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Effects of Online-Supervised Daily Weighing on Body Composition and Mood in Overweight/Obese Women with Anxiety and Depression: A Postprint Study

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Date: 2023-05-11T00:00:00+00:00

Abstract

Background The prevalence of overweight/obese women is showing an increasing trend year by year, with high prevalence of depression and anxiety states and psychological disorders. Overweight/obese women with anxiety and depression lack effective coping strategies for emotions and behavior, and weight loss efficacy is worrisome. Currently, both domestically and internationally, there is limited attention to weight loss outcomes and emotional states in this population.

Objective To investigate the effects of online-supervised daily weighing intervention on body composition and mood in overweight/obese women with anxiety and depression.

Methods This was a prospective randomized controlled study. From October to December 2019, 92 overweight/obese women with mild-to-moderate anxiety and depression were recruited voluntarily from Haidian District, Beijing. Using a random number table method, participants were randomly divided into experimental and control groups in a 1:1 ratio, with 46 participants in each group. Both groups received individualized guidance on scientific dietary intake and appropriate exercise for weight management; the experimental group was supervised online by designated personnel to perform daily self-weighing and report body weight data to the research team, while the control group underwent monthly body weight monitoring with data collection by the research team. The intervention lasted for 3 months. Both groups underwent body composition measurement and completed the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) at baseline and after 3 months of intervention, comparing various body composition parameters and scale scores between the two groups before and after intervention.

Results All 92 participants completed the questionnaires and follow-up. Post-intervention, body weight, BMI, body fat percentage, body fat mass, and visceral fat area in the control group were higher than those in the experimental group (P<0.05); the experimental group showed decreases in these parameters post-intervention compared with baseline (P<0.05). The experimental group exhibited reduced SAS and SDS scores post-intervention compared with baseline (P<0.05); post-intervention SAS and SDS scores in the experimental group were lower than those in the control group (P<0.05).

Conclusion For overweight/obese women with anxiety and depression, online-supervised daily weighing intervention can effectively reduce body fat and weight, improve adverse psychological states such as anxiety and depressive symptoms, and represents a simple, effective, and safe intervention.

Full Text

Influence of Daily Self-weighing Supported by Online Supervision on Body Composition and Emotions in Overweight/Obese Women with Anxiety and Depression

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Abstract

Background: Overweight and obese women represent a growing population with a high incidence of depression, anxiety, and psychological abnormalities. Due to a lack of effective coping strategies for emotions and behaviors, weight loss outcomes are often unsatisfactory in overweight/obese women with comorbid anxiety and depression, yet limited attention has been paid to this group' s weight loss outcomes and emotional well-being.

Objective: To explore the effect of daily self-weighing supported by online supervision on body composition and emotional states in overweight/obese women with anxiety and depression.

Methods: This prospective randomized controlled study enrolled 92 overweight/obese women with mild to moderate anxiety and depression through voluntary recruitment in Beijing' s Haidian District from October to December 2019. Participants were randomly assigned in a 1:1 ratio to either an experimental group (n=46) or a control group (n=46) using a random number table. Both groups received individualized guidance on scientific diet and reasonable exercise for weight control. The experimental group measured their body weight daily under online supervision from designated research staff and reported the data to the research team, while the control group had their weight measured monthly, with data collected by the research team. The intervention lasted for three months. Body composition measurements were obtained, and participants completed the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) at baseline and after the 3-month intervention. Changes in body composition indices and scale scores were compared between and within groups.

Results: All 92 participants completed the questionnaires and follow-up assessments. After intervention, the control group showed significantly higher body weight, BMI, body fat percentage, body fat mass, and visceral fat area compared to the experimental group ($P<0.05$). The experimental group demonstrated significant reductions in body weight, BMI, body fat percentage, body fat mass, and visceral fat area post-intervention ($P<0.05$). Additionally, the experimental group exhibited significantly lower SAS and SDS scores after intervention compared to baseline ($P<0.05$), and these post-intervention scores were also lower than those of the control group ($P<0.05$).

Conclusion: Daily self-weighing with online supervision is an effective intervention for reducing weight and fat mass while improving anxiety and depression symptoms in overweight/obese women with comorbid anxiety and depression. This approach represents a simple, effective, and safe weight management strategy.

Keywords: Overweight; Obesity; Anxiety; Depression; Daily weighing; Self-rating anxiety scale; Self-rating depression scale

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Introduction

Obesity has emerged as a major public health threat in China and worldwide[1]. Currently, the number of obese women in China has reached 46.4 million, significantly exceeding that of men[2]. Obesity not only triggers a range of health issues in women, including metabolic disorders, tumors, and reproductive endocrine abnormalities, but is also associated with high rates of depression, anxiety, and psychological dysfunction. Compared to the general population, overweight and obesity confer greater risks for emotional disorders, with obese individuals facing a 55% lifetime risk of depression—particularly among women

—while individuals with depression have a 58% probability of developing obesity[3].

Women with overweight/obesity and comorbid anxiety and depression often experience physical and psychological imbalance under chronic stress, lacking effective strategies to manage emotions and behaviors. Conventional weight management approaches typically focus narrowly on dieting or high-intensity exercise alone, making it difficult for this population to adhere to interventions and achieve satisfactory weight loss outcomes. Research indicates that daily self-weighing is a feasible weight control behavior[4,5]. Unlike direct lifestyle interventions, daily weighing represents a cognitive-level strategy that enables self-monitoring based on weight feedback, prompting individuals to actively adjust their diet and physical activity to achieve weight loss[5]. However, few studies have examined weight loss outcomes and emotional changes in overweight/obese women with anxiety and depression, and no domestic research has specifically targeted this population.

With the deep integration of healthcare and information technology, internet-based online interventions are increasingly applied to weight management services for overweight/obese populations. Previous studies have primarily explored internet-based dietary and exercise interventions, lacking assessment of psychological changes associated with weight loss. This study employed a 3-month online supervision protocol that encouraged participants to adhere to daily weighing, enabling them to self-regulate diet and exercise based on weight feedback while monitoring psychological status. We aimed to evaluate the actual impact of daily weighing on body composition and emotional states in overweight/obese women with anxiety and depression, and to explore effective and safe weight control strategies for this population.

Methods

1.1 Study Participants and Eligibility Criteria

From October to December 2019, we recruited 92 overweight/obese women with anxiety and depression from Beijing's Haidian District through voluntary enrollment. Participants were randomly assigned to experimental and control groups (n=46 each) using a random number table. The study protocol was approved by the Ethics Committee of Beijing Shijitan Hospital, Capital Medical University (Ethics No.: 2019-25), and all participants provided informed consent.

Inclusion criteria: (1) Women aged 18-45 years; (2) BMI between 24 kg/m^2 and 32.5 kg/m^2 according to Chinese reference standards[1]; (3) Mild to moderate anxiety (SAS score 50-<60) and mild to moderate depression (SDS score 53-<72) based on the Self-Rating Anxiety Scale[7] (SAS) and Self-Rating Depression Scale[7] (SDS); (4) No exercise limitations and no regular weight monitoring habit (frequency > once per month); (5) Willingness to participate in

the study.

Exclusion criteria: (1) Severe physical illness; (2) Severe mental disorders (severe anxiety, severe depression, schizophrenia, dementia); (3) Current use of anti-anxiety or antidepressant medications; (4) Endocrine or metabolic diseases such as diabetes or adrenal disorders; (5) Cardiovascular, pulmonary, gastric, or renal diseases, developmental defects, or implanted metal medical devices (e.g., pacemakers, metal screws); (6) Cancer; (7) Diseases limiting daily activities; (8) Weight-loss medication or surgery within the past 6 months; (9) Pregnancy, lactation, or menopause.

1.2 Sample Size Calculation

We estimated sample size using a two-independent-sample t-test for comparing means. The formula was:

$N = \frac{(Z_{\alpha/2}+Z_{\beta})^2\sigma^2}{\delta^2} \times \left(\frac{1}{Q_1} + \frac{1}{Q_2}\right)$

where N represents total sample size, σ is standard deviation, δ is the difference between means, and Q_1 and Q_2 are sample proportions ($Q_1=n_1/N$, $Q_2=n_2/N$). Based on prior clinical data and literature review, SAS scores were estimated as (56.1$±1.7)*pointsfortheexperimentalgroupand*(54.7±$2.0) points for the control group[8]. Using a two-sided α of 0.05 and power (1-β) of 90%, with Q_1 and Q_2 both at 0.5, the calculated required sample size was 38 participants per group. To account for potential attrition, we increased the sample size by 20%, resulting in 46 participants per group (total N=92).

1.3 Assessment Content and Methods

1.3.1 Questionnaires Participants completed questionnaires at baseline and after 3 months of intervention. Research staff distributed the questionnaires in person, provided assistance as needed, and collected them immediately. Before administration, staff ensured participants understood the study purpose and requirements, explaining questions objectively without suggestive or leading language. Participants were instructed to respond truthfully based on their actual circumstances.

Assessment included: 1. **General information:** Age, education level, monthly income, marital status, height, weight, chronic disease history, and employment status. 2. **Anxiety:** The Self-Rating Anxiety Scale (SAS) assesses subjective anxiety symptoms. It contains 20 items (15 positively scored, 5 negatively scored), each rated on a 4-point scale, with total scores ranging from 20-80. Higher scores indicate greater anxiety severity[9]. Based on Chinese norms: <50=normal, 50-59=mild anxiety, 60-69=moderate anxiety, $ $70=severe anxiety. Cronbach' s α=0.931[10]. 3. **Depression:** The Self-Rating Depression Scale (SDS) assesses subjective depressive symptoms. It includes 20 items rated on a 4-point scale, covering four dimensions: psycho-emotional symptoms (2 items), somatic disturbances (8 items), psychomotor disturbances (2 items),

and depressive cognition (8 items), with total scores ranging from 20-80. Higher scores indicate more severe depression[9]. Based on Chinese norms: <53=normal, 53-62=mild depression, 63-71=moderate depression, $ $72=severe depression. Cronbach' s α=0.782[11].

1.3.2 Body Composition Measurement Body composition was measured using the Inbody 770 body composition analyzer (Biospace, Korea) at baseline and after 3 months. Trained technicians obtained measurements of body weight, body fat percentage, body fat mass, BMI, waist-to-hip ratio, and visceral fat area. Participants were required to wear light clothing, remove all metal accessories, and stand barefoot during measurement.

1.4 Intervention Protocol

1.4.1 Health Education Both groups received face-to-face health education from the research team' s nutritionist before intervention. Content and duration were identical for both groups and included: (1) Basic obesity knowledge (diagnostic criteria, causes, health impacts across life stages, weight loss methods); (2) Dietary recommendations emphasizing fresh vegetables and fruits, strict limitation of high-calorie/high-fat/high-cholesterol foods, moderate carbohydrate reduction, with macronutrient distribution of 15-20% protein, 25-30% fat, and 50-60% carbohydrates[1]; (3) Exercise recommendations: brisk walking beginning 1 hour after meals, 3-5 days/week for $ $30 minutes/day at moderate intensity (target heart rate=170-age, with participants reporting mild warmth, fatigue, and sweating), plus resistance training (dumbbells, resistance bands) at least 3 times/week for 15 minutes/session. Participants could contact the research team via phone or in-person visits for questions, and received individualized dietary and exercise adjustments based on weight changes.

1.4.2 Weight Monitoring Electronic scales were calibrated and distributed uniformly by the research team. Standardized measurement procedures required placing scales on flat, hard surfaces; participants measured weight barefoot in light clothing after morning voiding and before breakfast, recording the value once stabilized.

Experimental group: Participants measured weight daily for 3 months. (1) Designated research team members (including 1 associate chief physician, 1 chief physician, 1 general practitioner, 1 dietitian, 1 psychological counselor, and 1 case manager) provided online reminders and supervision via WeChat, encouraging daily self-weighing and monitoring submission of weight photos. (2) Leveraging internet convenience, the team recorded weights daily, provided weekly summaries of weight trends via WeChat, analyzed weight changes with participants, and helped them self-regulate diet and exercise based on weight feedback. (3) Peer modeling was conducted via WeChat, sharing successful weight management experiences to motivate others.

Control group: Participants measured weight monthly for 3 months and received monthly telephone follow-up, during which weight data were collected by the research team.

1.5 Statistical Analysis

Data were analyzed using SPSS 25.0 software. Normally distributed continuous variables were expressed as ($\bar{x}$±s) and compared between groups using independent samples t-tests; within-group pre-post comparisons used paired t-tests. Categorical variables were expressed as frequencies and compared using ^{2} tests. Statistical significance was set at P<0.05.

Results

2.1 Baseline Characteristics

All participants completed follow-up without attrition. The experimental group (n=46) had a mean age of (36.3$±1.5)*years, whilethecontrolgroup*(*n* = 46)*hadameanageof*(36.9±$2.0) years. No significant differences were observed between groups in age, education level, monthly income, marital status, chronic disease history, or employment status (P>0.05) .

2.2 Body Composition Changes

No significant differences existed between groups at baseline in body weight, BMI, body fat percentage, body fat mass, waist-to-hip ratio, or visceral fat area (P>0.05). The control group showed no significant changes in any body composition parameters pre- to post-intervention (P>0.05). Post-intervention, the control group had significantly higher body weight, BMI, body fat percentage, body fat mass, and visceral fat area compared to the experimental group (P<0.05). The experimental group demonstrated significant reductions in body weight, BMI, body fat percentage, body fat mass, and visceral fat area after intervention (P<0.05). No significant difference in waist-to-hip ratio was observed between groups post-intervention (P>0.05) .

2.3 Anxiety and Depression Score Changes

Baseline SAS and SDS scores did not differ significantly between groups (P>0.05), and the control group showed no significant pre-post changes in either score (P>0.05). The experimental group exhibited significant reductions in both SAS and SDS scores after intervention (P<0.001). Post-intervention SAS and SDS scores were significantly lower in the experimental group compared to the control group (P<0.05) .

2.4 Adverse Events

No adverse events were reported during the study, including gastrointestinal discomfort, dizziness, palpitations, menstrual irregularities, or severe cognitive/psychological disturbances.

Discussion

With socioeconomic development and lifestyle changes, the prevalence of obesity among women continues to rise. Female obesity not only increases risks for metabolic disorders, tumors, and reproductive system diseases, but also impacts social and psychological well-being. Research demonstrates that overweight and obesity are associated with elevated risks for anxiety and depression[12]. When obesity and emotional disorders co-occur, their combined detrimental effects on quality of life and health are compounded, making early identification and intervention critical. However, current weight management strategies have not adequately addressed this specific population.

This study has several distinctive features: (1) It targets overweight/obese women with comorbid anxiety and depression—a special population with unique needs; (2) It employs internet-based daily supervision of weight measurement, providing intuitive, convenient, and timely feedback; (3) Unlike previous online lifestyle interventions, daily self-weighing is a cognitive intervention strategy based on self-monitoring[13,14], with periodic online feedback on weight trends that helps participants reflect on their dietary and exercise behaviors, thereby promoting active self-regulation; (4) When participants observe weight reduction through daily weighing, a positive cycle emerges—steady weight loss builds confidence, overcomes anxiety and depression, and reinforces healthy behaviors.

In this study, the experimental group adhered to daily weighing, using weight feedback to reflect on and adjust dietary and exercise behaviors, estimate daily energy balance, and make appropriate modifications. Through healthy eating and regular exercise, participants achieved gradual weight reduction. Online interaction with the research team enabled continuous supervision, real-time feedback, and weekly progress summaries, facilitating the development of sustainable healthy eating and exercise habits that promoted fat metabolism and reduced body fat content. In contrast, the control group lacked frequent weight data, long-term supervision, and regular weight trend analysis, limiting opportunities for behavioral adjustment and resulting in less effective weight and fat loss.

Furthermore, reductions in weight were accompanied by decreased anxiety and depression scores. Several mechanisms may explain this relationship. First, even modest weight loss improved body satisfaction, alleviated negative emotions, and promoted integration of physical and psychological health, thereby enhancing motivation and confidence for continued weight control[15,16]. Sec-

ond, daily weighing may serve as a cue that increases awareness of environmental triggers for eating[17]. Third, increased physical activity can reduce endorphin release patterns, and vigorous exercise effectively decreases anxiety while improving psychological well-being and mood[18,19]. As participants maintained better communication and functioning in social, occupational, and daily life domains, positive emotions and well-being increased while anxiety and depression decreased significantly. Consequently, the experimental group showed marked reductions in SAS and SDS scores after 3 months.

Large-scale surveys of young obese populations have found that women are particularly concerned about their weight and fear weight gain. Frequent self-weighing improves binge eating behaviors and positively influences weight loss outcomes, consistent with our findings. Weight reduction may also improve anxiety symptoms, and these psychological improvements may in turn increase the likelihood of successful weight loss[20], creating a bidirectional beneficial relationship.

This study has several limitations. First, participants were recruited from relatively developed Beijing districts, and their obesity awareness and education levels may differ from other regions. Second, the mechanisms linking anxiety, depression, and overweight/obesity are complex and multifaceted, requiring larger, more comprehensive studies to further validate the interplay between emotional and weight outcomes. Third, the sample size was relatively small; future research should expand sample sizes and extend intervention duration to examine long-term effects.

In conclusion, daily self-weighing with online supervision is an effective weight loss intervention for overweight/obese women with anxiety and depression, leading to significant improvements in both body composition and psychological symptoms. This approach can serve as a long-term self-monitoring strategy for scientific, effective, and safe weight management.

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Author Contributions

YIN Cong was responsible for study conception and design, data collection, and manuscript writing. DIAO He, SHENG Wei, and CAO Yan participated in data collection and organization. BAI Wenpei was responsible for topic selection, manuscript revision, quality control, and overall accountability.

Conflict of Interest Statement

The authors declare no conflicts of interest.

Funding

National Natural Science Foundation of China Youth Fund (82004409); China Railway Corporation Science and Technology Research and Development Plan Project (J2018Z603); Beijing Hospital Management Center "Peak Climbing" Program Special Funding (DFL20190701).

Table 1 Comparison of baseline characteristics between groups

Table 2 Comparison of body composition between groups before and after intervention ($\bar{x}\pm s$)

Table 3 Comparison of SAS and SDS scores between groups before and after intervention ($\bar{x}\pm s$)

Note: Figure translations are in progress. See original paper for figures.

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