training. This study also found an increase in aerobic capacity, but unlike ours also found statistically significant changes in systolic and diastolic blood pressure at the end of the applied training program. Mathunjwa *et al.* (2013) used a sample of 60 overweight women with an average age of 25 to explore the effects of a 10-week program of Tae Bo. The authors found positive effects in the form of a decrease in the risk factors traditionally linked to cardio-metabolic diseases. With participants over the age of 30, dance aerobics programs, to which Tae Bo belongs owing to its characteristics, also had positive effects in terms of increased fitness ability (Dowdy, Cureton, Duval, & Ouzts, 1985; Okura, Nakata, & Tanaka, 2003; Gillett & Eisenman, 2007; Schiffer, Kleinert, Sperlich, Schulte, & Struder, 2009). In addition to the positive effect of Tae Bo on women's fitness abilities, its positive effects on men have also been identified. Thus, Roby (2010) identified a positive effect of Tae Bo on aerobic endurance, speed, and leg muscle strength in male adolescents with an average age of 19.5±1.2. In addition to the positive effects on men and women, Tae Bo has been found to enhance physical abilities in children aged 11-15 in the study by Boeva *et al.* (2003).

These studies indicate that Tae Bo can be used with success by both women and men, in terms of increasing levels of fitness ability, such as muscle and cardio-respiratory endurance and flexibility.

CONCLUSION

Taking into account the obtained results, we conclude that the applied 8-week Tae Bo training program, with a frequency of 4 times a week, had positive effects on certain fitness abilities in women aged 22-27. The positive effects were realized primarily in terms of a positive change and increase in cardio-respiratory endurance, muscle endurance for arm and leg extensor muscles, torso flexor muscles, and flexibility. This suggests that Tae Bo as an aerobic exercise program causes appropriate physiological changes in the body that lead to more efficient functioning of the cardio-respiratory system, and thus to increased aerobic endurance. Furthermore, engaging arm and leg muscles repetitively when performing movements, kicks and punches leads to increased muscular endurance. Consequently, the applied Tae Bo training program can be recommended for young women for the purpose of enhancing cardio-respiratory endurance, muscle endurance, and flexibility.

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EFEKTI TAE BO AEROBNOG TRENINGA NA FITNES SPOSOBNOSTI MLADIH ŽENA

Cilj ovog rada je utvrditi efekte Tae bo treninga na određene fitness sposobnosti kod mladih žena. Uzorak ispitanika je činilo 60 mladih žena starosti 20-27 godina, koje su bile podeljene u eksperimentalnu i kontrolnu grupu. Eksperimentalni program je trajao 8 nedelja, sa frekvencijom vežbanja od 4 puta nedeljno. Svaki pojedinačni trening je trajao 60 minuta. Da bi se utvrdile promene u fitness sposobnostima korišćena je baterija od 11 testova. MANCOVA i ANCOVA analiza su korišćene da bi se utvrdili efekti primenjenog programa. Dobijeni rezultati su pokazali da je na multivarijantnom nivou došlo do statistički značajnih efekata primenjenog Tae bo programa (p=0,00). Na univarijatnom nivou utvrđene su statistički značajne razlike između ispitanica eksperimentalne i kontrolne grupe na finalnom merenju u varijablama: sklekovi, podizanje trupa iz ležanja na leđima, čučanj na desnoj nozi, čučanj na levoj nozi, pretklon raskoračno i Queen college step test na nivou značajnosti p=0,00. Na osnovu dobijenih rezultata može se zaključiti da je primenjeni Tae bo program vežbanja ostvario pozitvne efekte u smislu poboljšanja određenih fitnes sposobnosti, pre svega mišićne izdržljivosti mišića opružača ruku i nogu, i pregibača trupa, kardiorespiratorne izdržljivosti i fleksibilnosti kod mladih žena.

Ključne reči: *efekti, fizički fitnes, program vežbanja, žene.*