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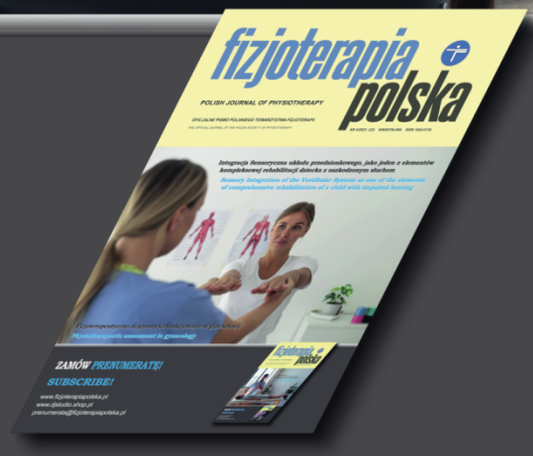

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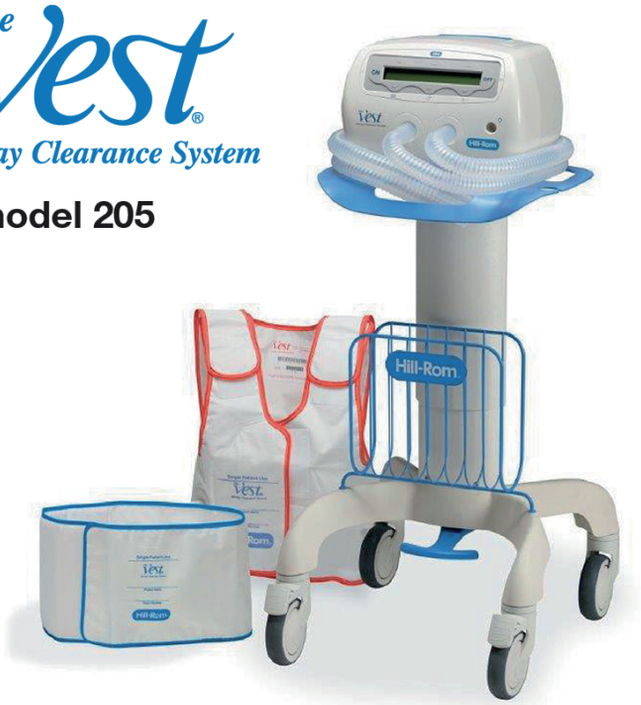

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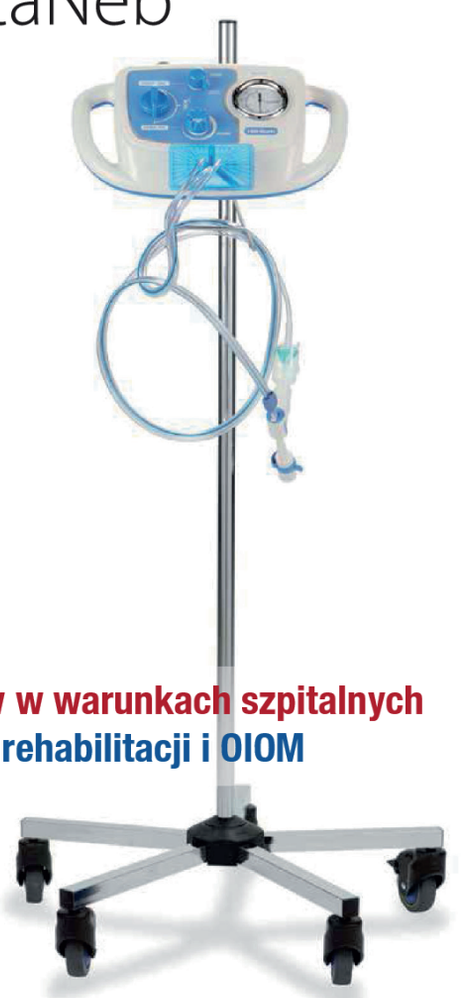

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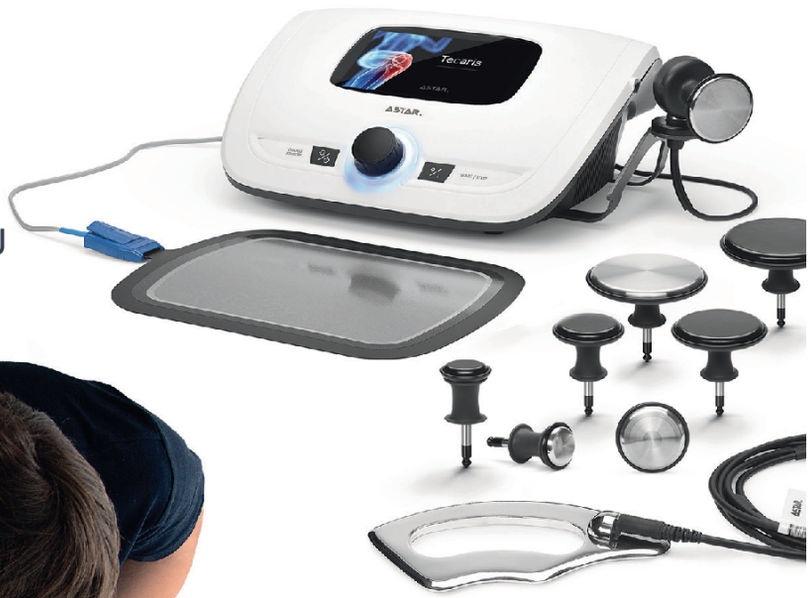

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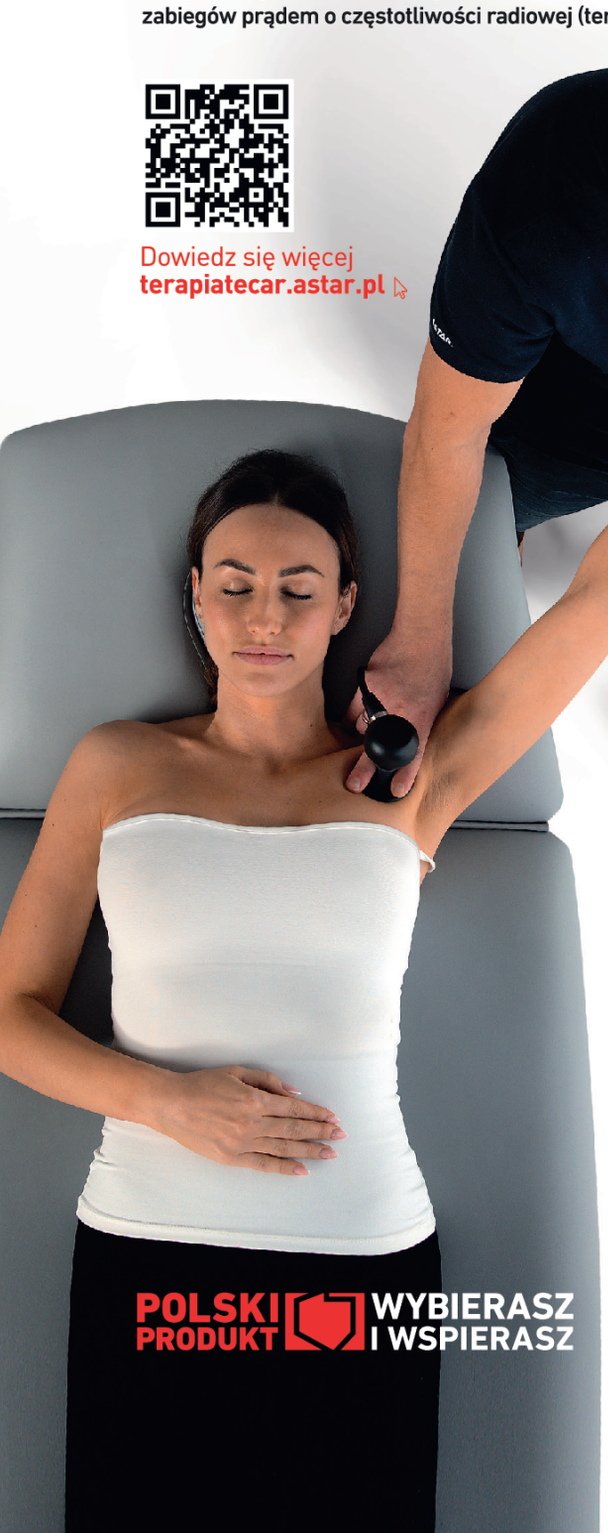

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Effect of monotonous 10-week TABATA workout for overweight female ages 19-21 years old

Efekt jednostajnego 10-tygodniowego treningu TABATA dla kobiet z nadwagą w wieku 19-21 lat

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Abstract

The efficacy of the TABATA workout for college students has been emphasized in academic literature. Nevertheless, there is a dearth of research undertaken on college students within the specific setting of higher education institutions in the Philippines. Therefore, the purpose of this study was to evaluate the TABATA workout's efficacy for overweight female college students. The present study utilized an experimental methodology to evaluate the efficacy of TABATA training among twenty overweight college students aging from 19-21 years old [(N_{20yo} = 9 (45.00%), N_{19yo} = 6 (30.00%), N_{21yo} = 5 (25.00%); mean = 19.95]. Furthermore, the students participated in a 20-minute workout, three times each week, for a duration of ten weeks. The paired t-test was employed to ascertain the statistical significance of the variance observed in participants' BMI values after a duration of 10 weeks. Following a 10-week exercise regimen, it was observed that participants saw a decrease in their body mass index (BMI) and shown overall improvement [$BMI^{a(pre)}$ (26.81 ± 1.37) and $BMI^{b(post)}$ (25.75 ± 1.63), t(19) = 9.379, p < .05]. According to the results obtained, engagement in the TABATA program has demonstrated efficacy and the potential to yield substantial enhancements in students' body mass index. This study did not consider additional variables that could potentially influence the outcome of the study. Hence, it is possible to conduct similar experiments by considering additional variables that were not accounted for in this study.

Keywords

HIIT, overweight, physical education, tabata workout

Streszczenie

Skuteczność treningu TABATA dla studentów była podkreślana w literaturze akademickiej. Niemniej jednak, istnieje brak badań przeprowadzonych na studentach w specyficznym środowisku wyższych uczelni na Filipinach. Dlatego celem tego badania było ocenić skuteczność treningu TABATA dla kobiet z nadwagą studiujących na uczelniach. Niniejsze badanie wykorzystało metodologię eksperymentalną do oceny skuteczności treningu TABATA wśród dwudziestu studentek z nadwagą w wieku od 19 do 21 lat [(N_{20yo} = 9 (45.00%), N_{19yo} = 6 (30.00%), N_{21yo} = 5 (25.00%); średnia = 19.95]. Ponadto, uczestniczki brały udział w 20-minutowym treningu, trzy razy w tygodniu, przez dziesięć tygodni. Test t dla par został użyty do określenia statystycznej istotności obserwowanej zmienności wartości BMI uczestniczek po upływie 10 tygodni. Po dziesięciotygodniowym reżimie ćwiczeń zaobserwowano, że uczestniczki odnotowały spadek indeksu masy ciała (BMI) i wykazały ogólną poprawę [$BMI^{a(przed)}$ (26.81 ± 1.37) oraz $BMI^{b(po)}$ (25.75 ± 1.63), t(19) = 9.379, p < .05]. Według uzyskanych wyników, udział w programie TABATA wykazał skuteczność i potencjał do osiągnięcia znaczących usprawnień w indeksie masy ciała studentów. Badanie to nie uwzględniało dodatkowych zmiennych, które mogłyby potencjalnie wpłynąć na wynik badania. W związku z tym możliwe jest przeprowadzenie podobnych eksperymentów, biorąc pod uwagę dodatkowe zmienne, które nie zostały uwzględnione w tym badaniu.

Słowa kluczowe

HIIT, nadwaga, wychowanie fizyczne, trening tabata

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Introduction

The college setting is a significant context for young individuals in terms of the development of detrimental dietary patterns, heightened susceptibility to weight gain and obesity, and even the occurrence of anemia. These conditions are primarily characterized by the consumption of foods high in saturated fat and inadequate levels of essential minerals like iron and folic acid [1]. The incidence of overweight and obesity has experienced a twofold increase in recent decades, impacting nearly one-third of the global populace, with a particular emphasis on students residing in industrialized nations [2], including the Philippines. Moreover, recent studies have highlighted a concerning trend regarding the proportion of college students who do not engage in regular physical activity [3, 4]. This issue is widely observed on a global level and can be attributed to various factors, including academic demands, limited self-discipline, and inadequate access to sports facilities [5–8]. The causes described above are seen as a public health issue and a pandemic [9–11].

Educational institutions, particularly higher education establishments, have been widely recognized as significant settings for the facilitation of physical activities, particularly within the context of physical education programs [12–15]. Given the substantial amount of time that students, particularly those obtaining undergraduate degrees, spend in educational institutions, these establishments serve as suitable environments and platforms for the implementation of interventions that prioritize the cultivation of a healthy and active lifestyle [16]. Several scientists have emphasized the significance of educational institutions, particularly the Physical Education curriculum, in addressing the issue of overweight and the 'obesity pandemic' [12, 17, 18]. Numerous nations have undertaken the development of resources, programs, and specialized teaching methodologies with the aim of promoting an active and healthy lifestyle among young adolescents, specifically addressing the mitigation of overweightness and obesity issues [19, 20].

One of the activities offered to college students includes High-Intensity Interval Training (HIIT) activities, including TABATA workouts. In recent years, a considerable body of research has been dedicated to investigating the efficacy of TABATA workouts in enhancing persons' overall health [21–23]. TABATA training is widely recognized as a form of high-intensity interval or intermittent training (HIIT), characterized by variations in exercise style, intensity, and durations of activity and rest [24, 25]. The primary objective of this training program is to maximize the advantages obtained within a limited timeframe. For instance, in every iteration of the exercise, an individual has the option to engage in eight repetitions of intense physical activity lasting for 20 seconds, succeeded by a period of rest lasting for 10 seconds. High-intensity interval training (HIIT) is a form of exercise characterized by near maximum or submaximal effort. It is often performed at an intensity that elicits more than 80% (sometimes ranging from 85% to 95%) of an individual's maximal heart rate, as described by [26]. One perspective proposes a more comprehensive interpretation of High-Intensity Interval Training (HIIT), wherein it generally encompasses brief intervals of vigorous physical activity, followed by a brief interlude of rest and recuperation, with a total duration of approximately less than 30 minutes for completion [27]. Within the field of exercise physiology, the categorization of exercise intensity is commonly established in relation to the maximum oxygen consumption (VO_{2max}). Specifically, exercise intensity is classified as either 'submaximal,' 'maximal,' or 'supramaximal' depending on whether the oxygen demand is lower than, equal to, or higher than VO_{2max}, respectively. The training known as TABATA, which exceeds the VO_{2max} by 170%, can be classified as a form of supramaximal intensity intermittent training. Moreover, when considering the exercise recovery ratio, it is important to note that TABATA differs from other forms of exercise, such as sprint interval training (SIT). This training program can be characterized as an innovative and distinctive approach to fitness, commonly referred to as either "interval training" or "HIIT" (High-Intensity Interval Training). HIIT encompasses a range of training methods that involve alternating periods of intense exercise with intervals of rest or lower intensity [24].

Remarkably, recent studies have revealed that engaging in such exercise regimens might provide significant advantages in terms of enhancing the body mass index (BMI) among student populations [28–31]. Significant attention has been given to the examination of multiweek high-intensity interval training (HIIT), specifically the TABATA workout, in scholarly literature. Notably, investigations have been conducted on the effects of this training regimen on overweight young individuals as well as those with a normal body mass index (BMI). The findings from these studies suggest that the improvements resulting from multiweek HIIT, particularly in overweight and obese individuals, are highly effective [32–35]. Moreover, new research has addressed the efficacy of TABATA training within the virtual setting. According to [36], virtual TABATA training has been found to be highly helpful in enhancing the physical fitness and psychological well-being of student-athletes. Similarly, an additional investigation was undertaken wherein it was also noted that the utilization of online TABATA exercise regimens yielded favorable outcomes in terms of enhancing muscle mass, ankle strength (specifically dorsiflexion), hip strength (including abduction, flexion, extension, and external rotation), knee strength (both extension and flexion), as well as balance (as assessed by the Y-balance test) among adolescent individuals [37]. Nevertheless, the aforementioned research has mostly directed their attention towards physical fitness components such as VO_{2max}, endurance, speed, power, strength, and psychological well-being, rather than specifically examining the Body Mass Index. However, while conducting an extensive examination of existing scholarly literature pertaining to this subject within the context of college students in the Philippines, no studies were found. Moreover, the investigation into the efficacy of TABATA exercises in relation to the enhancement of body mass index among overweight female college students remains unexplored. The assessment of its efficacy is of great advantage, particularly for tertiary-level physical

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education instructors in the Philippines. This evaluation aims to promote awareness of its significance in enhancing students' body mass index (BMI) to mitigate or reduce the existing prevalence of overweight students.

Method and materials

Research design

The present study utilized an experimental design to assess the efficacy of a 10-week TABATA exercise regimen in enhancing the Body Mass Index (BMI) of female students who are overweight. The investigation is conducted using a scientific technique that follows a planned and rigorous approach, with a primary emphasis on gaining precision and developing exact conclusions [38]. As previously stated, this study employed a sample technique in which individuals were chosen based on specific qualities that were deemed highly appropriate for the purposes of this investigation. In light of this matter, a criterion for selection was devised with the aim of acquiring the most dependable and precise data from the participants:

- Enrolled in the Exercise Program-based course.
- Ages 19-21 years old.
- Female.
- Participant should be overweight.
- No medical history.

Table 1 illustrates the demographic characteristics of the participants. Based on the table, there are two participants who volunteered to join in the experimental study. Most of the participants are 20 years old, followed by 19 and 21 years old respectively [(N_{20yo} = 9(45.00%), N_{19yo} = 6(30.00%), N_{21yo} = 5(25.00%)] with a mean of 19.95 years old.

Table 1. Ages of the participants

Variables	Items	N(%)	Mean ± SD
Age	19 years old	6(30.00%)	19.95 ± 0.76
	20 years old	9(45.00%)	
	21 years old	5(25.0%)	

Table 2 presents the TABATA training regimen, which has been developed in accordance with the curriculum of the course, specifically tailored for female students. Additionally, it offers a systematic procedure in which students are required to engage during classroom instruction. The aforementioned exercise regimen will be executed by the students in a repetitious fashion for a duration of 20 minutes per day, three times per week, spanning a period of ten weeks.

Instruments and data gathering procedure

The acquisition of data from the participants was effectively accomplished by the utilization of a two-part questionnaire. The first part of the study involves collecting demographic information from the participants, including their age and body mass index (BMI) both before and after the test. The students' height and weight have been measured utilizing the DETECTO 339 instrument. The participants maintained an upright posture while positioning themselves on the device. They placed their bare feet upon the scales in order to complete the data gathering procedure. The researchers also employed the Physical Activity Readiness Questionnaire (PAR-Q) to assess the individuals' present health condition, thereby establishing eligibility and exclusion criteria for the study.

Statistical analysis

The data obtained from the participants underwent processing using IBM Statistical Package for the Social Sciences version 27 (IBM SPSS 27). The demographic features of the participants were analyzed using descriptive statistical methods, including frequency (f), mean (M), and percentage (%). Finally, a paired samples t-test was conducted to assess the statistical significance of the differences in BMI following a series of TABATA workouts performed for twenty minutes per day, three times per week, over a period of ten consecutive weeks [39].

Ethical Considerations

The participants in this experiment were given a comprehensive overview of the study, including its aims, the instruments to be utilized, and the variables that would be assessed throughout the entire length of the investigation. Additionally, the study also outlined modest hazards associated with participation. The participants were requested to grant their written consent by indicating their agreement with the statement presented on the questionnaire.

Results

Table 3 presents a comprehensive analysis of the body mass index of the individuals prior to and following the 10-week Tabata exercise regimen. The data shown in the table indicates a notable decrease and enhancement in the body mass index of the participants following the completion of the specified exercise regimen. Interestingly, half of the subjects achieved the normal categorization following their engagement in the aforementioned fitness regimen.

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Table 2. 10-week monotonous TABATA workout program (3 times/week, 20minutes)

Workout	Instructions
High Knees	1. Start standing. 2. Run in place, driving the knees towards the chest. 3. Use arms and try and go as fast as you can. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Sprawl	1. Start in a plank position. 2. Jump feet toward hands, dropping butt below knees and lifting torso up, and raising hands to chest level. 3. Jump feet back to plank position. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Skaters	1. Start standing with feet hip-distance apart. 2. Jump to the right, landing on right foot and bringing your left leg behind body. 3. Jump back to the left, landing on left foot and bringing right foot behind body. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Knee Tuck to Pushup	1. Start in a high plank position. 2. Jump knees between hands (or place sliders under feet, and pull knees forward in line with hands). 3. Return feet to plank position. 4. Bend elbows and lower into a pushup with control. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Tuck Jumps	1. Start standing. 2. Jump straight up, tucking knees to your chest. 3. Land softly, and immediately repeat that move. That's one rep. Complete 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute.
Mountain Climbers	1. Start in a plank position. 2. Drive your knees toward chest, one at a time, as quick as you can. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Squat Jump	1. Start standing with feet shoulder width apart, toes pointed forward, and weight in heels. 2. Lower down into a squat, and then drive through heels to reverse movement and jump up as high as possible. 3. Land softly back into the squat position. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.
Burpees	1. Start standing. 2. Squat down to plant palms on mat. 3. Immediately, jump feet back into a plank position. 4. Perform a pushup. 5. Jump feet toward hands. 6. Push down through heels to rise up and jump into the air, bringing hands over head. 7. Land softly back on mat. That's one rep. Complete as many reps as possible in 20 seconds at maximum effort, followed by 10 seconds of rest. Repeat eight times. Rest for one minute then continue on to the next move.

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Table 3. Complete comparison on the participants' Body Mass Index based on pre- and post-test scores

Participant	Age	10-Week Tabata Workout	
		Pre-test score Body Mass Index	Post-test score Body Mass Index
F1	19	26.20	24.30
F2	19	27.35	26.45
F3	19	28.45	27.25
F4	20	29.00	28.50
F5	20	26.45	24.35
F6	20	28.00	27.85
F7	20	29.35	28.55
F8	21	29.50	28.75
F9	21	25.60	25.00
F10	21	26.25	25.00
F11	20	25.75	25.25
F12	20	26.75	26.00
F13	19	25.80	25.00
F14	19	27.00	26.00
F15	19	26.00	25.00
F16	20	25.85	25.00
F17	20	26.25	24.85
F18	21	25.00	23.55
F19	21	26.55	24.85
F20	20	25.00	23.45
	$\bar{x} \pm SD$	26.81 ± 1.37	25.75 ± 1.63

Table 4 presents the significant variation seen following the implementation of a 10-week Tabata exercise regimen. The results indicate a notable variance between the pre- and post-test scores of the individuals following the completion of the workout [$BMI^{a(pre)}$ (26.81 ± 1.37) and $BMI^{b(post)}$ (25.75 ± 1.63), $t(19) = 9.379$, $p < 0.05$]. Based on the evidence at hand, it can be inferred that the 10-week Tabata training yields significant effectiveness among female students who are overweight ages between 19-21 years old.

Table 4. Significant variance between pre- and post-test scores after performing Tabata workout

Variables	Paired Differences				t	df	Sig.
	M ± SD	SE	95% Confidence Interval of the Difference Lower	Upper			
$BMI^{a(pre)} - BMI^{b(post)}$	1.06 ± 0.50	0.113	0.82150	1.29350	9.379	19	0.000

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Discussion

The objective of this study was to assess the efficacy of a ten-week regimen involving repeated TABATA workouts in enhancing the Body Mass Index (BMI) of the participants. The results of the study indicate a statistically significant difference and improvement in the participants' body mass index when considering everything in perspective. The present study's findings are consistent with those of [28], who conducted a study demonstrating a statistically significant difference in the body mass index (BMI) of participants who engaged in a 10-week TABATA program, as indicated by a two-way analysis of variance (ANOVA) [BMI ($F = 120.30$, $p < 0.001$)]. This effect was especially evident among individuals classified as overweight. Similarly, Meng et al. (2022) discovered that BMI and body fat mass exhibited a decrease (BMI: $-1.8\ kg/m^2$ vs. $-1.2\ kg/m^2$, $P < 0.01$; FM: $-1.6\ kg$, $P < 0.05$ vs. $-3.7\ kg$, $P < 0.01$) when individuals engaged in high-intensity interval training (HIIT) using the TABATA program over a duration of twelve weeks. In line with the research conducted by [30], it was observed that a 12-week low-volume TABATA-style functional high-intensity interval training (HIIT) regimen yielded significant improvements in cardiorespiratory fitness, body fat levels, cardiometabolic health indicators, and habitual physical activity among female university students. Similarly, the research conducted by [40] has revealed that children classified as overweight or obese can experience positive outcomes from high-intensity interval training (HIIT) protocols including work-to-rest ratios of 1:1 or 2:1, irrespective of the total duration of the exercise regimen. In this context, it may be argued that the TABATA exercise regimen has the potential to significantly decrease and enhance the waist circumference of individuals classified as overweight or obese. Numerous research has substantiated the considerable advantages of TABATA workouts, particularly for individuals with excess weight or obesity. According to the research conducted by [34], it was found that a 12-week High-Intensity Interval Training (HIIT) regimen yields significant effectiveness in addressing overweight among adult individuals. In a study conducted by [41], it was discovered that the TABATA method is a highly successful approach for lowering body weight and fat, particularly among persons who are overweight or obese. On the one hand, based on previous research, it is not advisable to implement this form of training for students classified as underweight or within the normal weight range, as it may have adverse effects on their health. From an optimistic standpoint, it is possible to recommend the training program to students who are underweight or have a normal weight, provided that it is accompanied by appropriate caloric consumption.

Conclusion

According to the results of the study, it has been noticed that engaging in a 10-week TABATA training regimen with repeated sessions can lead to a considerable improvement in the body mass index of female students aging from 19 - 21 years old. In this context, physical education instructors at the college may consistently employ this physical exercise as a means to promote a favorable, health-conscious, and pleasurable activity that could contribute to the enhancement of their body mass index (BMI). Moreover, empirical evidence suggests that the High-Intensity Interval Training (HIIT) program has demonstrated considerable efficacy among female college students. The conclusions drawn from this study are derived from its notable observation, which demonstrates a strong applicability to students classified as overweight.

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Piśmiennictwo/ References

1. Quiliche Castañeda RB, Turpo-Chaparro J, Torres JH, Saintila J, Ruiz Mamani PG. Overweight and Obesity, Body Fat, Waist Circumference, and Anemia in Peruvian University Students: A Cross-Sectional Study. Md Akim A, editor. J Nutr Metab. 2021 Dec 8;2021:1–9. https://doi.org/10.1155/2021/5049037
2. Chen Y, Liu X, Yan N, Jia W, Fan Y, Yan H, et al. Higher Academic Stress Was Associated with Increased Risk of Overweight and Obesity among College Students in China. Int J Environ Res Public Health. 2020 Jul 31;17(15):5559. https://doi.org/10.3390/ijerph17155559
3. Kljajević V, Stanković M, Đorđević D, Trkulja-Petković D, Jovanović R, Plazibat K, et al. Physical Activity and Physical Fitness among University Students—A Systematic Review. Int J Environ Res Public Health. 2021 Dec 24;19(1):158. https://doi.org/10.3390/ijerph19010158
4. Chaabna K, Mamtani R, Abraham A, Maisonneuve P, Lowenfels AB, Cheema S. Physical Activity and Its Barriers and Facilitators among University Students in Qatar: A Cross-Sectional Study. Int J Environ Res Public Health. 2022 Jun 16;19(12):7369. https://doi.org/10.3390/ijerph19127369
5. Winpenny EM, van Sluijs EMF, White M, Klepp KI, Wold B, Lien N. Changes in diet through adolescence and early adulthood: longitudinal trajectories and association with key life transitions. Int J Behav Nutr Phys Act. 2018 Dec 10;15(1):86. https://doi.org/10.1186/s12966-018-0719-8
6. Memon AR, Gupta CC, Crowther ME, Ferguson SA, Tuckwell GA, Vincent GE. Sleep and physical activity in university students: A systematic review and meta-analysis. Sleep Med Rev. 2021 Aug 1 [cited 2023 Apr 27];58:101482. https://doi.org/10.1016/j.smrv.2021.101482
7. Ferreira Silva RM, Mendonça CR, Azevedo VD, Raoof Memon A, Noll PRES, Noll M. Barriers to high school and university students' physical activity: A systematic review. Huertas-Delgado FJ, editor. PLoS One. 2022 Apr 4;17(4):e0265913. https://doi.org/10.1371/journal.pone.0265913
8. Lestari AT, Zamzami IS, Rihatno T, Dlis F, Lobo J, Bachtiar B, et al. Blended teaching to improve the mood state and motor performance skills of student-athletes in softball: A randomized-controlled trial. Fizjoterapia Pol. 2023 Aug 31;23(3):96–106. https://doi.org/10.56984/8ZG1433BB
9. Tanucan JCM, Garcia MA, Bojos MT. Housework-based exercise versus conventional exercise on health-related fitness of adolescent learners. Pedagog Phys Cult Sport. 2022 Oct 28;26(6):364–73. https://doi.org/10.15561/26649837.2022.0602
10. Meldrum DR, Morris MA, Gambone JC. Obesity pandemic: causes, consequences, and solutions—but do we have the will? Fertil Steril. 2017 Apr;107(4):833–9. https://doi.org/10.1016/j.fertnstert.2017.02.104

11. Sobarna A, Lobo J, Setiawan E, Estilo K, Parcon LM, Bulquerin AA, et al. An examination of an 8-week online activity-specific skills program to BMI of local college students. Fizjoterapia Pol. 2023 Aug 30;23(3):228–34. https://doi.org/10.56984/8ZG143B52
12. Kahan D, McKenzie TL. The Potential and Reality of Physical Education in Controlling Overweight and Obesity. Am J Public Health. 2015 Apr;105(4):653–9. https://doi.org/10.2105/AJPH.2014.302355
13. Martin J, Lobo J, Jesus J De, Santos M, Baltazar S, Baltazar J, et al. Selected Physical Fitness Efficiency in the Improvement of Students' Body Mass Index in an Online Learning Environment. Int J Hum Mov Sport Sci. 2023 Jul;11(4):926–37. https://doi.org/10.13189/saj.2023.110429
14. Lobo J, Prevandos FG, Bautista C, De Dios D Al, Dimalanta G, Gazali N. Exploring the Effectiveness of a Battery of Physical Fitness Tests via Virtual Learning Environment. Phys Educ Theory Methodol. 2023 Aug 30;23(4):487–98. https://doi.org/10.17309/tmfv.2023.4.01
15. Resita C, Widiastuti W, Setiakarnawijaya Y, Sopiah O, Lobo J, Estilo K, et al. Rhythmic physical activity to improve the motor abilities of junior students-athlete in gymnastics: randomized control trial. Fizjoterapia Pol. 2023 Aug 30;23(3):174–80. https://doi.org/10.56984/8ZG14337C
16. Wyszyńska J, Ring-Dimitriou S, Thivel D, Weghuber D, Hadjipanayis A, Grossman Z, et al. Physical Activity in the Prevention of Childhood Obesity: The Position of the European Childhood Obesity Group and the European Academy of Pediatrics. Front Pediatr. 2020 Nov 5;8(November):1–8. https://doi.org/10.3389/fped.2020.535705
17. Quennerstedt M, Barker D, Johansson A, Korp P. The relation between teaching physical education and discourses on body weight – an integrative review of research. Curric Stud Heal Phys Educ. 2021 Sep 2;12(3):287–305. https://doi.org/10.1080/25742981.2021.1894407
18. McKenzie TL, Lounsbery MAF. The Pill Not Taken: Revisiting Physical Education Teacher Effectiveness in a Public Health Context. Res Q Exerc Sport. 2014 Jul 3;85(3):287–92. https://doi.org/10.1080/02701367.2014.931203
19. Alfrey L. An expansive learning approach to transforming traditional fitness testing in health and physical education: student voice, feelings and hopes. Curric Stud Heal Phys Educ. 2023 Feb 27;1–16. https://doi.org/10.1080/25742981.2023.2183477
20. Cale L, Harris J, Chen MH. Monitoring health, activity and fitness in physical education: its current and future state of health. Sport Educ Soc. 2014 May 19;19(4):376–97. https://doi.org/10.1080/13573322.2012.681298
21. Popowczak M, Rokita A, Koźlenia D, Domaradzki J. The high-intensity interval training introduced in physical education lessons decrease systole in high blood pressure adolescents. Sci Rep. 2022 Feb 7;12(1):1974. https://doi.org/10.1038/s41598-022-06017-w
22. Ekström A, Östenberg AH, Björklund G, Alricsson M. The effects of introducing Tabata interval training and stability exercises to school children as a school-based intervention program. Int J Adolesc Med Health. 2019 Aug 27;31(4):1–11. https://doi.org/10.1515/ijamh-2017-0043
23. Li Z, Liu Y, Han X, Zhou Z. Effects of running-based versus body-weight-based high-intensity interval training on physical fitness in healthy adolescents. Front Physiol. 2023 Mar 10;14(March):1–11. https://doi.org/10.3389/fphys.2023.1060216
24. Tabata I. Tabata training: one of the most energetically effective high-intensity intermittent training methods. J Physiol Sci. 2019 Jul 19;69(4):559–72. https://doi.org/10.1007/s12576-019-00676-7
25. Emberts T, Porcari J, Dobers-Tein S, Steffen J, Foster C. Exercise intensity and energy expenditure of a tabata workout. J Sports Sci Med [Internet]. 2013;12(3):612–3. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3772611/
26. Weston KS, Wisløff U, Coombes JS. High-intensity interval training in patients with lifestyle-induced cardiometabolic disease: a systematic review and meta-analysis. Br J Sports Med. 2014 Aug;48(16):1227–34. https://doi.org/10.1136/bjsports-2013-092576
27. Thompson WR. Worldwide Survey of Fitness Trends for 2023. ACSMs Health Fit J. 2023 Jan;27(1):9–18. https://doi.org/10.1249/FIT.0000000000000834
28. Domaradzki J, Cichy I, Rokita A, Popowczak M. Effects of Tabata Training During Physical Education Classes on Body Composition, Aerobic Capacity, and Anaerobic Performance of Under-, Normal- and Overweight Adolescents. Int J Environ Res Public Health. 2020 Jan 30;17(3):876. https://doi.org/10.3390/ijerph17030876
29. Meng C, Yucheng T, Shu L, Yu Z. Effects of school-based high-intensity interval training on body composition, cardiorespiratory fitness and cardiometabolic markers in adolescent boys with obesity: a randomized controlled trial. BMC Pediatr. 2022 Mar 1;22(1):112. https://doi.org/10.1186/s12887-021-03079-z
30. Lu Y, Wiltshire HD, Baker JS, Wang Q, Ying S. The effect of Tabata-style functional high-intensity interval training on cardiometabolic health and physical activity in female university students. Front Physiol. 2023 Feb 27 [cited 2023 Apr 27];14. https://doi.org/10.3389/fphys.2023.1095315
31. Shah N, Purohit A. Effect of Tabata Training for Weight Loss in Overweight Middle Age Female of Ahmedabad City: An Experimental Study. Int J Sci Healthc Res [Internet]. 2020;5(December):281–4. Available from: https://ijshr.com/IJSHR_Vol.5_Issue.4_Oct2020/IJSHR0036.pdf
32. Domaradzki J, Rokita A, Koźlenia D, Popowczak M. Optimal Values of Body Composition for the Lowest Risk of Failure in Tabata Training's Effects in Adolescents: A Pilot Study. Maugeri A, editor. Biomed Res Int. 2021 Feb 24;2021:1–7. https://doi.org/10.1155/2021/6675416
33. Ouerghi N, Fradj MK Ben, Bezrati I, Khammassi M, Feki M, Kaabachi N, et al. Effects of high-intensity interval training on body composition, aerobic and anaerobic performance and plasma lipids in overweight/obese and normal-weight young men. Biol Sport. 2017;34(4):385–92. https://doi.org/10.5114/biolsport.2017.69827
34. D'Amuri A, Sanz JM, Capatti E, Di Vece F, Vaccari F, Lazzer S, et al. Effectiveness of high-intensity interval training for weight loss in adults with obesity: a randomised controlled non-inferiority trial. BMJ Open Sport Exerc Med. 2021 Jul 20;7(3):e001021. https://doi.org/10.1136/bmjsem-2020-001021
35. Espinoza Silva JM, Latorre Román PÁ, Cabrera Linares JC, Párraga Montilla JA, Martínez Salazar C. Effects of a High Intensity Interval Training (HIIT) Program on Anthropomorphic and Cardiometabolic Variables in School Children with Overweight and Obesity. Children. 2023 Feb 7;10(2):317. https://doi.org/10.3390/children10020317
36. Gani RA, Setiawan E, Achmad IZ, Aminudin R, Purbangkara T, Hofmeister M. Virtual reality-based tabata training: a professional method for changing levels physical fitness and psychological well-being on student-athletes. Pedagog Phys Cult Sport. 2023;27(2):91–101. https://doi.org/10.15561/26649837.2023.0201
37. Lee KJ, Noh B, An KO. Impact of Synchronous Online Physical Education Classes Using Tabata Training on Adolescents during COVID-19: A Randomized Controlled Study. Int J Environ Res Public Health. 2021 Sep 30;18(19):10305. https://doi.org/10.3390/ijerph181910305
38. Miller CJ, Smith SN, Pugatch M. Experimental and quasi-experimental designs in implementation research. Psychiatry Res. 2020 Jan;283(June 2019):112452. https://doi.org/10.1016/j.psychres.2019.06.027
39. Ross A, Willson VL. Paired Samples T-Test. In: Basic and Advanced Statistical Tests. Rotterdam: SensePublishers; 2017 [cited 2022 Dec 7]. p. 17–9. https://doi.org/10.1007/978-94-6351-086-8_4
40. José De Menezes-Junior F, Correa De Jesus Í, Ferreira VL, Wiens A, Mota J, Leite N. Effect of Different Interval Training Protocols on Adiposity Indicators in Overweight-Obese Children and Adolescents: a Systematic Review and Meta-Analysis. J Phys Educ v. 2020;31:3161. https://doi.org/10.4025/jphyseduc.v31i1.3161
41. Taufikkurrachman T, Wardhati A, Rusdiawan A, Sari R. The Effect of Cardio and Tabata Exercises on Decreasing Body Fat, Weight and Increasing Physical Fitness. In: Proceedings of the 5th International Seminar of Public Health and Education, ISPHE 2020, 22 July 2020, Universitas Negeri Semarang, Semarang, Indonesia. EAI; 2020. https://doi.org/10.4108/eai.22-7-2020.2300320