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Original article

Effects of Whole-Body Electromyostimulation-Assisted Exercise on Self-Esteem and Body Mass Index in Men with Obesity: A Preliminary Randomized Controlled Study

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ABSTRACT

Background: Obesity is associated with adverse physical and psychological health outcomes, including diminished self-esteem. Whole-body electromyostimulation (WB-EMS) has emerged as a complementary exercise modality, although evidence regarding its effects on body mass index (BMI) and self-esteem remains limited.
Objective: This study examined the effects of WB-EMS-assisted exercise on BMI and self-esteem in adult men with obesity.
Methods: This randomized controlled study employed a pretest–posttest design involving 48 men aged 30–60 years with obesity (BMI > 30 kg/m²) recruited from fitness centers in Mashhad, Iran, in 2026. Participants were randomly assigned to an EMS-assisted exercise group or an exercise control group (n = 24 each). Both groups completed 12 exercise sessions over four weeks, with the intervention group additionally receiving EMS. Self-esteem was measured using the Eysenck Self-Esteem Questionnaire, and BMI was calculated from anthropometric measurements. Between-group differences in post-intervention outcomes were examined using analysis of covariance, adjusting for baseline values.
Results: The EMS group demonstrated significantly lower adjusted post-intervention BMI than the control group (29.698 vs. 31.186 kg/m²; adjusted mean difference = −1.488, 95% CI [−2.220, −0.756]; $F(1, 45) = 16.756$, $p < .001$, partial $\eta^2 = .271$). Adjusted self-esteem scores were also significantly higher in the EMS group (22.779 vs. 19.805; adjusted mean difference = 2.974, 95% CI [0.559, 5.389]; $F(1, 45) = 6.152$, $p = .017$, partial $\eta^2 = .120$).
Conclusion: EMS-assisted exercise was associated with greater improvements in BMI and self-esteem than conventional exercise alone over four weeks. Although these findings suggest potential benefits of incorporating EMS into exercise programs for men with obesity, larger, longer-term trials with closely matched exercise protocols are needed to establish its independent effects.

WHAT IS ALREADY KNOWN ON THIS TOPIC	WHAT THIS STUDY ADDS	HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY
Obesity is associated with adverse physical and psychological outcomes, while exercise may improve body composition and self-esteem. EMS is increasingly used as a complementary training approach.	EMS-assisted training was associated with a greater reduction in BMI than standard training alone, whereas no significant between-group difference was observed in self-esteem.	These preliminary findings support further investigation of EMS as a complementary exercise approach for obesity, while larger controlled studies are needed before broader clinical recommendations.

1. Introduction

Obesity is a chronic, multifactorial condition characterized by excessive adiposity and associated with increased risks of cardiometabolic disease, several cancers, and premature mortality (Hruby & Hu, 2015; World Health Organization, 2026). Among adults, a body mass index (BMI) of 30 kg/m² or higher is commonly used to classify obesity, although BMI does not directly quantify body fat or distinguish fat mass from lean mass (World Health Organization, 2026). The scale of the problem continues to grow: global projections suggest that approximately 3.8 billion adults aged 25 years or older could be living with overweight or obesity by 2050 (Ng et al., 2025). These trends underscore the importance of identifying accessible interventions that address both weight-related health outcomes and psychological well-being.

The psychological correlates of obesity warrant particular attention. Self-esteem, understood as an individual's overall evaluation of personal worth, may be affected by experiences related to body weight, physical appearance, and perceived physical competence. However, obesity should not be assumed to cause low self-esteem in every individual. A recent systematic review and meta-analysis found a small inverse association between BMI and global self-esteem in adults, with variation across populations and study characteristics (Moyon et al., 2026). Within exercise psychology, the exercise and self-esteem model proposes that changes in perceived physical competence and physical self-worth may contribute to broader evaluations of the self (Sonstroem & Morgan, 1989). This framework provides a rationale for investigating psychological outcomes alongside anthropometric changes, while recognizing that self-esteem and body image are related but distinct constructs.

Physical exercise, particularly resistance training, is an established component of weight-management and health-promotion programs. Whole-body electromyostimulation (WB-EMS) has also been investigated as a complementary training modality. It delivers electrical impulses to multiple muscle groups and is commonly combined with voluntary movements or low-load exercises, potentially offering a relatively time-efficient form of muscular training (Kemmler et al., 2023). Evidence for its physical effects is promising but not uniform. One systematic review and meta-analysis reported improvements in muscle mass and strength without a statistically significant overall reduction in body fat (Kemmler et al., 2021), whereas another meta-analysis reported favorable effects on muscle mass, strength, and body fat (Rodrigues-Santana et al., 2023). Differences in samples, training protocols, and comparison conditions may help explain these findings.

More recent intervention studies provide additional, although population-specific, evidence. In physically active adults, Ulupınar et al. (2025) compared WB-EMS with traditional resistance training and observed improvements in BMI and other physical outcomes, with differing patterns of adaptation between the interventions. Among participants with excess weight, Riyahi et al. (2025) reported favorable changes in BMI and selected metabolic indicators following EMS training. These studies support further evaluation of WB-EMS but do not establish that it is superior to conventional exercise or that changes in BMI necessarily reflect changes in adiposity. In addition, WB-EMS should not be described as risk-free: published guidance emphasizes qualified supervision, screening for contraindications, individualized progression, and adequate recovery (Kemmler et al., 2023).

The potential psychological effects of WB-EMS are less well established, particularly in populations with obesity. In a controlled study of healthy young men, Kim et al. (2021) reported favorable changes in self-esteem and body-related perceptions following a 12-week WB-EMS intervention with different stimulation intensities. Although relevant, these findings cannot be directly generalized to adult men with obesity. Moreover, evidence concerning the simultaneous effects of WB-EMS on global self-esteem and BMI in this population remains limited. Examining these outcomes together may help clarify whether an intervention directed primarily at muscular activity is accompanied by changes in psychological self-evaluation.

Accordingly, the present study aimed to evaluate the effects of an WB-EMS intervention on self-esteem and BMI in adult men with obesity. By considering a psychological outcome alongside an anthropometric indicator, the study seeks to contribute evidence on the potential role of EMS within multidimensional approaches to obesity management.

2. Methods

2.1. Study Design

This study used a two-arm, randomized, pretest–posttest controlled design to compare the effects of a four-week WB-EMS-assisted exercise program with those of conventional exercise on BMI and self-esteem in men with obesity and low baseline self-esteem. The principal analyses compared post-intervention scores between groups after adjustment for the corresponding baseline values (Hopewell et al., 2025). Ethical approval was reported from the Research Institute of Physical Education and Sport Sciences of Iran (approval code IR.SSRC.REC.1402.202). Participants received an explanation of study procedures and provided informed consent before assessment. Following eligibility screening, the principal researcher allocated participants in a 1:1 ratio using a paper-draw procedure. Allocation concealment was not implemented. The same researcher conducted the baseline and post-intervention assessments and was aware of group assignments.

2.2. Participants and Recruitment

The study population comprised men aged 30–60 years who had recently begun exercising at bodybuilding facilities in Mashhad, Iran, during 2026. Eligibility criteria were male sex, no regular exercise participation during the preceding two years, less than one month of recent gym attendance, BMI > 30 kg/m², and a baseline Eysenck Self-Esteem Questionnaire score of 11 or less. Exclusion criteria were unwillingness to continue participation, a history of seizures, or an injury occurring during the intervention that would make further participation potentially harmful.

An a priori sample-size calculation was conducted using G*Power (Faul et al., 2007) with an assumed effect size of f = 0.56, a significance level of .05, statistical power of .80, and two comparison groups. The stated minimum sample was 28 participants. Of 50 individuals initially considered, one was excluded and another had no recorded data in the study system, leaving 48 participants in the reported sample. Eligible participants were assigned to the WB-EMS–assisted exercise or control group in a 1:1 ratio. Further details regarding the allocation procedure are provided below.

2.3. Measures

2.3.1. Self-Esteem

Self-esteem was assessed using the 30-item Eysenck Self-Esteem Questionnaire. Each item was answered "Yes," "No," or "?" (uncertain). Responses were scored according to item-specific keyed directions, with uncertain responses assigned 0.5 points; the total score ranged from 0 to 30, with higher scores indicating higher self-esteem. Previous Iranian research has described scores below 11 as low, scores of 11–21 as moderate, and scores above 21 as high self-esteem (Yousefi et al., 2021). For the present study, a score ≤ 11 was applied as the prespecified eligibility threshold. Cronbach's alpha for the scale in the present sample was .76.

2.3.2. Body Mass Index

Body mass was measured using a Dena Tozin digital scale (model HBMI-P, Iran); participant height was also used to calculate BMI as body mass in kilograms divided by squared height in meters (kg/m²). In accordance with the conventional adult classification, BMI values of 25.0–29.9 kg/m² indicate overweight and values of 30.0 kg/m² or higher indicate obesity (World Health Organization, 2026). The study-specific inclusion criterion was BMI > 30 kg/m².

2.4. Procedures and Intervention

2.4.1. Exercise Program

Both groups participated in a four-week, gym-based exercise program scheduled three times per week, with each session lasting 60 minutes: 20 minutes of aerobic warm-up and dynamic stretching, 35 minutes of resistance and bodyweight exercises, and 5 minutes of static stretching. Bodyweight sessions included push-ups, pull-ups, squats, sit-ups, burpees, and box jumps. Barbell sessions included back squats, standing bent-over reverse flyes, lunges, standing shoulder presses, deadlifts, and bench presses; dumbbell sessions used corresponding dumbbell exercises. The resistance-exercise component comprised familiar multi-joint and single-joint movements, broadly consistent with established resistance-training principles (Ratamess et al., 2009).

The control group performed three sets of 15 repetitions per exercise. Resistance loads, rest periods, and progression were determined by the participants rather than standardized centrally. The WB-EMS group followed a timed exercise format and made several exercise substitutions: standing knee-to-chest raises and step-ups replaced sit-ups and box jumps, respectively, and cable chest presses replaced free-weight chest presses. Accordingly, the interventions differed not only in the application of electrical stimulation but also in some exercise selections and aspects of loading.

2.4.2. WB-EMS Protocol

A wireless Wiemspro WB-EMS system was used to deliver electrical stimulation to multiple muscle groups during the intervention. Stimulation electrodes were positioned over the pectoral muscles, shoulders, latissimus dorsi, triceps brachii, biceps brachii, abdominal muscles, gluteal muscles, quadriceps, and hamstrings.

The use of WB-EMS as a training modality was supported by previous controlled research in untrained adult men, although earlier studies used different stimulation settings and session schedules (Kemmler et al., 2016). Participants in the intervention group received a WB-EMS component over four weeks, with three nominal 20-minute stimulation sessions scheduled per week. The reported intermittent stimulation settings were 27 Hz, 12 seconds of stimulation followed by 4 seconds without stimulation, a pulse width of 150 µs for the biceps and triceps, and 250 µs for larger muscle groups (quadriceps, hamstrings, gluteal muscles, abdominal muscles, chest, back, and shoulders). The timed training format comprised three 6-minute activity blocks separated by 3–5 minutes of active recovery (walking without stimulation). Stimulation intensity was monitored by the instructor and participants but was not recorded on a numerical scale or individualized using predefined progression criteria. These stimulation settings and the three-sessions-per-week schedule describe the present study and should not be interpreted as parameters derived from or endorsed by international safety guidance (Kemmler et al., 2023).

Participants were instructed in exercise technique and breathing, and sessions could be interrupted for hydration or discomfort. Training was supervised by an instructor with a doctorate in exercise physiology and a Level 3 EMS coaching certification. Sessions missed on their scheduled day were reportedly completed on a subsequent day, and completion of the prescribed training sessions was reported for both groups. No adverse events were reported during the intervention; the stated grounds for stopping stimulation were pain or an injury that made continued participation potentially harmful. International guidance particularly emphasizes qualified supervision, contraindication screening, gradual familiarization, and adequate recovery between WB-EMS exposures (Kemmler et al., 2023). Following the four-week program, BMI and self-esteem were reassessed. The post-intervention assessor was not blinded to group allocation.

2.5. Statistical Analysis

Analyses were performed using IBM SPSS Statistics, version 27. Participant characteristics and study outcomes were summarized using means, standard deviations, and frequencies, as appropriate. The Shapiro–Wilk test was used to examine distributional properties. Group differences in each post-intervention outcome were assessed using a separate analysis of covariance (ANCOVA), with treatment group as the fixed factor and the corresponding baseline outcome as the covariate. Thus, post-intervention BMI was adjusted for baseline BMI, and post-intervention self-esteem was adjusted for baseline self-esteem. Assumptions concerning residual normality, equality of error variances, and homogeneity of regression slopes were examined and reported as satisfied. Adjusted group means, F statistics, p values, and partial eta squared (ηp^2) were used to summarize the findings. Statistical significance was set at $p < .05$. Using baseline-adjusted ANCOVA for follow-up comparisons is supported by methodological guidance for randomized studies with pre-intervention and post-intervention measurements (Vickers & Altman, 2001).

3. Results

The mean age of the participants was 43.33 years (SD = 8.43), and all participants were within the predefined age range of 30 to 60 years. The WB-EMS and control groups appeared broadly comparable at baseline with respect to the demographic characteristics assessed, including age, employment status, and place of residence.

Figures 1 and 2 present the observed pretest and posttest means for BMI and self-esteem, respectively. Descriptively, self-esteem scores increased from pretest to posttest in both groups, with a larger increase in the WB-EMS group than in the control group. BMI decreased over the intervention period in both groups, and the observed reduction appeared greater in the WB-EMS group. Because inferential comparisons were based on baseline-adjusted models, the principal statistical results are reported in Table 1.

Table 1. ANCOVA results for post-intervention BMI and self-esteem

Outcome	Adjusted mean WB-EMS	Adjusted mean Control	Adjusted difference (95% CI)	F (1,45)	p	η^2
BMI	29.698	31.186	−1.488 (−2.220, −0.756)	16.756	< .001	.271
Self-esteem	22.779	19.805	2.974 (0.559, 5.389)	6.152	.017	.120

Note. Adjusted means were estimated from separate analyses of covariance controlling for the corresponding pretest value. For BMI, a negative adjusted mean difference indicates a lower post-intervention value in the WB-EMS group relative to the control group. For self-esteem, a positive adjusted mean difference indicates a higher post-intervention value in the WB-EMS group relative to the control group.

After adjustment for baseline BMI, the analysis of covariance showed a statistically significant effect of group on post-intervention BMI, $F(1, 45) = 16.756$, $p < .001$, partial $\eta^2 = .271$. The adjusted post-intervention mean BMI was 29.698 in the WB-EMS group and 31.186 in the control group. The adjusted mean difference between groups was −1.488 kg/m² (95% CI [−2.220, −0.756]), indicating a lower adjusted post-intervention BMI in the WB-EMS group.

A significant between-group effect was also observed for self-esteem after adjustment for baseline self-esteem, $F(1, 45) = 6.152$, $p = .017$, partial $\eta^2 = .120$. The adjusted post-intervention mean self-esteem score was 22.779 in the WB-EMS group and 19.805 in the control group. The adjusted mean difference was 2.974 points (95% CI [0.559, 5.389]), indicating a higher adjusted post-intervention self-esteem score in the WB-EMS group. Overall, the baseline-adjusted analyses indicated statistically significant post-intervention differences between the EMS and control groups for both BMI and self-esteem. The magnitude of the group effect was larger for BMI (partial $\eta^2 = .271$) than for self-esteem (partial $\eta^2 = .120$).

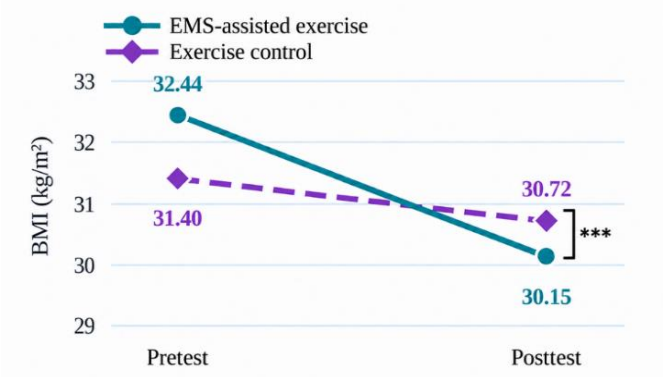


Figure 1. Observed pretest and posttest BMI means for the WB-EMS and control groups

Note. Bars represent observed means. The bracket indicates the baseline-adjusted between-group comparison at posttest obtained from the analysis of covariance. ***p < .001.

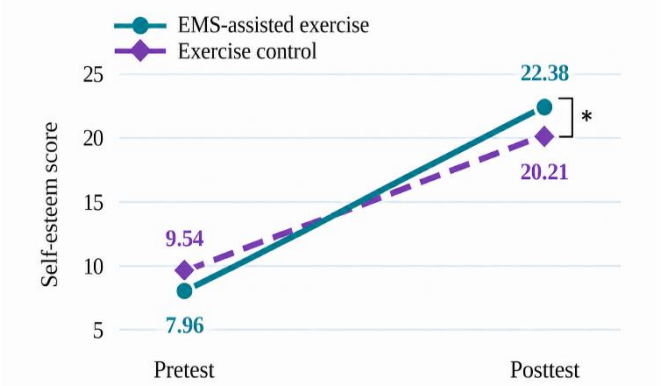


Figure 2. Observed pretest and posttest self-esteem means for the WB-EMS and control groups

Note. Bars represent observed means. The bracket indicates the baseline-adjusted between-group comparison at posttest obtained from the analysis of covariance. *p = .017.

4. Discussion

This study examined whether WB-EMS-assisted exercise program was associated with better BMI and self-esteem outcomes than conventional exercise among adult men with obesity and initially low self-esteem. After adjustment for baseline values, the WB-EMS group had a lower post-intervention BMI than the control group and a higher self-esteem score. Although both outcomes changed favorably in the descriptive pretest–posttest data, the reported analyses support statistically significant adjusted between-group differences, not separate claims of statistically significant within-group changes. Interpretation should also account for differences between the exercise programs beyond the use of electrical stimulation.

The larger reduction in BMI observed in the WB-EMS group is broadly compatible with studies suggesting that muscle stimulation may complement exercise-related changes in body composition. Lee et al. (2023) found improvements in muscle mass, strength, and body fat measures when WB-EMS was combined with resistance exercise in healthy young adults. Löklüoğlu (2025) reported reductions in BMI and body fat percentage following an eight-week WB-EMS program in previously inactive adults. A recent systematic review by Segatto et al. (2026) also examined WB-EMS outcomes in individuals with obesity, although variations in participant characteristics and intervention protocols complicate direct comparisons with the present four-week study.

The wider evidence is not uniformly supportive of an additional fat-loss effect. In a systematic review and meta-analysis, Kemmler et al. (2021) found favorable effects of whole-body EMS on muscle mass and strength, but the pooled effect on body fat mass was not statistically significant. More recently, Seite et al. (2026) found that adding electrical stimulation to a short inpatient rehabilitation program for adults with severe obesity did not improve weight-loss or body-composition outcomes beyond the usual rehabilitation program. Differences in intervention duration, dietary support, baseline health, comparison conditions, and stimulation protocols may help explain the inconsistent findings. In the present study, BMI was measured without direct assessment of fat mass or muscle mass; therefore, the lower BMI cannot be interpreted as evidence of a specific reduction in adiposity or as confirmation of a particular metabolic mechanism.

The WB-EMS group also showed a higher baseline-adjusted self-esteem score at posttest. This finding is consistent with the possibility that electrically assisted exercise may have psychological as well as physical correlates. Kim et al. (2021) observed differences in self-esteem, body image, and body-shape perceptions across WB-EMS intensity conditions in healthy young men. In a controlled pilot study, Keicher et al. (2021) reported short-term improvements in subjective well-being and relaxation after WB-EMS compared with sham training; however, these outcomes should not be equated with global self-esteem. Taken together, these studies provide a rationale for further investigation rather than evidence of a universally established psychological benefit.

Changes in perceived physical competence, body image, or satisfaction with exercise could plausibly contribute to self-esteem changes, but these proposed pathways were not measured in the present study. Nor can the improvement in self-esteem be assumed to follow directly from a reduction in BMI. Moyon et al. (2026) reported only a small negative pooled association between BMI and global self-esteem among adults ($r = -.11$), while the long-term findings of Kiviruusu et al. (2016) indicated that BMI–self-esteem relationships differ by sex and developmental period and are generally weaker among men. The present results therefore support an association between assignment to the WB-EMS-assisted program and higher adjusted posttest self-esteem, without identifying the psychological processes responsible.

These findings suggest that WB-EMS-assisted exercise merits further study as a possible adjunct to supervised training for adults with obesity, rather than as a replacement for established physical activity or weight-management approaches. Any application must consider safety, feasibility, and individual suitability. In particular, the international position statement by Kemmler et al. (2023) recommends a gradual familiarization period and a frequency not exceeding one 20-minute WB-EMS session per week during the initial 8–10 weeks. The three-session-per-week schedule reported here differs substantially from that recommendation. The absence of reported adverse events over four weeks does not establish the safety of this dosing regimen, particularly without objective monitoring of muscle damage or detailed individual stimulation intensity records.

A strength of the study is the use of a control group receiving active exercise, random group allocation, and baseline-adjusted comparisons for both outcomes. Several limitations nonetheless constrain interpretation. The groups differed not only in electrical stimulation exposure but also in certain exercise substitutions and aspects of training organization, so the independent contribution of WB-EMS cannot be isolated. Allocation concealment was absent, outcome assessment was unblinded, and dietary intake, energy expenditure, and training loads were not comprehensively controlled. The small sample, purposive recruitment from two sports facilities, inclusion of men only, and restriction to participants with low initial self-esteem limit transferability. The short intervention and absence of follow-up prevent conclusions about the maintenance of BMI or psychological changes. Finally, body composition, body image, perceived competence, and other potential mediating variables were not directly assessed.

Future trials should match exercise volume and content across groups, use concealed allocation and blinded outcome assessment where feasible, systematically monitor nutrition and stimulation intensity, and incorporate validated measures of body composition and psychological mechanisms. Longer follow-up and prespecified criteria for meaningful change would clarify whether any effects are sustained and practically important. Studies should also evaluate adverse events and adherence under stimulation schedules consistent with current safety guidance.

5. Conclusions

In this short-term trial involving adult men with obesity and low baseline self-esteem, the WB-EMS-assisted exercise group had a significantly lower adjusted post-intervention BMI and higher adjusted self-esteem score than the exercise-only control group. These findings are preliminary because the interventions differed in more than electrical stimulation exposure, several potential confounders were not controlled, and the clinical relevance and durability of the changes remain uncertain. WB-EMS-assisted exercise may warrant consideration as a supervised adjunctive training approach, but larger, methodologically rigorous trials are needed before its independent effectiveness or safety for weight management and psychological well-being can be established.

CRediT Authorship Contribution Statement

A.S.M: Conceptualization, Investigation, Data collection, Literature search, Writing – original draft, Data analysis.
M.Y.K: Data analysis, Validation.
All authors reviewed and approved the final version of the manuscript and take responsibility for the work.

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Declaration of competing interests

The authors declare that they have no known financial or non-financial competing interests that could have influenced the design, conduct, analysis, or reporting of this study.

Declaration of generative AI in scientific writing:

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) for language editing.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable ethical requirements and participant confidentiality.

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