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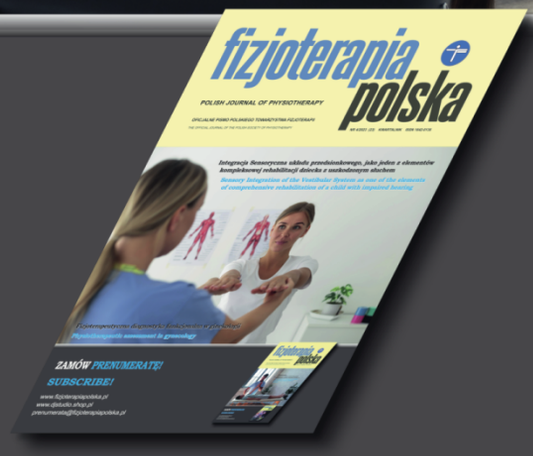

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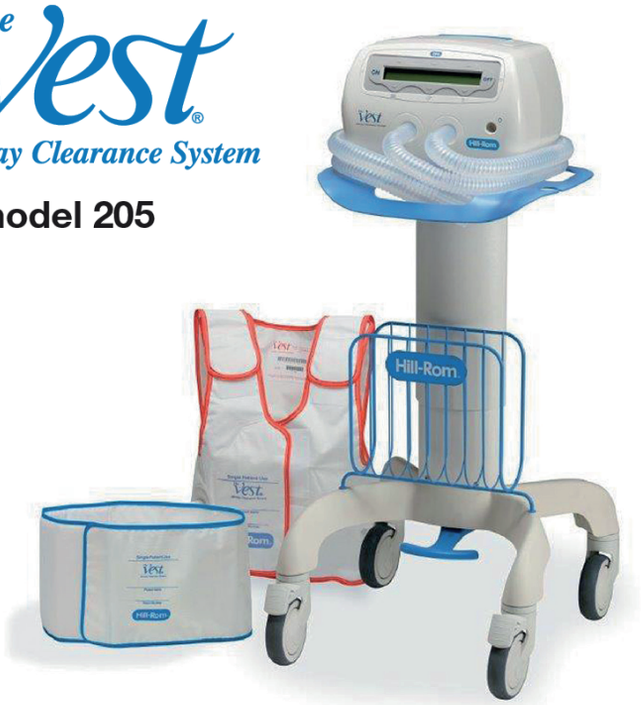

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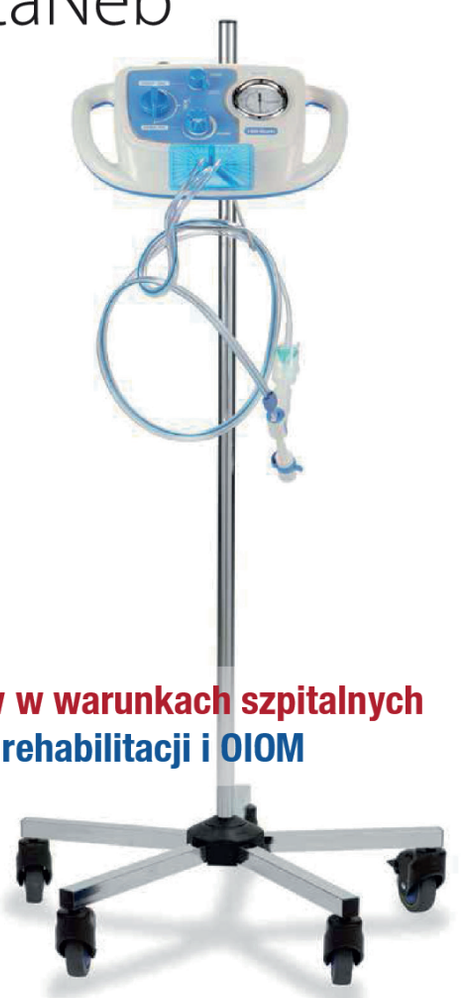

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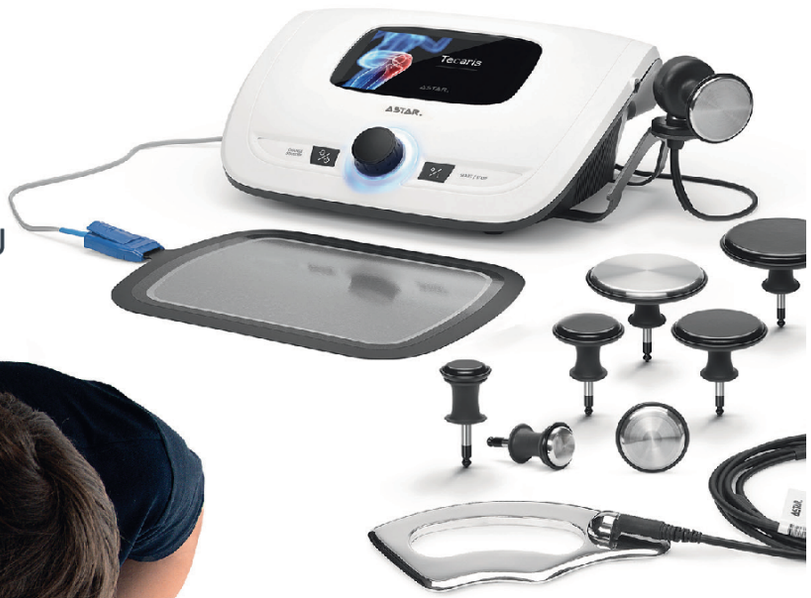

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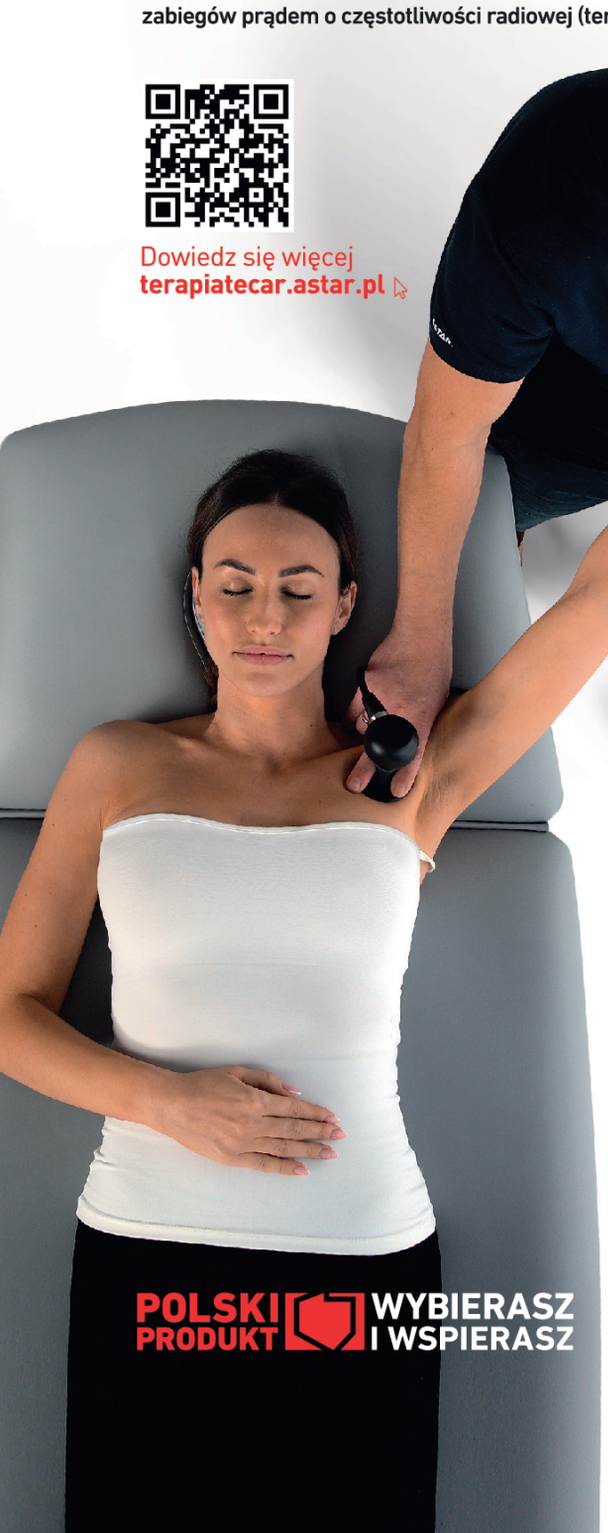

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Changing the game in the fitness industry: effectiveness of high-intensity interval training for girth, vital signs, and BMI

Rewolucjonizowanie branży fitness: efektywność treningu interwałowego o wysokiej intensywności dla obwodu ciała, parametrów życiowych i BMI

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Abstract

The High-Intensity Interval Training program quickly became one of the most popular exercise regiments due to its ability to improve health by significantly impacting the body. This experimental study focused on determining the effectiveness of a 1-month High-Intensity Interval Training program to 10 selected clients which are classified as overweight and obese. Based on the findings, it was found that after participating in High-Intensity Interval Training for one month, most of the participants successfully reduced body measurements, vital signs, and body mass index. In terms of girth measurements, participants' abdomen, chest and waist circumference improved significantly; while forearm and the legs have a slight significant difference. Based on blood pressure, it was observed that High-Intensity Interval Training may positively help to keep blood pressure in the normal range. However, no evidence to imply that this particular program can regulate it. Lastly, based on the pre- and post-test scores of the clients, it was observed that High-Intensity Interval Training program has a significant effect on the improvement on their girth measurement, vital signs, and body mass index. Performing a similar study to support or repudiate the claims of this study is highly recommended.

Keywords

Body mass index, fitness, girth measurement, high-intensity interval training, vital sign

Streszczenie

Program treningu interwałowego o wysokiej intensywności szybko stał się jednym z najpopularniejszych programów ćwiczeń ze względu na swoją zdolność do poprawy zdrowia poprzez znaczący wpływ na ciało. Niniejsze badanie eksperymentalne skupiło się na określeniu skuteczności miesięcznego programu treningu interwałowego o wysokiej intensywności dla 10 wybranych klientów, którzy są klasyfikowani jako osoby z nadwagą i otyłością. Na podstawie wyników stwierdzono, że po miesiącu uczestnictwa w programie, większość uczestników z powodzeniem zredukowała obwody ciała, parametry życiowe oraz wskaźnik masy ciała. Pod względem pomiarów obwodu, znacząco poprawiły się obwody brzucha, klatki piersiowej i talii uczestników; natomiast przedramiona i nogi wykazały nieznaczne, ale znaczące różnice. W oparciu o ciśnienie krwi zaobserwowano, że trening interwałowy o wysokiej intensywności może pozytywnie wpływać na utrzymanie ciśnienia krwi w normie. Jednak nie znaleziono dowodów na to, że ten konkretny program może je regulować. Wreszcie, na podstawie wyników testów przed i po programie klientów, zaobserwowano, że program treningu interwałowego o wysokiej intensywności ma znaczący wpływ na poprawę obwodów ciała, parametrów życiowych i wskaźnika masy ciała. Wykonanie podobnego badania w celu potwierdzenia lub obalenia twierdzeń tego badania jest wysoce zalecane.

Słowa kluczowe

Wskaźnik masy ciała, fitness, pomiar obwodu, trening interwałowy o wysokiej intensywności, parametry życiowe

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Introduction

During the pre-pandemic era, individuals frequently visited gyms and fitness establishments with the intention of reducing body weight, enhancing their physical well-being, and preserving optimal health [1, 2]. As the progression of the pandemic unfolded, the imposition of several health restrictions resulted in a curtailment of individuals' mobility. Due to safety concerns, certain individuals with weight-related concerns were subject to limitations in using exercise facilities. The High-Intensity Interval Training (HIIT) program has gained significant popularity due to its efficacy in facilitating weight loss. In addition to its efficacy in promoting weight loss, HIIT has been empirically demonstrated to enhance girth measurement, vital signs, and body mass index (BMI).

HIIT refers to a type of physical activity that involves exerting near maximum or submaximal effort. According to [3], individuals frequently engage in physical activity at an intensity level that surpasses 80% (sometimes varying between 85% and 95%) of their maximum heart rate. One perspective posits a more all-encompassing interpretation of HIIT, which typically involves short bursts of intense physical activity, followed by brief periods of rest and recovery, with a total duration of less than 30 minutes [4]. The classification of exercise intensity in the discipline of exercise physiology is often based on the measurement of maximum oxygen consumption (VO_{2max}). Exercise intensity is categorized into three classifications: submaximal, maximal, and supramaximal. These classifications are determined based on the comparison between the oxygen demand and VO_{2max}. Submaximal intensity refers to an exercise level where the oxygen demand is lower than VO_{2max}. Maximal intensity is characterized by an oxygen demand equal to VO_{2max}. Lastly, supramaximal intensity indicates an exercise intensity where the oxygen demand exceeds VO_{2max}.

Maintaining physical fitness has become increasingly imperative in contemporary society, owing to the prevalence of obesity rates [5–7]. Among the six nations examined from the study of Tancio as mentioned by [8], the Philippines exhibits the second-lowest prevalence rates of obesity and overweight, with figures of 5.1 percent and 23.6 percent, respectively. Nevertheless, despite the relatively low prevalence rates, the impact of obesity in the Philippines is noteworthy due to the substantial population of individuals affected by this condition within the country [9].

Null hypothesis

H0: There is no significant difference in the body girth measurement, vital signs and BMI after undergoing in the HIIT.

Materials and methods

Research design

The present study utilized an experimental design to assess the efficacy of a 1-month HIIT to a set of samples. In addition, the investigators used observation and monitoring procedures to prove the effectiveness of HIIT to participants' girth measurement, vital signs, and body mass index.

Population and sample of the study

The participants who participated in the study are individuals who are unemployed, students, and business owners through the use of Purposive Sampling Technique. Additionally, the clients who were selected for the study falls under the classification of overweight and obese. A total of ten (10) participants were selected in an attempt to implement the HIIT program lasting for one month and monitor other effects.

Research instrument and measurement

The study participants were required to complete a survey form that recorded their girth measurements, vital signs, and BMI. In addition, the current study has employed an online survey questionnaire. To acquire the measurement of girth, the researchers utilized a measuring tape as a means of monitoring. The sphygmomanometer has been utilized to measure blood pressure. The conventional method for monitoring heart rate involves palpating the artery with the index and middle fingers. Finally, the height and weight of the clients were assessed using the DETECTO 339 device. The participants adopted a vertical body posture when positioning themselves on the equipment. The participants placed their bare feet onto the weighing scales in accordance with the established data collection protocol. The computation of an individual's BMI entails dividing their weight in kilograms by the square of their height in meters.

Data analysis

The researchers conducted experiments involving individuals who were categorized as overweight and obese. During the initial phase of the experiment, the participants' girth measurement, vital signs, and body mass index were assessed and monitored over a period of one month while engaging in the HIIT program. Upon the conclusion of the program, the investigators proceeded to assess the participants' BMI and girth measurements in order to ascertain the program's efficacy in facilitating weight loss. The evaluation of the participants' improvement was conducted by comparing their performance before and after doing HIIT in the study. Once all the data had been collected, statistical methods such as calculating the mean, frequency, percentage, and conducting a T-test were employed to examine the dataset.

Results

Table 1 presents the demographic characteristics of the respondents. Based on the findings, most of the respondents fall under the age of 18–23 years old, followed by 24–29 and 30–35 years old [$N_{18–23\ years\ old}$ = 7(70.00%), $N_{24–29\ years\ old}$ = 2(20.00%), $N_{30–35\ years\ old}$ = 1(10.00%)]. Additionally, most of the respondents are male compared to their counterparts [N_{Male} = 9(90.00%), N_{Female} = 1(10.00%)]. Lastly, it is observed that most of the respondents are unemployed, followed by student and business owner [$N_{Unemployed}$ = 7(70.00%), $N_{Student}$ = 2(20.00%) $N_{Business\ owner}$ = 1(10.00%)].

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Table 1. Demographic characteristics of the respondents (N = 10)

Variables	Items	N (%)
Age	18-23 years old	7 (70.00%)
	24-29 years old	2 (20.00%)
	30-35 years old	1 (10.00%)
Sex	Male	9 (90.00%)
	Female	1 (10.00%)
Economic Status	Unemployed	7 (70.00%)
	Student	2 (20.00%)
	Business owner	1 (10.00%)

Table 2 reports the result on the difference on Girth Measurement of the participants based on their scores before and after one month of training with High-Intensity Interval Training. It was observed that there is a significant difference and improvement in the chest (2.50), abdominal (2.40), and waist circumference (2.05). On the one hand, there is a slight significant difference and improvement between the scores in the forearm (0.54) and legs (1.02), among all the body parts. For the remaining, biceps/triceps (1.25), buttocks (1.40) and thighs (1.45) were also seen to have a quite significant difference and improvement.

Table 2. HIIT Training to Girth Measurement (pre-test versus post-test scores)

Body Parts	Body Measurement		
	Pre-HIIT Training	Post-HIIT Training	Difference
Chest	40.75	38.25	2.50*
Upper Arm			
•Forearm	11.14	10.6	0.54*
•Biceps/Triceps	13.15	11.9	1.25*
Legs	17.12	16.1	1.02*
Abdominal	37.25	34.85	2.40*
Waist Circumference	38.1	36.05	2.05*
Buttocks	40.55	39.15	1.40*
Thighs	22.1	20.65	1.45*

Table 3 typifies the participants' blood pressure before and after the 1-month training. It was observed that most of the participants are hypertensive [$N_{Hypertension}$ = 5 (50.00%)], followed by prehypertensive [$N_{Prehypertension}$ = 4 (40.00%)] and hypotensive [$N_{Hypotension}$ = 1 (10.00%)], indicating that the participants' blood pressure is somewhat higher than what is regarded as typical. After the 1-month training, it was observed that the blood pressure of the participants improved and became relatively normal. Most of the participants became normal [N_{Normal} = 8 (80.00%)], followed by prehypertensive [$N_{Prehypertension}$ = 1(10.00%)]; on the one hand, even there is a significant improvement with the blood pressure, participant 7 still falls under the category of hypertensive [$N_{Hypertension}$ = 1(10.00%)].

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Table 3. Impact of HIIT on Vital Sign

Participants	Blood pressure			
	Pre-test		Post-test	
	f	Range	f	Range
Participant 1	130/77	Prehypertension	120/81	Normal
Participant 2	131/57	Prehypertension	128/85	Normal
Participant 3	131/57	Prehypertension	129/80	Normal
Participant 4	160/87	Hypertension	125/87	Prehypertension
Participant 5	139/88	Hypertension	120/80	Normal
Participant 6	84/63	Hypotension	125/83	Normal
Participant 7	149/104	Hypertension	130/90	Hypertension
Participant 8	130/90	Hypertension	120/76	Normal
Participant 9	130/70	Prehypertension	120/70	Normal
Participant 10	130/90	Hypertension	120/80	Normal

The findings regarding the participants' heart rate before and after the 1-month training are presented in Table 4. The data reveals that 60% of the participants had a low heart rate, indicating a state of being very unfit. The remaining 40% had a heart rate below the norm, which is not optimal for an individual of average fitness. In a positive vein, it is evident that following the training, there was an observable improvement in the heart rates of the responders. Specifically, a majority of the participants had a decrease in their heart rates, so demonstrating that HIIT has a discernible effect on reducing heart rate. Nevertheless, despite the presence of compelling evidence showcasing the efficacy of HIIT in reducing heart rate, it is important to acknowledge that certain individuals within the study cohort did not see significant alterations in their heart rate regulation.

Table 4. Heart-rate results

Participants	Heart rate			
	Pre-test		Post-test	
	f	Range	f	Range
Participant 1	82	Poor	77	Below average
Participant 2	78	Below average	74	Below average
Participant 3	78	Below average	81	Below average
Participant 4	87	Poor	75	Below average
Participant 5	74	Below average	68	Below average
Participant 6	77	Below average	65	Above average
Participant 7	103	Poor	80	Below average
Participant 8	90	Poor	78	Below average
Participant 9	97	Poor	84	Poor
Participant 10	87	Poor	83	Poor

Interpretation (Heartbeats per minute): 49-55bpm = Very fit, 56-61bpm = Excellent, 62-65bpm = Good, 66-69bpm = Above average, 70-73bpm = Average, 74-81bpm = Below average and 82+bpm = Poor.

Table 5 displays the difference in the BMI among the participants prior to and subsequent to their participation in the one-month HIIT program. The findings indicated that a majority of the individuals exhibited a predominant state of obesity (60.00%), with overweight being the subsequent prevalent condition (40.00%). However, these proportions underwent a shift subsequent to the implementation of HIIT. In this context, it is conceivable that the implementation of a HIIT regimen may lead to a decrease in the BMI of those included in the program. It is evident that a significant proportion of individuals classified as obese saw a reduction in weight, resulting in their transitioning to the overweight

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category (60.00%). Similarly, a smaller percentage of overweight individuals achieved a normalization of their weight status (20%). Conversely, the remaining 20.00% did not exhibit any discernible changes in their BMI classification. In an encouraging finding, the BMI of the participants exhibited a considerable improvement subsequent to their enrollment in a HIIT program lasting for a duration of one month.

Table 5. HIIT to Body Mass Index

Participants	Body Mass Index			
	Pre-test		Post-test	
	f	Range	f	Range
Participant 1	32.8	Obese	29.0	Overweight
Participant 2	33.8	Obese	29.5	Overweight
Participant 3	28.9	Overweight	27.3	Overweight
Participant 4	25.0	Overweight	23.3	Normal
Participant 5	33.3	Obese	29.8	Overweight
Participant 6	25.5	Overweight	24.5	Normal
Participant 7	31.6	Obese	29.4	Overweight
Participant 8	27.4	Overweight	26.4	Overweight
Participant 9	31.6	Obese	29.3	Overweight
Participant 10	34.3	Obese	29.9	Overweight

Interpretation: < 18.5 = Underweight, 18.5-24.9 = Normal weight, 25.0 = 29.9 = Overweight, and > 30.00 = Obese

The findings as shown in Table 6 indicate that the null hypothesis has been rejected and the alternative hypothesis has been supported, suggesting a significant impact of HIIT on Body Girth Measurement, Vital signs, and BMI. In order to calculate the T-test, it was necessary to obtain the mean, standard deviation, variance, and frequency. These numbers were then used to determine the T-values, which were found to be 2.144, 2.119, and 2.109. Given that the alpha level was less than 0.05, the appropriate value of the degree of freedom was around ± 1.812. If the calculated T-value exceeds the crucial value of ± 1.812, it is necessary to reject the null hypothesis and adopt the alternative hypothesis. In light of this observation, it may be inferred that HIIT has a notable impact on Body Girth Measurement, Vital Signs, and BMI.

Table 6. Hypothesis testing reference table

	Mean	SD	T-critical	T-value	Decision
Girth Measurement	26.7694	12.2549	± 1.812	2.144	Reject H0
Vital sign	80.9	8.9613	± 1.812	2.119	Reject H0
Body mass index	29.38	3.0336	± 1.812	2.109	Reject H0

Discussion

The findings of this study indicate that a significant number of participants saw a decrease in various body measurements, as evidenced by the notable discrepancy seen between their pre-training and post-training assessments. The chest, abdomen, and waist circumference areas exhibited the most significant disparity in circumference changes between pre-training and post-training. Conversely, a marginal distinction was observed between the forearm and the legs following a one-month period of HIIT, when considering all the anatomical regions of the body.

Furthermore, it has been noticed that the blood pressures of the participants prior to the study predominantly exhibited hypertension, prehypertension, and hypotension, suggesting that the participants' blood pressure levels were somewhat higher compared to the established norm. Following the implementation of HIIT, a notable improvement in the blood pressure of the majority of participants was seen, resulting in a somewhat normalized blood pressure level. The majority of subjects reported having normal blood pressure, whereas the remaining individuals exhibited prehypertension and hypertension. The available evidence indicates that HIIT may have a beneficial effect on maintaining blood pressure within the normal range or in terms of reduction and improvement as stated by other published scholarly works [10–12]. In the pre-HIIT training phase, a majority of the participants demonstrated suboptimal heart rates, indicating a state of poor physical fitness. Additionally, a subset of individuals exhibited heart rates below the average range, which is not considered desirable for individuals with typical fitness levels. Following the completion of the training regimen, it became evident that the participants' heart rates exhibited improvement, with a majority seeing a reduction. This observation suggests that HIIT possesses the ability to

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effectively reduce heart rate as corroborated by recent empirical evidences [13–15]. This finding serves to illustrate that there exists compelling evidence indicating the effectiveness of HIIT in reducing heart rate. However, it is important to note that HIIT does not appear to have a significant impact on heart rate regulation, as evidenced by the fact that certain participants transitioned from a poor to below-average status. Nevertheless, it is worth acknowledging that there were still participants who were unable to alter the status of their heart rate. Furthermore, the findings indicated that a majority of the participants exhibited a higher body weight and BMI, indicative of overweight and obesity. However, a notable shift in these measurements was observed subsequent to the implementation of HIIT sessions. The data indicates a drop in the BMI of the majority of individuals, suggesting a significant influence of HIIT training on BMI as supported by various scholars [16–18]. According to the results, individuals who were initially obese transitioned to the overweight category. Additionally, some participants who were initially overweight were able to achieve a normal weight status. However, there were still participants who did not experience any changes in their BMI categorization. In this context, it is noteworthy that HIIT has the potential to yield favorable outcomes in terms of participants' BMI by effectively facilitating weight reduction over a period of one month. In summary, it can be inferred that HIIT has a notable impact on girth measurement, vital signs, and BMI [19].

Conclusions

Based on the preliminary results, it can be inferred that HIIT has a considerable positive impact on the girth measurement, vital signs, and body mass index of the participants. Significantly, this method has the potential to yield substantial advantages for those who are overweight or obese, particularly those who want immediate outcomes. One potential approach is ensuring clients are adequately informed and advised prior to engaging in strenuous physical activity. Finally, it is strongly recommended that a subsequent study be conducted to corroborate or refute the assertions made in this current research.

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