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Psychological and Anthropometric Effects of Fasted High-Intensity Interval Exercise in Overweight College-Aged Adults: A 12-Week Single–Group Pre-Post Study

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Abstract: The study aims to investigate the psychological and anthropometric outcomes of 12 weeks of high-intensity interval training (Tabata) in the fasted state in overweight college-aged adults. The research followed a quantitative single-group pre–post design that incorpo-rated 120 overweight and obese individuals aged 18 -25 years. No control or comparison group was included; therefore, the findings should be interpreted as within-group pre–post changes rather than controlled intervention effects. Baseline and post-12-week data were collected using direct anthropometric measurements and structured self-report ques-tionnaires measuring BMI, waist circumference, waist-to-hip ratio, body fat percentage, exercise self-efficacy, overweight preoccupation, and body areas satisfaction. Paired-samples t-tests were used to examine within-group pre–post changes. Significant within-group improvements were observed in BMI, MD = 0.76, 95% CI [0.67, 0.86], dz = 1.44; waist circumference, MD = 3.02, 95% CI [2.69, 3.35], dz = 1.65; waist-to-hip ratio, MD = 0.02, 95% CI [0.02, 0.02], dz = 1.60; and body fat percentage, MD = 2.51, 95% CI [2.26, 2.76], dz = 1.82. Psychological outcomes also improved significantly. The findings suggest that fasted Tabata training was associated with beneficial physical and psychological changes, alt-hough the absence of a control group limits causal interpretation.

Keywords: fasted Tabata training, overweight college-aged adults, exercise self-efficacy, body image per-ception.

1. Introduction

Overweight and obesity, as a health issue among students of a university, have become a significant matter. Recent statistics have shown that the prevalence of overweight among university students worldwide lies between 20 and 40 percent, and a 2025 Saudi university study has indicated that the overall prevalence of overweight and obesity is 43.6 percent among the students, including 26.4 percent overweight and 17.1 percent obese [1, 2]. These statistics are important since overweight among student groups is not only associated with future cardiometabolic disease but also with low self-esteem and poor academic and psychological health, implying that overweight in young adulthood is a physical and psychosocial, but no longer a cosmetic problem [3]. Simultaneously, body dissatisfaction has a strong relationship with reduced physical activity in Chinese university students, and weight gain is linked to body dissatisfaction and low self-esteem, meaning that the college years is

a pivotal point where adiposity, self-perception, and exercise behavior can strengthen each other [4, 5]. The trends mentioned above suggest that the problem of overweight among university students should be considered a multidimensional issue of physical and psychological health. From a Lifestyle Medicine and Preventive Rehabilitation perspective, this burden is multi-dimensional and an early modifiable phase in the chronic disease-related disability pathway. Management of overweight is therefore a preventive opportunity to maintain long-term functional independence, not just a weight management issue, when disease-related functional decline is already established in young adulthood.

Against this backdrop, the real issue is not merely that a large portion of the population of college-aged adults is overweight, but rather that excess adiposity is frequently accompanied by decreased activity levels, negative body-related perceptions, and decreased confidence to sustain an exercise routine, which may undermine adherence to healthy behavior [3, 4]. Thus, the current study was devoted to the anthropometric indicators along with the exercise self-efficacy and body image perception since the results reflect the apparent and psychological load of overweight in young adults [4, 5]. Therefore, structured exercise interventions provided during this developmental window can be considered a lifestyle medicine approach, and one that can help to preserve physical performance in the future and decrease the likelihood of disability from chronic diseases. The reason behind choosing a fasted high-intensity interval Tabata training is obvious. Recent literature indicates that the studies on intermittent fasting in individuals between the ages of 10 and 25 are underdeveloped, and HIIT is becoming more perceived as one of the methods of time saving that may be of physical and mental health benefit to overweight and obese people [6–8]. The fasted condition is theoretically relevant because overnight fasting reduces immediate carbohydrate availability and may increase reliance on stored fat during and after exercise. When combined with Tabata-style high-intensity intervals, this state may increase metabolic stress, post-exercise oxygen consumption, catecholamine-related lipolysis, and lipid oxidation, which could produce different outcomes from fed-state exercise. Therefore, fasted Tabata training was expected to influence body composition not only through exercise intensity but also through the metabolic condition in which the exercise was performed [9-11]. Meanwhile, exercise seems to have an effect on exercise self-efficacy via resilience and body image connected mechanisms, but the connections between exercise, self-efficacy, and psychological change in college students are underinspected [12-14]. With this respect, the current research was designed to fill this overlapping gap and to investigate the psychological and anthropometric outcomes of a 12-week fasted high-intensity interval Tabata exercise program in overweight college-aged adults. The following literature review first considers evidence on HIIT and anthropometric outcomes, before examining exercise self-efficacy and body image as psychological outcomes relevant to overweight young adults.

Current evidence suggests that HIIT is a time-efficient exercise modality that has been linked with beneficial effects on body composition, fitness, fat distribution, and selected cardiometabolic parameters in overweight and obese adolescents, young adults, university students, and adult populations [11, 15, 16, 17, 18, 19, 20, 21, 22]. However, the literature also shows that HIIT outcomes are not uniform across protocols, samples, or measurement indicators. Different interval formats, such as running-based HIIT, Tabata-based training, whole body training, jump rope intervals, etc., seem to induce different patterns of changes in BMI, body fat, visceral fat, lean body mass, waist measurements, and cardiovascular parameters [15, 16, 17, 18, 19, 20, 21, 22]. This variation is significant and will indicate that interval training is not only a model of intervention. Some findings indicate that indicators of fatness are more sensitive to changes than BMI, and others suggest that fitness or central adiposity may improve, notwithstanding any small change in overall body mass [11, 19, 20, 21, 22]. Meanwhile, some studies use wider populations of adults or normal-weight

obese participants or compare different types of exercise programs without a well-defined overweight college-aged population [11, 18, 19]. Thus, the available literature suggests that HIIT is relevant, but there is a focused gap in the literature of supervised 12-week fasted Tabata training in overweight college-aged adults and the combined anthropometric indicators.

This anthropometric evidence is closely tied to exercise self-efficacy (ESE) as physical change is not enough to ensure that lifestyle will improve unless they have confidence to maintain their exercise. Self-efficacy for exercise is well known as a determinant of physical activity initiation and maintenance in people with overweight/obesity [23, 24]. In previous studies, higher self-efficacy has been reported to be correlated with increased moderate and vigorous activity, greater activity choice, higher readiness to overcome barriers, and increased adherence to weight-related or physical activity programs [25, 26, 27, 28, 29]. The overall results of these studies indicate that confidence is not just a second-order psychological response to an intervention, but a behavioural mechanism that can influence the likelihood of sustaining involvement in exercise activities following an intervention. However, the evidence is not consistent as some studies are cross-sectional, culturally specific, clinically focused, older adult focused, female only or not supervised exercise focused in mixed sex college aged adults [25, 26, 27, 28, 29]. This makes it difficult to transfer the results to the population of students in universities where they might have other obstacles, such as timetables, body image, a lack of routine and low confidence in maintaining difficult exercise. Therefore, the aim of the present study is to assess whether exercise self-efficacy is associated with body composition indicators after a 12-week fasted Tabata programme in overweight young adults.

Body image adds another psychological perspective as overweight youth may feel concerned about their weight, be dissatisfied with their body, and be less motivated to be active than physically healthy. Past research has shown that physical activity and exercise participation have generally been related to more positive body image, better perceived physical condition, decreased sedentary time, better body-related quality of life, and satisfaction with appearance or body areas [30, 31, 33, 34]. However, this relationship is not consistent across all populations, as some findings show only limited or variable associations between physical activity and body image satisfaction among adults with overweight or obesity [32]. This incongruity implies that body image is not just a function of physical activity but also of age, weight status, social context, perceived physical competence, and subjective interpretation of body change [30, 31, 32, 33, 34]. Limitations in the literature also exist because many studies have adopted cross-sectional designs, pandemic context data, heterogeneous samples and used general physical activity measures instead of taking a supervised intervention approach for overweight college-aged adults [30, 31, 32, 33, 34]. Thus, it is concluded that there is evidence that HIIT can lead to physical and psychological benefits; however, more focused pre-post evidence is needed in the field with supervised fasted Tabata training in overweight adults ages 18-25. The aim of the present study is to fill this gap by exploring anthropometric outcomes as well as exercise self-efficacy, overweight preoccupation and body areas satisfaction within one integrated framework.

This research aims to examine the psychological and anthropometric effects of a 12-week fasted high-intensity interval (Tabata) training program among overweight college-aged adults. To address this gap, the study was guided by the following two research questions:

1. Does a 12-week fasted Tabata training program significantly improve anthropometric indicators (BMI, waist circumference, waist-to-hip ratio, and body fat percentage) among overweight college-aged adults?

2. Does participation in a 12-week fasted Tabata training program significantly improve psychological outcomes, including exercise self-efficacy and body image perception, among overweight college-aged adults?

To provide an explanatory basis for these research questions, the study draws on theories that explain how structured exercise may influence both behavioural confidence and body-related psychological adaptation. This study is theoretically grounded in the social cognitive theory and self-determination theory. According to social cognitive theory, human behaviour is explained as the result of a mutual interaction between the personal beliefs, behaviour and environmental factors, and the self-efficacy takes the middle ground as to whether an individual starts, continues, and controls action or not [35, 36]. This theory was most appropriate since the intervention involved participants whose time and again they had to perform strenuous exercise in fasted conditions and the ability to continue with it despite discomfort, fatigue, and obstacles was of particular importance. By undergoing frequent mastery experiences during the 12-week programme, participants were able to reinforce beliefs regarding overcoming the exercise-related barriers, going back to exercise after a break and maintaining effort, all of which are in line with the exercise self-efficacy construct of the measure in the study. Exercise research findings have also revealed that self-efficacy is closely connected with physical activity behaviour and change throughout the period of exercise interventions.

On the other hand, according to self-determination theory, a person's motivation and happiness are influenced by their ability to meet three fundamental psychological requirements, including independence, competence, and connection with others [37]. The choice of this theory was correct, as a long-term engagement in organised training could help to develop a sense of competence by providing a successful performance, a sense of self-regulation due to the frequent commitment to the behavioural pattern, and more positive self-assessment in the long term. In this research, these processes contributed particularly to the interpretation of alterations in the level of body image perception, such as less weight preoccupation and heightened satisfaction with body parts and more general psychological adaptation to exercising attendance. Studies that used the Self-Determination Theory in relation to physical activity have continually revealed that an increased degree of self-determination correlates with enhanced exercise behaviors and continued behaviors and psychological health [38]. Collectively, these two theories formed a solid explanatory foundation on how to associate structured fasted Tabata training with behavioural confidence and psychological change related to the body.

Based on this theoretical foundation, the conceptual framework (Figure 1) was developed to show how the 12-week fasted Tabata training programme was expected to relate to the anthropometric and psychological outcomes examined in this study.

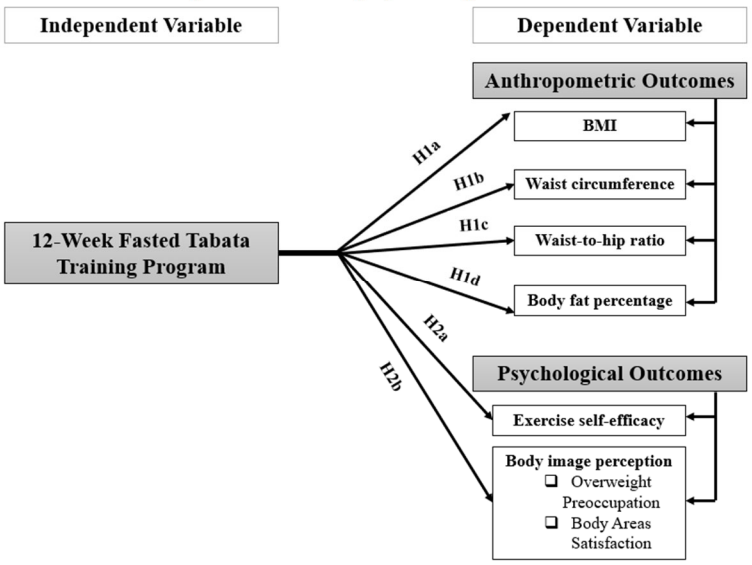

Figure 1. Conceptual framework of the relationship between the 12-week fasted Tabata training programme and anthropometric and psychological outcomes.

The conceptual framework introduces the Tabata training program of 12 weeks as an independent variable and classifies the dependent variables in two primary outcome domains, namely, anthropometric outcomes and psychological outcomes. The anthropometric domain consists of body mass index, waist circumference, waist-to-hip ratio and body fat percentage, which are physical changes that are measurable including body composition and fat distribution. The psychological domain comprises exercise self-efficacy and body image perception that describes the confidence that the participants possess in exercising and how the participants view themselves after the intervention. The perception of body image is also expressed in two dimensions, including, overweight preoccupation and body areas satisfaction, to portray both worrying about weight and content with certain parts of the body. Such a design indicates that this intervention would have impacts on physical and psychological aspects of health in overweight college-aged adults. The framework facilitates a systematic foundation of the study to analyze the change in the outcome of the pre and post intervention by categorizing the variables into distinct areas of investigation and to harmonize measurement, analysis, and results in the study. The study hypotheses were deduced based on this conceptual framework (Figure 1):

- H1a: Mean BMI will be significantly lower after the 12-week fasted Tabata training program compared to baseline.
- H1b: Mean waist circumference will be significantly lower after the 12-week fasted Tabata training program compared to baseline.
- H1c: Mean waist-to-hip ratio will be significantly lower after the 12-week fasted Tabata training program compared to baseline.
- H1d: Mean body fat percentage will be significantly lower after the 12-week fasted Tabata training program compared to baseline.
- H2a: Mean exercise self-efficacy scores will be significantly higher after the 12-week fasted Tabata training program compared to baseline.
- H2b: Mean body image perception scores will significantly improve after the 12-week fasted Tabata training program compared to baseline.

2. Materials and Methods

2.1. Research design

This research was based on a quantitative single-group pre–post design to investigate the differences in anthropometric and psychological variables after the 12-weeks fasted Tabata training program [39]. This study design was suitable since it allowed a similar group of overweight college-aged adults to be measured preintervention and postintervention, allowing the direct evaluation of change over time with regard to BMI, waist circumference, waist to hip ratio, body fat percentage, exercise self-efficacy and body image perception. Pretest-posttest designs are frequently applied to determine intervention effects as a comparison of baseline (preintervention) and postintervention measures of the same individuals. Therefore, this design was quite consistent with the purpose of the study, which was the evaluation of change in relation to interventions.

2.2. Data Collection

The data collection was performed on two occasions during the baseline (before the intervention) and at the completion of the 12-week fasted Tabata training program. Anthropometric measurements were directly measured on the participants at both stages when body weight, height, waist circumference, waist-to-hip ratio and body fat percentage measurements were obtained, and body mass index was calculated. Further, the psychological data were collected using the structured questionnaire that was applied during the pre-intervention and post-intervention stages to measure exercise self-efficacy and body image perception. The intervention lasted 12 weeks whereby the participants performed fasted Tabata on three occasions weekly.

Each session was done in the format of Tabata repeated high-intensity and brief intervals that were divided by rest using bodyweight exercises consisting of squats, push-ups, burpees, and jumping jacks. The participants were advised to conduct the sessions once they had fasted in the night and their customary pattern of lifestyle during the period of supervised training. Intervention fidelity and adherence were monitored throughout the 12-week programme by recording participant attendance at each of the supervised Tabata sessions. All 120 enrolled participants completed the full 12-week intervention and were included in the final pre- and post-intervention analysis, with no participants lost to follow-up. Compliance with the fasting requirement was checked verbally before each session, and participants who reported not having fasted were asked to complete that session on another appropriate day within the same week. Missed sessions were rescheduled within the same week wherever possible to maintain intervention consistency; participants unable to reschedule a session within that window had the session recorded as missed rather than substituted. No adverse events were observed during the intervention period. This process has provided a measure of consistency in the two time points and has also facilitated the accurate evaluation of the changes after the intervention.

2.3. Research Participants

In this research, 120 college-aged overweight and obese (18-25 years) adults were used as participants. The selection of the participants was based on young adults since it is at this age that the status of weight, body image, and physical exercise behaviour are interrelated. According to the World Health Organization, a body mass index (BMI) more than 25 indicates that a person is overweight, which is defined as having abnormally high levels of fat that may have negative effects on health [40]. In this study, the participants were all within the necessary weight-related requirements during the baseline. The convenience sampling was deemed to recruit the sample of this study due to the nature of the study that targeted the availability of college-aged adults who were accessible to join the 12 weeks of supervised exercise intervention [41]. This approach was convenient in the context of recruiting an adequate number of eligible participants in the study context and it was also appropriate in terms of repeated pre- and post-intervention measurement under the conditions of controlled research.

Table 1. Demographic Characteristics of the Participants (N = 120).

Factor	Attribute	Frequency	Percent %	Mean	Standard Deviation
Age	18–20 years	52	43.3	21.31	2.47
	21–22 years	23	19.2		
	23–25 years	45	37.5		
	Total	120	100.0		
Gender	Male	62	51.7	NA	NA
	Female	58	48.3		
	Total	120	100.0		
Initial Weight	Kilograms	-	-	86.18	12.71
Height	Metres	-	-	1.72	0.09

As shown in Table 1, the participants had a mean age of 21.31 years with a standard deviation of 2.47 years. The largest age group was 18–20 years, representing 52 participants or 43.3% of the sample, followed by the 23–25 years group with 45 participants or 37.5%. The smallest age group was 21–22 years, comprising 23 participants or 19.2%. In terms of gender, 62 participants were male, representing 51.7%, while 58 participants were female, representing 48.3%, indicating a relatively balanced gender distribution. The baseline weight of the participants had a mean of 86.18 kg with a standard deviation of 12.71, which implies that there was a range of

weights in the sample at baseline. The mean height was 1.72 m with a standard deviation of 0.09, indicating a rather narrow range of height of the participants.

2.4. Research Instrument

The research instrument in this study was based on two parts, including direct anthropometric measurement and a structured self-report questionnaire, which was given in the pre-intervention and post-intervention phases. Anthropometric measurements were done to determine the physical outcome measures of the study, which are body mass index (BMI), waist circumference, waist-to-hip ratio, and body fat percentage. Body fat percentage was measured using bioelectrographic impedance method by Tan-ita BC-418 body composition analyzer. The device was calibrated as per the manufacturer's instructions prior to measurement sessions, and the participants were measured barefoot, standing upright and in similar pre- and post-measurement conditions. Body composition measurements were conducted before exercise sessions to minimize the possibilities of near-term sweating, fluid loss, or physical activity affecting the estimates. The weight and height were recorded and subsequently used to determine the BMI, whereas the waist circumference, waist-to-hip ratio, and body fat percentage were measured following typical anthropometric measurements. These were measured prior to the first week of the 12-week fasted Tabata training program and afterward, after the intervention, to see the changes in body composition and central adiposity over time. Repeated physical measurements before and after the intervention allowed the study to achieve both pre- and post-intervention status of the patients, along with the change related to the training program, in a consistent and objective way.

Measurement of the psychological variables was done through a structured questionnaire that consisted of standardized scales. The Exercise Self-Efficacy Scale (ESES) created by Kroll et al. was used to measure exercise self-efficacy and contained 10 questions that measured the confidence of participants in their effort to exercise despite some obstacles, including exhaustion, poor mood, lack of support, or unavailability of exercise facilities [42]. The Body image perception was assessed using the chosen subscales of the Multidimensional Body-Self Relations Questionnaire, which was introduced by Cash, namely overweight preoccupation with 4 items and body areas satisfaction with 9 items [43]. The subscales of overweight preoccupation measured the anxiety about fat, weight vigilance, dieting, and eating restraint, but the subscale body areas satisfaction measured the satisfaction with the specific body parts and general appearance. The ratings of all the questionnaire items were on a five-point Likert scale between strongly disagree and strongly agree. To analyze the data, the scale scores were averaged across the responses per subscale hence a standard measure of a psychological change between pre-intervention and post-intervention.

2.5. Data Analysis

In this research, SPSS was used to analyze the data taken through descriptive and inferential statistics to study the variation in anthropometrical and psychological results prior to and following the 12-week fasted Tabata training program. Descriptive statistics were performed for demographic variables, as well as the values at baseline and post-intervention of the whole range of study variables. The comparison of before and after intervention period scores in anthropometric and psychological data was done by utilizing paired-samples t-tests. This type of approach enabled the conclusion of the occurrence of statistically significant changes after the intervention. All analyses were set to $p < .05$ level of statistical significance.

2.6. Ethical Consideration

The study considered ethical considerations to ensure that the rights, safety, and privacy of all the participants were maintained. Before participation, everyone was given a participant information sheet in which they were informed about the aim of the study, the procedures, and the risks that may arise, as well as what to expect, so

that they could make an informed decision [44]. Subsequently, informed consent was secured by a signed consent form, and no data collection commenced [45]. The study was voluntary, and it was made clear to the participants that they were free to pull out of the study at any point without any penalty or adverse effects [46]. Besides, anonymity and confidentiality were preserved in the context of ensuring that personal identities were not revealed and that the data collected were utilized solely to conduct research [47]. The research was therefore carried out within the basic ethical research guidelines.

3. Results

3.1. Findings on Anthropometric Outcomes

Paired-samples t-test was conducted to compare pre and post intervention scores of anthropometric data before and after 12 weeks of the fasted Tabata training program. Table 2 shows the descriptive statistics of the anthropometric variables at before and after intervention period.

Table 2. A Comparison of Descriptive Statistics for Both Before and After the Intervention of Anthropometric Variables (N = 120).

Variable	Time	M	SD	SE
BMI	Pre-intervention	29.21	3.64	0.33
	Post-intervention	28.45	3.39	0.31
Waist Circumference	Pre-intervention	88.68	8.64	0.79
	Post-intervention	85.65	8.65	0.79
Waist-to-Hip Ratio	Pre-intervention	0.87	0.06	0.005
	Post-intervention	0.85	0.06	0.006
Body Fat Percentage	Pre-intervention	26.72	7.23	0.66
	Post-intervention	24.22	7.04	0.64

As shown in Table 2, the mean BMI decreased from 29.21 (SD = 3.64) at pre-intervention to 28.45 (SD = 3.39) at post-intervention. The mean waist circumference decreased from 88.68 (SD = 8.64) to 85.65 (SD = 8.65). The mean waist-to-hip ratio decreased from 0.87 (SD = 0.06) to 0.85 (SD = 0.06). The mean body fat percentage also decreased from 26.72 (SD = 7.23) to 24.22 (SD = 7.04). Now, Table 3 presents the paired-samples t-test results comparing the before and after intervention period.

Table 3. Paired-Samples t-Test Results for Pre- and Post-Intervention Anthropometric Variables (N = 120).

Variable	Mean Difference	SD	SE	95% CI Lower	95% CI Upper	t	df	p
Pre_BMI – Post_BMI	0.76	0.53	0.05	0.67	0.86	15.81	119	.000
Pre_WC – Post_WC	3.02	1.83	0.17	2.69	3.35	18.13	119	.000
Pre_WHR – Post_WHR	0.02	0.01	0.001	0.02	0.02	17.52	119	.000
Pre_Body Fat% – Post_Body Fat%	2.51	1.38	0.13	2.26	2.76	19.89	119	.000

The outcomes of the paired-samples t-test indicated that there was a significant difference in all four anthropometric variables between the before and after intervention period (Table 3). In the case of BMI, the comparison between the before and after intervention period scores was found to be significantly different, $t(119) = 15.81$, $p < .001$. This finding was an indication that H1a was supported. In case of waist circumference, paired samples t-test indicated that the difference between the before and after intervention period scores was statistically significant, $t(119) = 18.13$, $p < .001$. Therefore, H1b was supported. In the case of waist-to-hip ratio, the analysis also showed that there is a statistically significant difference between the two time points, $t(119) = 17.52$, $p < .001$. In this regard, H1c was in support. In the case of the body fat percentage, the paired-samples t-test also indicated that the before and after intervention period scores differed statistically, $t(119) = 19.89$, $p < .001$. Thus, H1d was supported. On the whole, the findings indicated that the statistical analysis supported all four hypotheses that were developed within the framework of the first research question.

3.2. Findings on Psychological Outcomes

3.2.1. Psychological Outcomes for Exercise Self-Efficacy

The paired-samples t -test was used to determine differences in before and after intervention period scores of exercise self-efficacy in the 12-week fasted Tabata training program. Table 4 shows descriptive statistics of exercise self-efficacy at the before and after intervention period.

Table 4. A Comparison of Descriptive Statistics for Both Before and After the Intervention of Exercise Self-Efficacy Scores (N = 120)

Variable	Time	M	SD	SE
Exercise Self-Efficacy	Pre-intervention	2.85	0.54	0.05
	Post-intervention	3.40	0.56	0.05

As presented in Table 4, the mean exercise self-efficacy score at pre-intervention was 2.85 (SD = 0.54, SE = 0.05), whereas the mean post-intervention score was 3.40 (SD = 0.56, SE = 0.05). Further, the findings of the paired-samples t-test for the exercise self-efficacy scores before and after the intervention period are presented in Table 5.

Table 5. Paired-Samples t-Test Results for before and after intervention period Exercise Self-Efficacy Scores (N = 120)

Variable	Mean Difference	SD	SE	95% CI Lower	95% CI Upper	t	df	p
Pre_ESES_Mean – Post_ESES_Mean	-1.11	0.18	0.02	-1.14	-1.07	-67.33	119	.000

As was indicated in Table 5, the paired-samples t-test analysis revealed that there was a statistically significant difference in scores of the exercise self-efficacy between the before and after intervention period assessment, $t(119) = -67.33$, $p < .001$. This was in support of hypothesis H2a which implied that mean scores in exercise self-efficacy would significantly increase after the 12-week fasted Tabata training program than at baseline.

3.2.2. Psychological Outcomes for Body Image Perception

Following the 12-week fasted Tabata training program, participants' body image perception was assessed through two separate dimensions: overweight preoccupation and body areas satisfaction. Table 6 presents the descriptive statistics for both subscales at the pre-intervention and post-intervention stages.

Table 6. A Comparison of Descriptive Statistics for Both Before and After the Intervention of Body Image Perception Scores (N = 120)

Variable	Time	M	SD	SE
Overweight Preoccupation	Pre-intervention	3.33	0.74	0.07
	Post-intervention	2.38	0.74	0.07
Body Areas Satisfaction	Pre-intervention	2.82	0.53	0.05
	Post-intervention	3.88	0.54	0.05

As presented in Table 6, the mean overweight preoccupation score at pre-intervention was 3.33 (SD = 0.74, SE = 0.07), whereas the mean post-intervention score was 2.38 (SD = 0.74, SE = 0.07). The mean Body Areas Satisfaction score was 2.82 (SD = 0.53, SE = 0.05) at pre-intervention and 3.88 (SD = 0.54, SE = 0.05) at post-intervention. Further, Table 7 presents the paired-samples t-test results for two intervention stages for body image perception scores.

Table 7. Paired-Samples t-Test Results for before and after intervention period Body Image Perception Scores (N = 120)

Variable	Mean Difference	SD	SE	95% CI Lower	95% CI Upper	t	df	p
Pre_OWP_Mean – Post_OWP_Mean	0.95	0.25	0.02	0.91	0.99	41.95	119	.000
Pre_BAS_Mean – Post_BAS_Mean	-1.05	0.18	0.02	-1.09	-1.02	-65.00	119	.000

The results of the paired samples t-test in Table 7 indicated that there was a significant difference between the Pre-intervention and post-intervention scores of the overweight preoccupation ($t(119) = 41.95$, $p < .001$). Paired-samples t-test also indicated that the scores in the Body Areas Satisfaction were significantly different between pre intervention and post intervention testing results $t(119) = -65.00$, $p < .001$. Hypothesis H2b which hypothesized that the means body image perception scores such as overweight preoccupation and body areas satisfaction would significantly increase at the end of the 12-week period following the fasted Tabata training program than the baseline was thus, achieved.

4. Discussion

4.1. Anthropometric Changes Following the 12-Week Fasted Tabata Training Program

The results indicated that the 12-week fasted Tabata training intervention was linked with the stable changes in all the anthropometric measurements investigated

in the research. However, these findings should be interpreted cautiously because the present study used a single-group pre–post design rather than a controlled trial. Therefore, unlike some of the HIIT studies used for comparison, this study cannot fully rule out placebo effects, Hawthorne effects, natural changes over time, regression to the mean, or unmeasured lifestyle changes. As a result, the comparisons with controlled HIIT studies should be understood as contextual support, not as evidence of equivalent causal strength. The first is that body mass index decreased following the intervention which implies that the participants went through the training period with an overall decrease in body mass with respect to height. This observation indicated a positive shift in weight conditions after periodic fasted high-intensity exercise. A number of research studies conducted in contemporary times have demonstrated the same findings as the current BMI following fasted Tabata training. First, Song et al. reported that eight weeks of HIIT among college students who are obese resulted in both male and female athletes making significant weight and BMI improvements, which is directly related to the current study that repeated high-intensity training may be associated with reductions in BMI in college-aged adults [48]. Furthermore, Guo et al. found four weeks of HIIT decreased waist circumference and body fat percentage in overweight young women, indicating that high-intensity exercise can quickly lead to a decrease in body composition, which can be used to explain the current reduction in BMI after a prolonged intervention [49]. Additionally, a current meta-analysis among university students found that HIIT decreased BMI, body fat percentage, and waist to hip ratio significantly, which supports the assertion that the current BMI change fits the wider evidence base among young adults [50]. Furthermore, there are also recent studies that provide valid explanations of this BMI improvement. Interestingly, Guo et al. have discovered that HIIT with fasting was better than control groups in reducing body mass and waist circumference, indicating that fasting-state exercise may contribute to body composition change in the current research [9]. Similarly, Jiang et al. demonstrated that HIIT achieves a higher apex post-exercise oxygen consumption, along with a higher percentage change in lipid oxidation compared to energy-matched continuous exercise in obese male college students, which can help explain the potential of repeated fasted Tabata sessions in decreasing BMI [10]. Likewise, Guo et al. hypothesized that the fat loss associated with HIIT could be caused by the changed metabolism, increased post-exercise oxygen intake, and changes in appetite, which offers a plausible explanation of the current finding [49]. On the whole, the current evidence of an improvement in BMI after twelve weeks of fasted Tabata training is in line with current evidence and is physiologically justified.

The results of the research also revealed that the waist circumference reduced during pre-intervention and post-intervention, with the results indicating that the central body size improved after the program. Such a trend implied that the training had a correlation with a decrease in abdominal adiposity in the participants. A number of recent studies have demonstrated the same, which is consistent with the current decrease in waist circumference following Tabata fasted 12-week program. First, Lu et al. discovered that low-volume Tabata-style HIIT intervention in female university students significantly decreased waist circumference that is strongly aligned with the existing evidence that an organized Tabata format can enhance central body size in young adults [51]. Besides, Wang et al. demonstrated that eight weeks of HIIT, with or without resistance training, should be regarded as a significant improvement in the waist circumference of young overweight or obese women, which supports the current observation that repeated high-intensity exercise can be used to decrease abdominal adiposity in similar groups [52]. Moreover, it was also found that HIIT results in small yet significant reductions in waist circumference in overweight or obese adults, and this also indicates that interval-based training may be beneficial in central adiposity despite relatively low changes in total body weight [53]. Furthermore, this

decreased circumference of the waist is biologically plausible as HIIT seems to selectively attack the abdominal and visceral fat by repeated metabolic stress, increased catecholamine-driven lipolysis, and increased post exercise energy expenditure, which can result in a progressive depletion of central fat stores over 12 weeks [54-56]. Similarly, it has been indicated that an exercise of moderate-vigorous intensity with enough time per week results in dose-related changes in waist circumference and visceral fat that likely explain why a regular fasted Tabata workout may make your abdomen smaller with time [56, 57]. Thus, the current reduction in the waist circumference is in line with recent findings and is effectively explained by the existing theories that relate interval exercise to abdominal fat loss.

As per the results of the present study, the decrease in waist-to-hip ratio was one more sign of the body fat distribution and central adiposity improvement after the intervention. This showed the impact of the program was not limited to the body mass alone but also fat patterning. A number of modern studies have recorded the same observations which is in line with the current decrease in the waist to hip ratio after the 12 week fasted Tabata regimen. First, Kv et al. found that a 12 week Tabata based intervention in sedentary female university students produced a decrease in waist to hip ratio alongside improvement in body composition, which closely supports the present finding that Tabata style training can improve fat distribution in young adults [58]. Further, Mehmood et al. noted that interval based high intensity circuit training demonstrated a significant increase in waist to hip ratio compared to no exercise in adult women, and again this shows that repeated HIIT can also decrease central adiposity as opposed to overall body weight [59]. Moreover, Ahmad et al. demonstrated that low volume and high volume HIIT had the same effect on improving waist to hip ratio in obese women, which supports the current demonstration of the fact that even varying HIIT volumes could have a beneficial impact on body fat patterning when sustained over a period of several weeks [60]. Furthermore, this observation is biologically plausible since interval training can generate a high level of post exercise energy requirement and increased fat oxidation as well as induce catecholamine related lipolysis, which can reduce abdominal and visceral fat over time and thus leads to an improvement of the waist to hip ratio [61-63]. Similarly, since waist to hip ratio is more indicative of fat distribution than body mass, the loss of abdominal and visceral adipose tissue is particularly significant, as visceral fat is more closely associated with metabolic and cardiovascular risk as well as because physical activity also alters insulin sensitivity that counteracts central deposits [64, 65]. In general, the current reduction in the waist to hips ratio aligns with the recent findings and indicates that fasted Tabata training may be associated with positive changes in central fat distribution among overweight college aged adults.

In addition, the findings of the current research revealed that the body fat percentage did reduce following the 12-week program indicating that the intervention was correlated with a positive body composition. Compiled, the anthropometric data revealed that fasted Tabata exercise was associated with general body changes in a wide range of indicators associated with the body. A number of modern research studies have indicated similar results that correlate with the present research finding on the body fat percentage. First, Liu et al. stated that HIIT intervention of 12 weeks could decrease body fat percentage and visceral fat area in normal weight obese female college students and this is very close to the current outcome since it demonstrates that a structured interval based exercise program can positively affect body composition in a young adult student group [66]. Besides, Tabata based HIIT also increased fat content in overweight female college students at eight weeks which correlates well with the current finding of demonstrating that Tabata style training is able to reduce adiposity in college aged individuals [67]. Moreover, the meta-analysis of randomized trials showed that HIIT elicited an overall decrease in body fat percentage and fat mass, and according to Khodadadi et al., the argument confirms that the overall reduction of body fat percentage was not a coincidental event but rather

one that is supported by broader evidence [68]. On the same note, Li et al. found that HIIT had a small benefit over moderate intensity continuous training in reducing body fat percentage in overweight or obese adolescents, which also indicates that the importance of interval training in enhancing adiposity related indicators across the younger age groups are meaningful [69]. Besides, the current decrease in body fat percentage is physiological as, when training is maintained over weeks, repeated high intensity bouts can cause high catecholamine or growth hormone release, post exercise oxygen use, and lipid mobilization and oxidation, which contribute to gradual fat loss [17, 70, 71]. Similarly, it has been shown that even less-volume interval training can have a significant effect and reduce the percentage of body fat in fat youths and obese, indicating that time-efficient interventions, including, the Tabata, can provide enough metabolic stimulus to enhance body composition despite the absence of extended exercise sessions [72]. Hence, the current finding is aligned with the recent evidence and demonstrates that a 12 weeks of Tabata fasted program has the potential to provide significant changes in body composition in overweight college aged adults throughout the intervention period.

Beyond weight-related change, these anthropometric improvements have important rehabilitation and functional-health implications. Reductions in BMI, waist circumference, waist-to-hip ratio, and body fat percentage may reduce mechanical loading on the musculoskeletal system, improve ease of movement, and support continued participation in physical activity. This is particularly relevant in young adults, because persistent central adiposity and excess body fat may contribute over time to reduced endurance, mobility limitation, obesity-related disability, and greater cardiometabolic burden. Therefore, although the present single-group design does not allow strong causal claims, the observed improvements suggest that fasted Tabata training may have value as an early preventive rehabilitation approach for preserving functional capacity in overweight college-aged adults.

4.2. Psychological Changes Following the 12-Week Fasted Tabata Training Program

The results indicated that the attendance of the 12 week fasted Tabata training program was linked to the evident enhancement of the exercise self-efficacy in overweight college aged man. This showed that the participants gained more confidence in their capacity to perform and maintain a physical activity after the intervention. Some of the recent studies have also indicated comparable results that support the present study finding on exercise self efficacy. First, Latino et al. concluded that 12 week exercise program made a significant change in self efficacy of obese adolescents, which adds to the current finding, stating that the ability to exercise regularly can contribute to the confidence of the belief in the capabilities of the individual with excessive weight [73]. Besides, a systematic review and meta analysis by Baghbani et al. found exercise interventions to be associated with better self efficacy and exercise motivation in adults, which is relevant to the current result since it theorizes that structured exercise may be used to change the beliefs of exercise capability among overweight related groups [74]. Moreover, Lee et al. outlined a physical activity self efficacy intervention of obese individuals that was selectively aimed at augmenting self efficacy levels of engagement in physical activities, thus supporting the current interpretation that self efficacy is adjustable with repetitive and specific exercise related engagement [75]. Likewise, Yu et al. observed that there is a positive correlation between physical activity and self efficacy among college students, which also validates the present finding as it implies that higher participation in exercise is associated with better exercise related efficacy among the young adults [76]. Furthermore, this enhancement of the exercise self efficacy is theoretically feasible since repeated successful completion of stressful exercise sessions can give participants mastery experiences, perceived barriers, and support personal assumptions about the potential to start and sustain physical activities later in life, in particular when participants start to experience positive changes in their fitness, body related outcomes, and behaviour consistency [77, 78]. Moreover, the latest findings suggest that exercise self-

efficacy becomes more robust with repeated positive involvement in exercising, increased perseverance, and enhanced involvement in behaviors [79]. Thus, the current result indicates that 12-week fasted Tabata training was associated with a significant within-group improvement in exercise self-efficacy among overweight college aged adults.

The findings also showed the positive changes in the body image perception following the training program in terms of diminished overweight preoccupation and concomitant body areas satisfaction. Some of the recent studies have demonstrated the same results that are consistent with recent research determination on the perception of body images. To begin with, a meta-analysis and systematic review of randomized controlled studies reported that exercise training had a positive impact on psychological outcomes among overweight or obese adults, which supports the current finding by showing that structurally organized exercise can bring about any significant psychological effects on other outcomes and not only physical changes [80]. In addition, Mahdifar et al. revealed that physically active adults tended to be more satisfied with their weight and body image, which is also related to the current result since the participants in the current research were more satisfied with their body related perceptions after training [81]. Moreover, Masotti et al. also stated that frequent sporting activity was linked to higher body image satisfaction, which also substantiates the current evidence that regular physical exercise could lessen dissatisfaction and help people to have more positive views about body parts [82]. Moreover, this enhancement is realistic since consistent exercise attendance might alter the focus on appearance anxiety to the bodily functioning, competence, and advancement, and adjustments in body composition can lessen overweight preoccupation and reinforce satisfaction with particular body parts with time [83, 84]. Similarly, the new intervention evidence indicates that body image is improved more easily when the movement related experiences are directly addressed and when the psychological support is supplemented with weight management or exercise, meaning that the regular Tabata sessions might have affected the physical perception and emotional assessment of the body [85, 86]. Moreover, body image is also strongly related to emotional well being, self acceptance, and anxiety in the university groups, and thus, increased participation in the activities may have also contributed to a more positive internal assessment of the body over the course of intervention [87, 88]. Thus, the current result is in line with recent post 2020 publications and indicates that a 12 week fasted Tabata training regimen was associated with beneficial within-group changes in body image perception among overweight college aged adults. The psychological results also need to be interpreted with caution since self-report questionnaires were used to measure the exercise self-efficacy and body image perception. Participants could have been affected by the response shift bias, which implies that their internal criteria of the evaluation of exercise confidence, weight concern, or body satisfaction could have shifted once participating in the 12-week programme. Thus, the psychological gains that are observed can be attributed not only to the actual change but also to the self-estimation after numerous exercise practices.

Furthermore, the present study did not establish whether the changes in anthropometric and psychological outcomes were beyond minimal clinically important differences despite the fact that the changes were statistically significant. The statistical significance does not therefore necessarily mean clinical or practical significance. Nevertheless, the BMI, waist circumference, waist-to-hip ratio and body fat percentage decreases that were observed may still be clinically relevant as even small adiposity and central fat changes could facilitate improved movement patterns and reduced risk in young adults. These gains in exercise self-efficacy and body image perception could also have implications for real-world health promotion by ensuring ongoing physical activity outside of the supervised programme. Future studies are needed to set clinically meaningful cutoffs for the BMI, waist circumference, body fat

percentage, exercise self-efficacy, and body image subscales to determine if the changes observed are of clinical significance.

4.3. Implications for Functional Health and Preventive Rehabilitation

These results suggest that fasted Tabata training could be used as a component of a Lifestyle Medi-cine and Preventive Rehabilitation approach, where time efficient and structured ex-ercise is used as a preventative strategy to support the maintenance of physical performance and functional independence throughout the lifespan, as opposed to as a standalone weight-management intervention. In this context, the anthropometric and psychological benefit seen here is an early stage indicator of disability prevention, applicable to populations that may not have developed chronic disease but are at high risk.

In addition to the anthropometric and psychological consequences mentioned above, the results have implications for functional health and preventive rehabilitation of young adults. Decreases in waist circumference, waist-to-hip ratio, and body fat percentage do not just show cosmetic or weight-related changes but they are indicators of decreases in central adiposity, which is a known factor for early musculoskeletal loading, reduced movement efficiency, and long-term cardiometabolic risk. In this way, the improvements observed may not only reflect aesthetic results, but possibly also a measure of functional capacity preserved or improved. Obesity in young adulthood is associated with a progressive decline in physical function, mobility and exercise toler-ance, which, over time, can lead to obesity-related disability and eventual need for rehabilitative care. Interventions that improve functional reserve, particularly fasted Tabata training, that can be delivered at this critical young adult phase, before impairment has set in, can hence be considered as a form of preventive rehabilitation, rather than treating disability per se. This interpretation is strengthened by the parallel im-provement in exercise self-efficacy, because the confidence in one's ability to exercise is an established predictor of long-term exercise maintenance and, therefore, sustainable functional health.

5. Conclusions

The most important results of the given research were the ability to show that the 12-week Tabata training program (fasted) significantly changed not only the physical but also the psychological sphere of overweight college-aged adults. Anthropometrically speaking, the intervention was related to the regular decrease in BMI, waist circumference, waist-to-hip ratio, and body fat percentage, which means that the overall body mass status was improved, as well as central fat distribution and body composition. These trends indicated the possibility that the training effect was not merely confined to simple weight-related change to more general measures of physical health. Psychologically, the results indicated that the participants experienced improved self-efficacy to exercise following the intervention, which is increased confidence in the participants being able to perform and maintain exercise behaviour. Moreover, there was an improvement in the body image perception in two mutually complementary directions: the overweight preoccupation levels of participants were reduced and the body areas satisfaction levels were increased, which both resulted in a more positive assessment of the body-related self-perception. Combined, the results indicated that Tabata training under fasting conditions was associated with multidimensional physical and psychological changes. From the rehabilitation and functional-health perspective, these findings indicate that a structured exercise programme, started early, could be beneficial in maintaining functional capacity in overweight young adults before more serious obesity-related limitations occur. The improvement in adiposity-related indicators could lower future cardiometabolic burden, and exercise self-efficacy and body image perception could help to maintain exercise participation. Thus, fasted Tabata training could be suggested as a preventive rehab tool for young adults who are at risk of functional decline due to obesity,

but the evidence needs to be more robust with RCTs, which include direct assessment of functional outcomes.

In this study, a number of limitations were found, which ought to be taken into consideration when deriving the results and further academic growth. Firstly, the study was based on a single-group pre–post design with no control or comparison group. Thus, the changes were not caused only by the fasted Tabata training programme as placebo effects, Hawthorne effects, natural changes over time, regression to the mean, motivation among the participants, or unmeasured lifestyle changes might have affected the outcomes as well. A randomized controlled study with fed-state exercise, non-exercise, or alternative-exercise comparison groups should be employed in future studies to enhance causal inferences. Second, the researchers used convenience sampling of adults of overweight college age in a convenient environment, which could have lessened the representativeness of the sample, and constrained the relevance of the results to the general populations of young adults. Future research ought to thus adopt probability based or multi-site sampling methods to enhance sample diversity and external validity. Third, the intervention was conducted over 12 weeks, which was not long enough to find out whether the anthropometric and psychological improvements would be maintained in the long term. Longitudinal follow up evaluation should also be incorporated in the future studies to establish the longevity of intervention effects. Fourth, the psychological outcomes were based on the scores of the self-report questionnaires and they could have been influenced by response bias, social desirability, temporary emotional conditions or response shift bias. Also, the research tested statistical significance but failed to determine whether the changes were greater than the minimal clinically important differences. Future research ought to deploy self-report measures alongside qualitative interviewing, behavioural measures, and a priori clinically relevant thresholds.

The study was important as it tested the impact of a 12 weeks fasted Tabata training session on anthropometric and psychological measurements in a single programme of intervention against overweight college aged adults. Its greatest innovation was the integration of body composition indicators with self-efficacy in exercising and body image perception, as opposed to the use of physical change as the sole point of evaluation. Moreover, the research was conducted on overweight young adults within a university-age cohort, which is noteworthy since it is a population that tends to be simultaneously challenged by the excess adiposity, body dissatisfaction, and infrequent exercise participation. The combination of fasted high-intensity interval exercise and a multidimensional outcome framework facilitated the study to expand the knowledge regarding how a time-efficient model of exercise can contribute to the visible health outcomes as well as internal psychological adaptation.

With regard to the implications of the study, the theoretical implications are that the results of the study indicate that overweight intervention studies need to be viewed as not only anthropometric change but also physical and psychological. The analysis revealed that structured exercise can potentially impact on body composition, exercise confidence, and body-related self-perception, which establishes an integrated perspective of exercise results among overweight youths. In practice, the research suggests that Tabata workouts done in a fasted state can be a viable and time-saving intervention to university groups who do not have enough time to participate in routine physical activities. It also implies that the student health programmes ought to aim at physical and psychological improvement of a child. These findings, from a rehabilitation perspective, highlight the importance of obesity-related functional decrements starting in young adulthood before mobility limitations, musculoskeletal complaints, or cardiometabolic disease become entrenched, and thus, it is not just about aesthetics or fitness, it's also about prevention in rehabilitation. Furthermore, placing this study in the context of lifestyle medicine and preven-

tive rehabilita-tion reveals that structured exercise can help maintain functional independence, maintain physical performance and prevent the onset of disability due to chronic disease before obesity-related decline is clinically evident in young adults.

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