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Effect of Tabata training program on body fat reduction in healthy inactive women

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Abstract

Background and Study Aim Tabata training is getting more and more popular these days. Based on interval training offers metabolic booster that causes major benefits for reducing body fat storage. It is an interval training protocol which is a cardio workout for fat loss. *The aim:* this study was to examine the effects of a specific 16-week Tabata intervention program on body fat reduction in inactive healthy women.

Material and Methods A non-randomized controlled trial with 2x2 statistical design was provide in this study. The research was conducted on a sample of 49 women (aged 30 to 45) employed in the administrative sector, with more than 6h of sedentary tasks in their habitual working day. It included one experimental group–EG (Tabata program, n=24) and one control group–CG (without physical activities, n=25) and two moments of evaluation: (Initial) at baseline and (Final) after 16 weeks of post intervention period. The body composition parameters and body circumference in each group was recorded. All body composition parameters were measured using a Body composition analyser (Tanita BC-418MA III).

Results The results revealed that there was statistical significance difference after Tabata training program (TTP) in EG for body composition parameters (Mean±SD) for Body mass index (kg/m²) = 22.11±2.59kg/m²; p=0.04, ES=0.07); Fat tissue (%) =25.97±4.72; p=0.03, ES=0.08) and Fat tissue (kg) =17.52±5.11; p=0.02, ES=0.10). Furthermore, there were statistical significance difference in upper-arm circumference (24.95±2.31, p=0.00, ES=0.16) and waist circumference (75.93±7.18, p=0.02, ES=0.10). The control group did not achieve significant differences in the final measurement.

Conclusions Tabata training exercise program (4 months) has been shown to be beneficial for reducing body fat in healthy inactive women

Keywords: fitness program, Tabata training, exercise, adipose tissue, women, differences

Introduction

In today's era of modern lifestyle, people's public health is the most important resource of the modern world. Various diseases (diabetes, cardiovascular diseases) are a consequence of obesity [1]. Insufficient physical activity is the main problem of a modern man, and the population of richer countries (with faster technological development) also records a lower level of physical activity, where 70% of the population is physically inactive [2]. Modern, technologically accelerated and hypokinetic lifestyles have made people's lives easier, but also caused an increase in numerous chronic diseases [3], resulting in an increase in the number of obese people. Data indicate that around 13% of the world's adult population (11% of men and 15% of women) were obese in 2016 [4]. Chronic non-communicable diseases are responsible for more than 60 percent of mortality in the world, which is a consequence of poor nutrition and insufficient physical activity. The number of people with diabetes increased to more than 420 million in 2014 [5].

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It is estimated by the profession that by 2019 there were over 351 million people of working age with diagnosed diabetes [6] and that number will increase to over 417 million by 2030 and over 486 million by 2045. The recommendation is for all healthy people aged 16-65 years to engage in moderate physical activity of an aerobic nature, at least 5 times a week for 30 minutes or intensive aerobic activity at least 3 times a week [7]. The main counter to such an appearance in the future is physical activity, more movement, less sitting, the application of various adequately dosed and clearly directed fitness and cardio programs of the user. According to Vrcić et al. [2] women can improve physical fitness, athletic performance and thus prevent the possibility of injuries through strength training because they have the same physiological condition as men. The research shows that women are, in adult age, less active that men [8]. Promoting fitness exercise has a positive effect on the general mental and physical health of women, which defines the primary strategy of health policy [9]. Physical exercise enables women to control body mass, preventing the possibility of cardiovascular system diseases and damage to the entire neuromuscular and musculoskeletal system.

The contemporary approach to improving physical and mental health has encourage fitness industry to provide various fitness programs with the aim of satisfying the motivation to preserve health, improve physical appearance and reduce body mass. When it comes to the female population, more and more of them exercise because they feel better, the tension is less, they are functionally and emotionally more capable, and thus more operational, more resilient in numerous jobs, family activities and many other obligations [10]. Many of them have specialized and programmed for age-specific purpose. For instance, middle-age women are challenging with hormonal disorders that, especially, impact their physical appearance. The water retention and, thus, increase of body fat with sedentary life style may lead to overweight and obesity. In this regard, the detection of adipose tissue in the body is the main determinant of the occurrence of metabolic disorders [11], with an emphasis on abdominal adipose tissue. It is also important to distinguish white adipose tissue in subcutaneous adipose tissue (it has a large storage capacity) from visceral adipose tissue, which is more metabolically active. Adequate application of various group fitness programs has shown significant effects of changes in body composition [2, 12, 13, 14]. Besides facts that overweight and obesity could cause severe health problems in women, aesthetic appearance is find to be leading motive for women's decisions to start exercising [15]. Due to the lack of time for exercise, women often choose home cardio programs that burns calories because they constantly seeking for more efficient, and thus, faster methods for weight lost and body fat reduction.

High intensity interval training (HIIT), in its various forms, is today one of the most effective means of improving cardiorespiratory and metabolic function and, in turn, physical sports performance. HIIT involves repeated short to long bouts of fairly high-intensity exercise interspersed with recovery periods. The HIIT method, which uses a short intervention time (up to a few minutes) with vigorous-intensity exercise (at about 75% of maximum heart rate), may offer a solution [2, 16]. The optimal stimulus to induce maximal cardiovascular and peripheral adaptations is believed to be one where athletes spend at least a few minutes per session in their "red zone", which is generally the introduction of 90% dosing [17]. New research on HIIT suggests that this exercise modality may lead to more significant fat loss than low/moderate continuous training [18, 19] and may more effectively reduce abdominal mass and visceral fat, which represent the most dangerous fat deposits [20].

Tabata training, as a form of HIIT, is getting more and more popular these days. Based on interval training offers metabolic booster that causes major benefits for reducing body fat storage. Tabata is a HIIT, which was patented by researcher Izumi Tabata in 1996 [21]. High intensity interval training with Tabata training protocol aimed to improve aerobic and anaerobic efficiency, strengthen the ligamentous and muscular system, and improve resting metabolism, which should lead to gradual body fat reduction. It is an interval training protocol which is a cardio workout for fat loss. The Tabata protocol uses the HIIT training method and consists of 8 periods of shorter high-intensity work (20 seconds) alternating with periods of rest (10 seconds). The program is based on maximum intensity exercises that have a beneficial effect on the heart muscle and the acceleration of metabolic processes with prolonged action up to 24 hours after training.

Previous researches on effect of Tabata training on adipose tissue were mostly conducted on adolescents [22, 23], overweight men [24] and overweight women [25, 26]. Some beneficial highlights were made in domain of anaerobic capacity and physical and motoric characteristic of athletes [27, 28, 29, 30]. While the physiological responses to traditional steady-state exercise are well-documented, there is limited research regarding its effect on adult women. Furthermore, previous research on the effects of Tabata training has left a scientific gap in the knowledge surrounding its effects especially on the fat reduction in healthy inactive individuals). It is believed that testing of Tabata training effects on healthy inactive women could promote this type of group fitness program into new approach in healthy recreationist. Tabata protocol does not require too much time per training session, so it could probably ensure sustainability in regular exercising. Therefore, the aim of this study was to examine the effects of a specific 16-week Tabata training program on body fat reduction in inactive healthy women.

Material and Methods

Participants

The research was conducted on a sample of 49 women (aged 30 to 45) employed in the administrative sector, with more than 6h of sedentary tasks in their habitual working day. Inclusion criteria: states that the participants must be female, physically inactive (less than 120 min of moderate-to-vigorous physical activity per week), inexperienced at Tabata training or any group-based fitness programs, healthy (without using drugs or any medicament that causes water retentions) and musculoskeletal injury free. Exclusion criteria: Women who have overcome severe diseases, such as cancer, stroke, or muscular illness were excluded from the study. During the intervention period both group (CG and EG) practiced their habitual food intake (3-5 meals

per day). Additionally, along the intervention period, both groups received two nutritional education sessions with recommendations for how to adopt healthy nutrition habits.

All participants received instructions on hydration, sleep, and diet before each measurement. In order to provide valid data and avoid water retention in the body, all participants stated that they did not menstruate during the testing period. This study was conducted according to the guidelines laid down in the Declaration of Helsinki for research of human subjects and the protocol was approved by the Ethics Committee of the Faculty of Sport and Physical Education at the University of Banja Luka (11.275-1/23).

Research Design

A Tabata protocol was applied to affected changes in body mass index, amount of fat tissue, fat-free mass consisting of muscles, bones, tissues and other fat-free mass and total body water. Additionally, changes were expected in the waist, upper-arm, thigh and hip circumferences.

The Tabata training program lasted four months (from December 2022 to March 2023). The test subjects were divided into 2 groups: The control group (CG; n=25) members had no physical activities (usual activities) during the duration of the experimental program. Women who attended 95 percent of the training sessions during the 16-week duration of the Tabata training program made up the experimental group (EG; n=24). 35 women began the Tabata training program, and of those, 24 met the requirements to be counted in the final measurement because they attended regularly. The participants in the experimental group did not engage in any other forms of physical activity during experimental program. The testing was carried out at the Sports Institute by professors from the Faculty of Physical Education and Sports before and after the Tabata training program.

A non-randomized controlled trial with 2x2 statistical design was provide in this study. It included one experimental group (Tabata intervention) and one controlled group (without physical activities) and two moments of evaluation: (1) at baseline and (2) after 16 weeks of post intervention period. The body composition parameters and body circumference in each group was recorded. All participants volunteered in this study and provided informed consent prior to participation.

Body composition

Body weight and Body Composition were assessed with the Bioelectrical Impedance Analysis (BIA) method using a body composition analysis (TANITA BC-418MA III, Japan), in accordance with the measurement protocol between 8.00-9.00 a.m. The following parameters were chosen to investigate how the Tabata training program affected changes in body composition:

1. Body mass index - BMI (kg/m^2),
2. Fat tissue - FAT (%),
3. Fat mass - FM (kg),
4. Fat-free mass - FFM (kg)
5. Total body water – TBW (%).

Body circumferences

All measurements were performed according to the ISAK [31]. The measurement was performed against skin with no clothing on, at the same time of day and before doing any physical activity. For purpose of this study upper-arm circumference, waist circumference, hip circumference and thigh circumferences were measured.

Tabata training program

Tabata training were held four times a week in the evening (6:30 -7:30 p.m.), outside working hours, for a total of 64 training sessions. The 16-week Tabata exercise program was completed by each participant in the experimental group (Table 1). The training was led by a certified fitness instructor. Each experimental training lasted not over 30 minutes in total and contained: warm-up, Tabata program, calming down and stretching. The warm-up lasts 3-5 minutes and is performed through basic movements that improves mobility and prepare body for main part of exercising. Each Tabata protocol consisted of four rounds and each round lasts four minutes (1 minute's rest between rounds, total 20 minutes). The rounds have 2-4 basic multi-joint exercises. Each round has compound of different exercising (and its modifications) and levels of execution with fastest repetition as possible within 20 sec of active work. The working regime for each round consists of 20 seconds of exercising/10 seconds of active rest. Calming down and stretching, the last component of the workout lasts to 5 and includes doing light moves while listening to relaxing music in order to progressively drop heart rate and achieve mental and psychological relaxation (tempo up to 100 bpm). Stretching is done to increase flexibility as well as to relax muscles and stop muscle soreness. In order to ensure optimal physiological adaptation all participants self-measured PR (pulse rate) by palpation method during exercise [32]. This assessment verify exercise intensity during TP and the maximum heart rate for inactive women was determined with the formula HRmax =211-0.8 x age [33]. The calculated maximum heart rate was used to compute the high-intensity exercise ranging 75%-80% of maximum heart rate. Furthermore, the intensity of sessions was assessed by the 0 to 10 rating perceived exertion (RPE) Borg scale [34]. The intensity changes during the training session were indicated by the instructor to control that no one made strenuous efforts and maintained moderate-to-vigorous-intensity physical activity (6-8 in the Borg scale). At the end of each session, participants

Table 1. Experimental program of Tabata training

Training sessions:		**1, 5, 9, 13**	**2, 6, 10, 14**	**3, 7, 11, 15**	**4, 8, 12, 16**
I month	Round 1	Knee lift, Sumo squat, Side taps, Crunches	Leg curl, Squat to knee raise, Standing toe taps, Hip bridge	Upper cuts, Squat pulses, 1,2,3…Knee up, Dead lift	Skater , Low kicks (RL), Low kicks (LL), Jabs
	Round 2	Skip in-out, Good morning	Skip, Low plank	Leg curl & arms up, Side low plank	Knee lift, Crunches
	Round 3	Squat hold, Glute kickbacks (RL), Shoulder fly & knee lift, Glute kickbacks (LL)	Squats, Kneeling push ups, Back extension, Straight lag raises (ALT)	Sumo squat, Obliques V ups (R), 1,2,3, Split squat, Obliques V ups (L)	Dynamic rowing, Thruster, Superman, Hip bridge
	Round 4	Crunches, Kneeling plank	Russian twists, Kneeling plank	Dead bug , Side plank	Scissors, Sit ups
Training sessions:		**17, 21, 25, 29**	**18, 22, 26, 30**	**19, 23,27, 31**	**20, 24, 28, 32**
II month	Round 1	Leg kicks, Pogo jumps, High knees, Quarter squats	Side kicks, Jumping jacks, Squat Back kicks	High knees, Forw.-back. lunge (RL), Chasee, Forw.-back. lunge (LL)	Low kiks & Jabs, Sing leg dead lift (RL), Pendulum, Sing leg dead lift (LL)
	Round 2	Side lunges, Bird dog	Squat jumps, Hip bride hold	Boxing, Sumo squat hold	Jump to squat, Glute kick side
	Round 3	Deep squat, Kneeling push ups,	Sumo squat, Plank rows,	1,2,3…Knee up Thruster with jump	Superman with lat pull, Kneeling push ups,
	Round 4	Frog sit ups Hip twist in plank	Bicycle crunches Low plank & jabs	Jumpin jacks & jabs V sit ups	Leg kicks Lying bicycle abs
Training sessions:		**33, 37, 41, 45**	**34, 38, 42, 46**	**35, 39, 43, 47**	**36, 40, 44, 48**
III month	Round 1	Pogo jumps Squat jumps Side to side jumps High knee steps	Jumping jacks Squat jumps Front to back jumps Leg curl	Squat hold, Glute kickbacks (RL), Shoulder fly & knee lift, Glute kickbacks (LL)	Knee up (RL) Jumpin jacks Knee up (LL) Burpee
	Round 2	Lunges Broad jumps	Burpee Hip bridge hold	Revers plank, Cross crunches	Lunges Push-up
	Round 3	Side to side jump, Push ups holds	Curtsy lunge, Plank rows	Superman, Flutter kicks	Swimmer , Dead bug
	Round 4	Sit up punches, Plank arm raise	Elbow to knee taps, Plank leg raise	V sit – hold, Side plank leg rises	Mountain climber, Scissors abs
Training sessions:		**49, 53, 57, 61**	**50, 54, 58, 62**	**51, 55, 59, 63**	**52,56, 60, 64**
IV month	Round 1	Rotating squat jumps Mountain climber High knees jumps Jumping jacks	Squat jumps Single leg jumps (RL) Single leg jumps (LL) Lateral ski jumps	Mountain climbers Squat with rotation Lunge with kicks (RL) Lunge with kicks (LL)	Pistol squat (RL) Pistol squat (LL) Pogo jumps Upper cuts
	Round 2	Jumping lunge, Single leg deadlift	Deep squat jumps Single leg hip bridge	Plank jack shoulder tap Lateral lunges	Push ups Knee in taps
	Round 3	Speed skaters Crab walk	Pendulum lunge Burpee	Triceps dips Goblet squats	Jump squats Up-down plank
	Round 4	V-ups Plank crunches	V sit circles Push up–straight arm reach	Power Jacks Walking planks	Cross Jacks Everest climber

declared the average intensity of the session and attendance.

Statistical analysis

Were calculated the basic descriptive parameters (Mean, Std. Dev) of the initial and final measurements for experimental and control group for all variables (BC and body circumferences). Descriptive parameters were calculated for the complete sample, then individually for the EG and CG. The Kolmogorov-Smirnov test (K-S) was used to determine a normal distribution ($p>0.05$). An independent t-test at the level of $p<0.05$ was used to establish significant differences in body composition and body circumferences between the experimental and control groups at the initial measurement. The dependent t-test at the level of $p<0.05$ was used to determine a significant difference between the groups' final measurement for the body composition parameters and body circumferences. In this study, the effect size values were calculated and analysed using formula $t^2/t^2+(N1+N2-2)$. Guidelines for the interpretation of this value were also taken based on analyses [35] and were: 0.01 = small effect, 0.065 = moderate effect, 0.14 = large effect. The obtained results were analysed with the statistical package SPSS 20.0 (IBM, Armonk, NY).

Results

Table 2 contains the results of initial measurement differences in parameters of BC and Body circumference between the experimental (EG) and control groups (CG), ($p<0.05$). The results of the Independent T-test showed that there were no statistically significant differences at the initial measurement between the groups, which indicates considerable intra-group homogeneity at the beginning of the experimental program. Levene's test showed significant homogeneity of variances at the initial measurement ($p>0.05$).

To determine a significant difference between the groups' final measurement for the body composition parameters and body circumferences the T – test for dependent samples was used (Table 3). Levene's test showed a significant homogeneity of variances also at the final measurement ($p>0.05$). The results revealed that there was statistical significance difference after Tabata training program in body composition parameters (FI vs. IN): BMI kg/m² (Mean FI=.11±2.59 vs. IN=23.02 for T= -2.02; p=0.04; Cohen's =0.07); amount of FAT % (Mean FI=25.97±4.72 vs. IN=29.10 for T=-2.12; p=0.03; Cohen's=0.08) and amount of FM kg (Mean FI=17.52±5.11 vs. IN=18.88 for T= -2.38; p=0.02, Cohen's=0.10). Furthermore, there were statistical

Table 2. The difference between the EG and CG (Initial measurement-IN)

Parameters		Group	Mean	Std. Dev.	Mean Differ.	95% CI difference.	T-test	Sig. p<0.05 (2-tailed)	Levene's Test	
									F	p
Body composition	BMI (kg/m²)	E	23.02	3.30	-0.84	-2.75 - 1.08	-0.873	0.387	0,088	0.768
		K	23.86	3.38						
	FAT (%)	E	29.10	5.58	0.55	2.26 - 3.37	0.394	0.695	1.487	0.229
		K	28.55	4.14						
	FM (kg)	E	18.88	5.87	-1.61	-4.97 - 1.75	-0.965	0.340	0.002	0.961
		K	20.49	5.82						
	FFM (kg)	E	45.10	3.56	0.87	-1.18 - 2.93	0.855	0.398	0.071	0.791
		K	44.22	3.60						
	TBW (%)	E	33.02	2.60	0.40	-1.07 - 1.89	0.555	0.582	0.018	0.893
		K	32.61	2.55						
Body circumferences	Upper arm (cm)	E	27.29	2.85	-0.55	-2.01 - 0.91	-0.754	0.455	1.589	0.214
		K	27.84	2.20						
	Thigh (cm)	E	56.12	5.41	-0.98	-4.09 - 2.14	-0.628	0.533	0.003	0.954
		K	57.10	5.45						
	Waist (cm)	E	81.29	8.78	-2.47	-8.03 - 3.10	-0.891	0.377	0.861	0.358
		K	83.76	10.48						
	Hip (cm)	E	98.68	8.64	-1.90	-7.37 - 3.59	-0.694	0.491	1.385	0.245
		K	100.58	10.32						

Note: BMI - Body mass index; FAT - Fat tissue; FM - Fat mass; FFM - Fat-free mass; - TBW - Total body water.

significance difference in Upper-arm circumference (Mean FI=24.95±2.31 vs. IN=27.29 for T= -3.00; p=0.00; Cohen's=0.16) and waist circumference (Mean FI=75.93±7.18 vs. IN=81.29 for T=-2.40; p=0.02; Cohen's=0.10). The control group (CG) did not achieve significant differences in the final measurement (Table 3).

Discussion

The main results of this study show that a 16-week Tabata training program provided positive changes in body composition and body circumferences of inactive adult healthy women for experimental group, however, did not show significant differences in the final measured parameters for control and experimental group (Table 3). Moreover, Tabata training program seems to be effective for decreasing body fat and decreasing body circumferences. It is especially important for middle-aged women since aging causes increasing in body fat.

As they go through perimenopause and menopause the hormone levels are decreasing, which consequently causes reduction of muscle mass and increase of fat, especially abdominal fat. The obtained values of the of the body composition parameters at the final measurement indicate that the implemented Tabata training protocol had a positive effect on decreasing BMI (kg/m^2) on average by 0.91, amount of Fat (%) on average by 3.13% and amount of FM (kg) on average by 1.36kg and FFM (kg) for 0.18kg. The amount of TBW (%) in the body decreased by 0.5%. In addition to changes in body composition, changes are evident in the area of body circumferences. Furthermore, there were decreasing in upper-arm circumference on average by 2.34cm and waist circumference on average by 5.36cm, as well. Observing the percentage of body mass of the control (mean=28.55±4.14) and experimental group (mean=29.10±5.58) at the beginning of the program, the subjects were in the category of moderate-excessive percentage of fat. After Tabata training, the EG reduced the percentage of adipose tissue by an average of 3.13% (mean= 25.97±4.72, p=0.03) and moved into the classification of acceptable percentage of fat and statistically significantly differs from the CG (mean=28.55±4.14) in which has no change in body fat percentage.

Similar research conducted on sample of 25-30 years old women [36] revealed that the Tabata classes in a fitness club could affect decreasing in the body weight if it consisted of regular workouts at least 3 times a week. Moreover, research showed that Tabata training contribute to fat burning, muscle strengthening and endurance training.

Table 3. The difference between the EG and CG (Final measurement-FI)

Parameters		Group	Mean	Std. Dev.	Mean Differ.	95% CI difference.	T-test	Sig.p<0.05 (2-tailed)	Cohen's size	Levene's Test	
										F	p
Body composition	BMI (kg/m^2)	E	22.11	2.59	-1.75	-3.48 - 0.08	-2.021	0.049*	0.07	1.575	0.216
		K	23.86	3.38							
	FAT (%)	E	25.97	4.72	-2.69	-5.24 - 0.14	-2.126	0.039*	0.08*	0.555	0.463
		K	28.67	4.13							
	FM (kg)	E	17.52	5.11	-3.49	-6.43 - 0.54	-2.382	0.021*	0.10*	0.012	0.912
		K	21.06	5.14							
	FFM (kg)	E	45.28	3.44	1.05	-0.97 - 3.08	1.046	0.301	0.02	0.252	0.618
		K	44.22	3.60							
	TBW (%)	E	32.52	2.36	-0.29	-1.67 - 1.08	-0.431	0.669	0.00	0.099	0.754
		K	32.82	2.42							
Body circumferences	Upper arm (cm)	E	24.95	2.31	-2.25	-3.74 - 0.74	-3.004	0.004*	0.16*	0,913	0,344
		K	27.20	2.86							
	Thigh (cm)	E	54.29	3.53	-2.17	-4.92 - 0.58	-1.583	0.120	0.05	5,263	0,026
		K	56.46	5.74							
	Waist (cm)	E	75.93	7.18	-5.43	-9.95 - 0.88	-2.406	0.020*	0.10*	0,211	0,648
		K	81.36	8.50							
	Hip (cm)	E	95.47	7.18	-3.39	-7.98 - 1.22	-1.476	0.145	0.04	0,884	0,352
		K	98.86	8.73							

Note: *Sig. p<0.05; BMI - Body mass index; FAT - Fat tissue; FM - Fat mass; FFM - Fat-free mass; - TBW - Total body water.

Research on body composition conducted by Shah et al. [26] indicates that Tabata training affects decreasing of waist circumference and body mass index in sample of 20-35 year-old women. It has been proven that 20min of Tabata training engages 86% of HRmax while consuming 74% of VO2max. This finding reinforces the idea that Tabata may be another option for those looking for a quick but effective workout [21].

Regardless of whether the fat reduction is accompanied by physical activity, physical activity plays a significant role in the prevention of obesity in women [37]. Research conducted by Zhang et al. [25] indicates that HIIT has better outcome on fat loss compared with moderate-intensity continuous training (MICT). Forty-three obese women with identical morphological characteristics were randomly selected to participate in HIIT versus MICT with equivalent oxygen consumption. After 3 months of intervention the results computed with tomography scans revealed a significant reduction in abdominal visceral and subcutaneous fat in the HIIT than in the MICT group. Research by Habibzadeh [14] and De Lany et al. [38] confirms that aerobic physical activity affects weight reduction, that is, a controlled and moderate diet for women (up to 25 years of age), and similar results have been obtained by other researchers. The other authors [13, 39] found in their study that the implemented program of aerobic exercises leads to a decrease in body mass. Recreational aerobic exercise three to five times a week for 20 minutes to 1 hour contributes to quantitative-qualitative changes in individual variables of morphological dimensions and motor skills [12, 40]. Experimental research was conducted on a sample of women of recreational age with a three-month program (work frequency, 3x20-60min/week) [2]. Changes were recorded in all variables except muscle mass, which was expected in relation to the defined goal.

Recent meta-analyses showed that HIIT significantly reduced total (p=0.003), abdominal (p=0.007), and visceral (p=0.018) fat mass, with no differences between the sexes [20]. High-intensity (above 90% peak heart rate) training was more successful in reducing whole body adiposity, while lower intensities had a greater effect on changes in abdominal and visceral fat mass. The analyses, also, indicated that only computed tomography scan or magnetic resonance imaging showed significant abdominal and /or visceral fat mass loss after HIIT interventions. Exercise is known to increase the number of mitochondria in muscle cells, and more mitochondria contribute to better cellular and metabolic health person. Tabata training as a form of HIIT ultimately aims to activate the body's metabolic processes through high-intensity exercise, which consequently produces increased stimulation of chemical processes in the time after the exercise itself. After HIIT, there is lactate and H+ elimination, glycogen resynthesis and an increase in GH levels, which results in fat oxidation after exercise, leading to fat elimination and weight reduction [41]. Tabata improves athletic performance and glucose metabolism and acts as an excellent catalyst for fat elimination. The effect of excessive post-exercise oxygen consumption (EPOC) for Tabata occurs immediately after the end of the exercise, in terms of the continuous continuation of calorie burning [26]. Numerous studies of Tabata training on energy transit and increase in aerobic capacity have been conducted on athletes, but the loss of body mass has never been the primary outcome.

Considering that, it has to be emphasised that the only proper programming and control of load could enable adequate training adaptation during Tabata protocol and, thus, provide expected outcomes, especially, in inactive individuals. Jurankova, et al. [42] in their study investigates the effects of 10-weeks of HIIT training on body composition with a focus on body fat and muscle mass in 7 women, average age 31. Although the results did not have statistical significance, reduction of fat mass and increase of muscle mass were recorded. Improvements in body composition in women it can be a consequence of the intensity of the exercise and the adequate progression of the training intervention [9]. HIIT stimulates greater neuromuscular and anaerobic development in comparison to other types of exercise [43], but these benefits, however, are largely dependent on different types of HIIT designs. Changes in the capacity of muscle composition in muscles after Tabata intervention are evident.

One of the most important changes that improves maximal accumulated oxygen deficit (MAOD) after Tabata intervention is the increased buffering capacity of the muscles engaged during HIIT [44], allowing more muscle lactate to be generated, resulting in proportional glycolytic ATP production for high-intensity exercise. After 8 weeks of sprint training, the muscle buffer capacity of their subjects increased by ~ 37%, explaining the increase in MAOD after HIIT including Tabata protocol. In addition, carnosine is considered contributor to muscle buffering capacity (5-10%), where carnosine mRNA 1 and protein values are increased by Tabata training, increasing body carnosine content [45, 46]. Tabata training reduces central arterial pressure to the same level as conventional aerobic training through the same arterial signalling mechanism, improves arterial function through the same mechanism, reducing the risk of cardiovascular events [47, 48]. Since Tabata training stimulates the expression of proteins that are correlated not only with sports results but also with the preservation of overall health [49], more research is expected in the future on the possible effects of Tabata interventions and

other training using the Tabata protocol on the health outcomes of people.

However, recent researches be Petrick et al. [50] implicates that HIIT could have unexpected shortcomings. The individuals who had been exercising HIIT three times per week in total 6 weeks didn't improve blood pressure or fats as much as people who exercised far more moderately five times per week. Another study shows that HIIT can damage mitochondria, the energy generators in every cell in the body. The study on athletes conducted by Flockhart et al. [29] revealed that Tabata training could cause mitochondrial damage and the beginning of blood sugar dysfunction. They consider Tabata exercising more beneficial if not used too often. When it comes to top athletes, the authors suggest that piling on intense interval training each week with little rest in between will lead to a tipping point. They, also, believe that the cascade of biochemical changes in the muscles in the third week, as the most difficult, overwhelmed the mitochondria, and such weak mitochondria led to disturbances in the control of blood sugar in people. The results of this study suggest that Tabata exercising should start with small intensive training sessions a couple of times a week, and walk on the other days. Considering all mentioned above, Tabata training is effective in fat reduction for all those who understand physiological postulates of exercising and, thus, can provide smart approach for leading the process. The prospective studies are required to establish the best HIIT protocols for reducing body fat mass according to subject characteristics. Future studies should be done on larger population and on healthy both male and female.

Conclusions

The current study suggests that a 16-week Tabata training exercise program is beneficial for reduction of body fat in healthy inactive women. The improvements were especially generated in decreasing BMI, amount of fat tissue (%), amount of fat tissue (kg). Furthermore, there was decreasing in upper-arm circumference and waist circumference. Apart from traditional weight loss methods Tabata represents time - efficient strategy for improving body composition. Moreover, this type of exercise is not equipment based so it is also, cost-effective.

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