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# Acceptance, Mindfulness, and Compassionate-Based Intervention in Overweight and Obese Women and its Effect on Metabolic Syndrome Components: A Randomized Controlled Trial

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**Abstract**

**Objectives:** This study aimed to examine the efficacy of acceptance, mindfulness, and compassion (Kg-free) on obese and overweight women diagnosed with metabolic syndrome components.

**Materials and Methods:** In this randomized controlled trial, 52 obese and overweight women with body mass index (BMI) ≥25 were evaluated in two intervention and control groups, The intervention was implemented weekly. Triglyceride (TG), high-density lipoprotein (HDL), fasting blood sugar (FBS), blood pressure (BP), BMI, and waistline measurements thyroid tests were assessed measured as the main outcome, and life-quality and sexual function improvement as its secondary outcome in pre, post and follow-up phase.

**Results:** The study results indicated that the acceptance, mindfulness, and compassion (Kg-free) protocol was effective on the BMI, waistline, TG level, BP (systolic and diastolic index), quality of life, and sexual function in women with overweight and obesity, but fasting BP and HDL level did not significant (d=0.001–0.50; significant at the 0.001 level).

**Conclusions:** The present trial was carried out aiming to examine the efficacy of group intervention based on acceptance, mindfulness, and compassion on obese and overweighed women and its effect on the components of metabolic syndrome, including the waistline, BMI, BP, FBS, TG, HDL, the quality of life, and the sexual function. Our results showed that group intervention based on acceptance, mindfulness, and compassion could reduce the BMI of the individuals in the intervention group compared to the control group. Moreover, the present study provided further evidence that this intervention bears an essential part in the psychological interventions for individuals struggling with overweight and obesity.

**Keywords:** Overweight, Obesity, Acceptance, Mindfulness, Self-compassion, Randomized controlled trial

## Introduction

Today, overweight and obesity are among the leading health problems and causes of metabolic syndrome, diabetes, cardiovascular disease, hypertension, and cancers (1), often associated with psychological problems (2). In addition, recent studies have shown that overweight and obese increase the risk of developing severe COVID-19 (3,4).

The prevalence of overweight and obesity, and related diseases such as metabolic syndrome in Iran is very high among different age groups. Also, women are more exposed than men (27.3% vs 13.7%). According to recent reports, more than 50% of Iranian adults are overweighed and obese (5). Overweight and obesity have a very wide impact on the quality of life. It was shown that overweight and obesity can lead to disturbance in various aspects of life including physical function, sexual function, self-confidence, and occupational performance (6,7). The research literature on the third-wave therapies (the acceptance, mindfulness, and compassion therapy) for overweight and obesity highly emphasizes the role of bashfulness and self-criticism as meta-diagnostic procedures involved in the mental pathology (8,9). Therefore, it seems that merely focusing on weight loss to enhance the health and welfare of the overweight and obese individuals may not be enough, and targeting the psychological procedures involved in weight gain may substantially help develop a healthy and accepting relationship with eating, weight, and experiences associated with the weight to increase the life-quality among overweighed and obese individuals (10).

Obesity is one of the leading causes of all metabolic syndrome components. Targeting obesity and overweight for therapeutic interventions is one of the most reasonable methods of handling metabolic syndrome (11).

Furthermore, acceptance, mindfulness, and compassion

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**Key Messages**

- The Kg-free protocol was effective on the BMI, waistline, TG level, BP (systolic and diastolic index), quality of life, and sexual function in individuals with overweight and obesity.
- Psychological interventions have an important role in individuals struggling with overweight and obesity.

therapy (Kg-free) have been not conducted in Iran, so the present study aimed to determine the efficacy of an acceptance, mindfulness, and compassionate based group-intervention over overweight and obese women.

## Methods and Materials

### Study Design and Participants

In this randomized clinical trial, 52 illiterate women with body mass index (BMI) >25 kg/m$^2$ without acute arthritis in their knees referred to the Nutritional Research Center, Tabriz Iran from 2019 to 2020 were enrolled by a simple random method. Our exclusion criteria were diseases affecting weight, including endocrine disorders such as thyroid issues, pregnancy or breast-feeding, consumption of drugs that affect weight or appetite, the impossibility of participation in the weekly sessions, and acute mental disorders such as schizophrenia spectrum disorders, severe depression, substance abuse disorder, bipolar disorders, and borderline personality disorder. The mentioned mental disorders were assessed Structured Clinical Interview (12). Then participants were randomly divided into two groups using the block randomization method. The intervention group underwent acceptance, mindfulness, and compassion therapy (Kg-free) protocol (n=26), and the control group (n=26) underwent the treatment-as-usual (TAU) interventions.

### The Protocol of Acceptance, Mindfulness, and Compassion (Kg-free Protocol)

This protocol was first designed at the Cognitive-behavioral Research Center of the Coimbra University, Portugal. The Kg-free protocol is a group intervention based on acceptance, mindfulness, and compassion for overweighed and obese individuals. The program consists of 10 2-hour weekly group sessions plus two refresher group sessions performed by a clinical psychologist together with an assistant therapist, provided in the framework of the therapy sessions: The control group received the treatment-as-usual (TAU) of the overweight and obesity-related healthcare centers, including correcting eating habits and diet, temporary cessation of smoking, and physical activities. The intervention group received a package based on acceptance, mindfulness, and compassion (Kg-free protocol) simultaneously as TAU (Table 1).

### Outcomes and Data Collection

The BMI, waist circumference (WC), blood pressure (BP), triglyceride (TG), fasting blood sugar (FBS), high-density lipoprotein (HDL), and thyroid tests were assessed and compared between the two study groups. BMI was calculated as body weight in kilograms divided by the squared value of height in meters. Thick clothes and belts were removed before measuring the waistline, and it was measured by a measuring tape placed above the navel,

**Table 1.** Outlines of the Sessions Assigned for the Intervention Group (Kg-free Protocol)

| Sessions | Objectives |
|---|---|
| Introduction | Introducing the participants; explaining the structure and method of the plan; introducing mindful eating; enhancing creative hopelessness |
| Psychoeducation 1 | Enhancing the mindfulness skills; understanding the association of the individuals with food; multiple functions of food; eliminating and reducing self-criticism, developing eating in a mindful manner |
| Psychoeducation 2 | Understanding the role of different emotions in human life; eliminating and reducing self-criticism; increasing awareness about the signs of hunger and satiety |
| Committed values and actions | Enhancing the mindful skills; enhancing values transparency; increasing the incentive to comply with healthy values; creating achievable targets for a healthy life |
| Acceptance and defusing | Enhancing the mindful skills; understanding why the speech leads to pain and misery; controlling the problem; introducing the importance of acceptance; thoughts are not real |
| Preparedness and tolerating distress | Enhancing the mindful skills; enhancing the acceptance and the unconscious internal experiences; empowering the tolerance of distress |
| Description versus Assessment | Enhancing the mindful skills, the mind as an assessment machine; distinction between the descriptions and assessments about self's body; enhancing the acceptance and the unconscious internal experiences |
| Shame and self-criticism | Enhancing the mindful skills; the role of shame and self-criticism; self-compassion as an antidote to shame and self-criticism |
| Self-compassion 1 | Enhancing the mindful skills; understanding what self-compassion is? Why do we need compassion? Realization of compassion and kindness for oneself |
| Self-compassion 2 | Enhancing the mindful skills; probing the hindrances of self-compassion; developing the self-compassion |
| Booster session 1 | Changing what you can and what you cannot change; enhancing the acceptance of the unconscious internal experiences; fragile patterns, and flexible actions |
| Booster session 2 | Adhering to the committed measures; combating the recurrence; and developing a personal practical program |

while feet were put together, hands were hanging on the sides with palms inward, and breathing out slowly (13).

### The Five Facet Mindfulness Questionnaire

The Five Facet Mindfulness Questionnaire (FFMQ) questionnaire is a self-assessment scale with 39 items, psychometric properties using the factor analysis, where they have obtained the factor, and the Cronbach alpha coefficient for the subtests is between $\alpha = 0.83$ and $\alpha = 0.87$ (14). In a study conducted on the validity and reliability of this questionnaire in Iran, the test-retest correlation coefficients of the FFMQ questionnaire were $r = 0.57$ for the non-judgmental Iranian factor, and the view factor was calculated as $r = 0.84$. Furthermore, the alpha coefficients related to the non-reactive and descriptive factors were calculated as $\alpha = 0.55$ and $\alpha = 0.83$, respectively (15).

### The Self-Criticism/Attacking and Self-Reassurance Scale

The self-criticism/attacking and self-assurance scale includes 22 items with a 5-point Likert scale ranging from "not at all like me" (score 0) to "extremely like me" (score 4), and minimum and maximum scores range between 0- 88, respectively. Cronbach alpha of the total scale was reported at 0.90 (16). Cronbach alpha of this scale was 0.83 for the total sample, 0.78 for men, and 0.85 for women in the Persian version. In this study, the reliability coefficient of Cronbach alpha for self-criticism was calculated as being 0.64 for the total sample (17).

### Self-Compassion Scale

This scale is a 26-item self-reporting tool developed by Neff to measure the level of self-compassion. Its questions are formulated in 6 subscales of 1) self-kindness, 2) self-judgment, 3) common humanity, 4) isolation, 5) mindfulness, and 6) over-identified items, which measure the association of the individuals with their experiences, such as how much the individuals are kind towards themselves and not critical, and how much they see their own experiences as a part of those of others, and that how much they abandon magnifying their experiences. Its scoring is determined on a 5-point Likert scale ranging from "almost never" (score zero) to "almost always" (score 4). High reliability and validity scores are reported for the Self-Compassion Scale, and overall validity was calculated through Cronbach alpha method as being 0.92. Furthermore, all subscales hold an acceptable internal consistency (18).

### The Three-Factor Eating Questionnaire

The three-factor eating questionnaire is a self-reporting 21-question tool designed to assess the disordered eating behaviors, encompassing three cognitive restraint, emotional eating, and uncontrolled eating subscales. The internal consistency of each subscale falls in the range of 0.76-0.85 based on Cronbach alpha, which indicates that the questionnaire commands a good validity. On this scale, items are scored by a 4-point Likert score. Question 21 is also scored by an 8-point Likert score. The raw scores of each subscale are yielded by summing the Likert scores of the questions for each subscale (19). According to the internal stability method, the validity and reliability of the Persian version of the Three-Factor Eating Questionnaire are 91.42, 0.0, and 0.78 for cognitive restraint, emotional eating, and uncontrolled eating, respectively. It also has a desirable validity (20).

### The Acceptance and Action Questionnaire for Weight-Related Difficulties – Revised (AAQW-R)

Compiled this questionnaire AAQW-R designed to measure psychological flexibility (21). The original version AAQ-W indicates the internal stability ($\alpha = 0.86$), and its good test and retest competence and reliability are reported (21). Its revised version includes ten items and 3 factors, rendering it a durable, reliable, and clinical change-sensitive tool (22). Cronbach alpha of the present questionnaire for overweighed and obese samples was $\alpha = 0.70$ as reported by the researchers.

### WHO Quality of Life Questionnaire – BREF (WHOQOL-BREF)

The World Health Organization's questionnaire of quality of life-BREF is a self-report 26-facet questionnaire prepared to assess the quality of life in four domains of physical health (7 facets), psychological health (6 facets), and social relations (3 facets), and environmental health (8 facets). This questionnaire contains two more questions dissociated from the said domains, measuring the general health and overall quality of life. The facets of this questionnaire are rated on a scoring scale where the higher scores indicate better quality of life. The overall score of this questionnaire falls in the range of 0-100. Cronbach alpha for the overall scores of this questionnaire is reported to be between 0.86 and 0.91 (23). For the Iranian sample, the Cronbach alphas of the questionnaire are reported as being 0.70, 0.73, 0.55, and 0.84 for physical health, psychological health, social relations, and environmental health domains (24).

### Female Sexual Function Index (FSFI) Questionnaire

It measures the females' sexual function index by 19 items. Cronbach alpha index of ≥0.89 and a good converging validity of this scale with the marital satisfaction scale were reported (25). Psychometric properties of the Persian version of this scale using Cronbach alpha showed desirable reliability ≥ 0.70 of this tool (25).

### Sample Size

The participants of the present study consisted of 102 overweight and obese women with a BMI ≥ 25. The sample size was estimated by the Stata software program to be 52 (26 in each group),considering the significance level of 95%, the power of 0.80%, and the mean and the standard

deviation of BMI loss are 0.54 and 0.92 respectively for the intervention group and 0.07 and 0.76 for the TAU group and used the following formula:

$$n = \frac{[2(z1 - \frac{\alpha}{2} + z1_{\beta})2]s2}{d2}$$

The data collection method in this study was of a simple random type, such that 102 individuals were picked by drawing from those participants referring to the nutritional research centers. Finally, based on inclusion and exclusion criteria 52 individuals randomly divided into two groups, namely intervention and control.

### Randomization

#### *Allocation Concealment Mechanism*

Randomization was carried out by the block randomization method. The randomization software programs created 6-folded random blocks, and the resulted randomization sequence was handed out to a colleague not aware of the executive process of the intervention. For the inclusion of each participant, determined the group in which every individual was to be included (intervention or control).

#### *Implementation*

In both groups, TG, HDL, FBS, BP, BMI, and WC, as well as thyroid tests, were measured and recorded before the intervention. Also, the five-facet mindfulness, self-criticizing/attacking and self-assuring scale, the self-compassion scale, the three-factors eating questionnaire, the acceptance and action questionnaire for weight-related difficulties, the World Health Organization quality of life questionnaire, and the FSFI questionnaire were completed by all the participants. The intervention plan was carefully explained to the intervention group, and briefing pamphlets were given to every participant. Also, the assigned tasks and practices were regularly checked to evaluate the extent of the individuals' compliance and adherence. The researcher made sure about home works fulfillment through phone calls or social networking virtual groups. The assigned home works were checked and reviewed in the next session. Also, the researcher went through necessary training of the third-wave therapies and their related protocols under the supervision of the experienced masters of this field.

The routine therapeutic tests and the questionnaires mentioned above were implemented and completed in two groups three months after the interventions. The control group received the TAU of the overweight and obesity-related healthcare centers, including correcting eating habits and diet, temporary cessation of smoking, and physical activities. The intervention group received a package based on acceptance, mindfulness, and compassion (Kg-free protocol) simultaneously as TAU.

#### *Blinding*

The blinding was of a simple-blind type method, such that the assessments are to be made bysomeone not participating in the intervention part, not aware of the interventionnot participating in the intervention part, not aware of the intervention. Considering that most of the outcomes of the present study are lab indexes, regarding this blinding method, the lab expert was unaware of which individual was in the intervention group and which one was in the control group. The measurement of the waistline, weight, and BP was carried out by center personnel unaware of the project details (12).

### Statistical Analysis

The data analysis was carried out by descriptive indices including the average, mean, standarddeviation, baseline differences analysis, intervention efficacy analysis, covariance analysis,and repeated measures to review the inter-group changes, using the latest version of SPSS.

## Results

Initially, the 102 women were eligible to enter the study. Out of them, 50 women were excluded due to not meeting inclusion criteria, and declined to participate. Finally, 52 women were assigned to two groups (26 in each group) and their data were analyzed (Figure 1).

### The Description of Demographic Variables

The participants' demographic information in this study is provided in (Table 2) by the two groups of the study.

### Baseline Differences

The *t* test for the independent groups was used to compare Kg-free and TAU groups on the baseline. Leven's test examined the assumption of the variance of the groups. This test was proved significant for FBS, mindfulness, and self-compassion indices, which indicates the dubiousness of variances cohort presumption. The *t* test results for these three variables show that the Kg-free group had less diastolic BP (t = -3.32, $P = 0.002$), more HDL (t = 2.63, $P = 0.011$), less AAQW (t = -2.81, $P = 0.007$), and more mindfulness (t = 2.22, $P$=0.032) on the baseline, compared to the TAU group. There was no difference in the rest of the indices and variables between the two groups on the baseline.

### Intervention Efficacy Analysis

The analysis of covariance (ANCOVA) method was used for the intervention efficacy analysis. Following the examination of the covariance analysis assumptions such as the normality of the distribution of the scores, the cohort among the variances, linearity, and the cohort of the regression slope, the baseline scores were put in the analysis as covariates, and the scores of post-test were compared in the intervention and control groups. Results are shown in (Table 3). The covariance analysis test results were significant for the variables of all main outcomes, including BMI, waistline, TG, and the systolic and

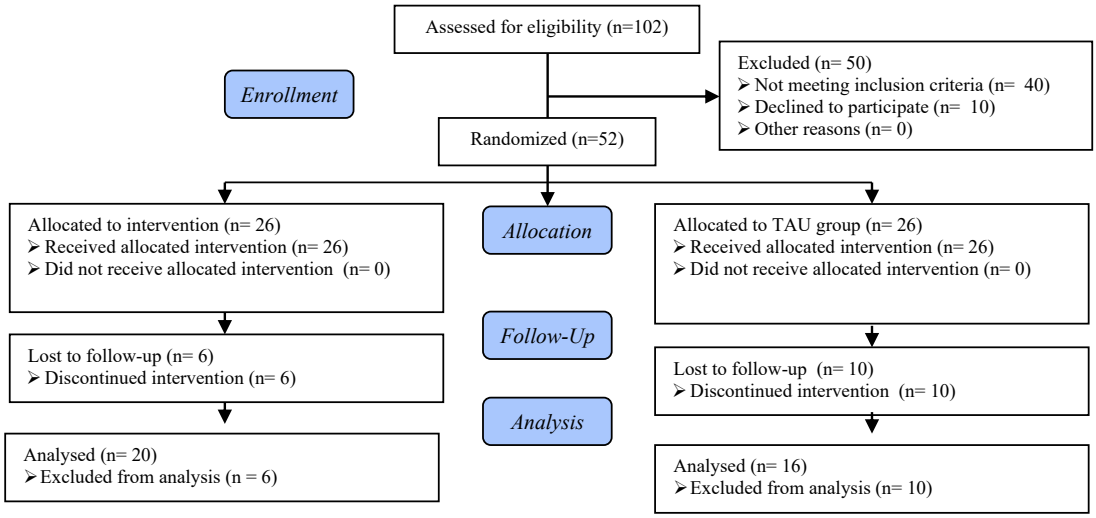


**Figure 1.** The Study CONSORT Flow Diagram.

diastolic indices. That means that these indices declined significantly after the intervention group intervention compared with the control group, and group intervention based on acceptance, mindfulness, and compassion is effective on these indices for overweighed and obese individuals at a low to medium level (d=0.001–0.50).

However, no changes were observed compared to the control group for the FBS and HDL indices. Therefore, it may be concluded that group intervention based on acceptance, mindfulness, and compassion is not effective on the FBS and HDL indices in overweighed and obese individuals.

Moreover, the covariance analysis test results on the secondary outcomes such as the quality of life and sexual function indices showed that individuals under group intervention based on acceptance, mindfulness, and compassion underwent a significant change compared to the control group. The level of efficacy of this intervention on the said indices was in a medium to a high level (d=0.59 –0.69).

The outcomes of the procedures such as mindfulness, self-criticism, self-compassion, and the behaviors related to eating, and experimental restraint related to weight in the intervention group, showed a significant difference compared to the control group. That means that individuals under group intervention based on acceptance, mindfulness, and compassion showed a significant difference compared to the control group. This intervention's levels of efficacy on the said indices were medium to high (d=0.50–0.83).

**Table 2.** Socio-demographic Characteristics of Two Study Groups

| | Groups | |
|---|---|---|
| | **Kg-Free (n = 26)** | **TAU (n = 26)** |
| Age, mean ± SD | 53.42 ± 1.30 | 52.26 ± 2.55 |
| BMI | 30.22 ± 1.74 | 29.80 ± 2.55 |
| Weight | 75.80 ± 11.92 | 72.11 ± 7.85 |
| Height | 156.84 ± 7.33 | 155.50 ± 5.21 |
| Education, No. (%) | | |
| 1-5 year | 3 (2.9) | 6 (5.9) |
| 6-13 year | 6 (5.9) | 10 (9.8) |
| BA | 15 (14.7) | 5 (4.9) |
| MSc | 2 (2.0) | 5 (4.9) |
| Occupation, No. (%) | | |
| Free | 1 (1.0) | 1 (1.0) |
| Houseworker | 22 (21.6) | 22 (21.6) |
| Retired | 3 (2.9) | 3 (2.9) |

BMI, Body mass index; SD, standard deviation; BA, Bachelor of Arts; MSc Master of Science.

## Repeated Measures to Examine the Inter-Group Changes

We went on with the repeated measurements method to examine the efficacy of the time effect (post-test, pre-test, and follow-up) for the two groups. The assumptions of this test, including the normality and variance cohort assumptions, were examined in the previous sections. Mauchly's test also evaluated the assumption of the covariance-variance matrix sphericity. According to the contents of Table 4, the inter-group efficacy for the intervention and control groups on the BMI variables of the main outcome at pre-test, post-test, and follow-up stages were significant. Additionally, the inter-group efficacy for the Kg-free group on the variable of waistline main outcome at the pre-test, post-test, and follow-up stages is significant. Also, the inter-group efficacy for the TAU group is not significant. The inter-group efficacy for the Kg-free group on the variable of TG at pre-test, post-test, and follow-up stages is significant. Still, it is insignificant for the control group. The inter-group efficacy for the Kg-free and control groups on the systolic index at pre-test, post-test, and follow-up stages is significant. In contrast, the inter-group efficacy for the Kg-free and control groups on the diastolic index at pre-test, post-test, and follow-up

**Table 3.** Mean (SDs) Score for all Outcome and Process Variables by Group, Analysis of Covariance and Effect Size of Efficacy Analyses

| Variables | Kg-Free | TAU | F | *P* | Cohen's d |
|---|---|---|---|---|---|
| **Main outcomes** | | | | | |
| BMI | 28.51 ± 1.33 | 30.12 (2.15) | 44.19 | 0.001 | 0.47 |
| WC | 95.11 (4.57) | 96.23 (5.19) | 73.49 | 0.001 | 0.50 |
| TG | 201.26 (47.14) | 207.65 (47.40) | 14.75 | 0.001 | 0.23 |
| Systolic | 131.38 (1.52) | 131.80 (2.93) | 5.25 | 0.026 | 0.09 |
| Diastolic | 85.69 (2.78) | 90.88 (3.30) | 29.80 | 0.001 | 0.37 |
| FBS | 106.15 (26.43) | 100.92 (6.56) | 0.056 | 0.814 | 0.001 |
| HDL | 44.42 (4.45) | 41.96 (3.82) | 0.315 | 0.577 | 0.006 |
| **Secondary Outcomes** | | | | | |
| QoL | 70.26 (6.90) | 52.03 (7.52) | 112.75 | 0.001 | 0.69 |
| FSFI | 19.38 (5.87) | 10.40 (4.61) | 69.82 | 0.001 | 0.59 |
| **Process Measures** | | | | | |
| FFMQ | 71.23 (6.64) | 46.53 (5.72) | 245.08 | 0.001 | 0.83 |
| FSCRS | 39.26 (5.11) | 50.69 (6.21) | 105.03 | 0.001 | 0.68 |
| SCS | 67.07 (12.91) | 53.00 (9.46) | 49.45 | 0.001 | 0.50 |
| TFEQ | 36.23 (4.14) | 54.96 (6.23) | 252.57 | 0.001 | 0.83 |
| AAQWP | 30.69 (3.41) | 50.76 (6.12) | 178.31 | 0.001 | 0.78 |

Data presented as mean ± SD.

*Note*. Kg-Free, treatment group; TAU, control group; BMI, body mass index; WC, waist circumference; TG, triglyceride; HDL, high-density lipoprotein; FBS, fasting blood sugar; HP, hypertension; QoL, quality-of-life; FSFI, Female Sexual Function Index; FFMQ, Five Facet Mindfulness Questionnaire; FSCRS, Forms of Self-Criticizing/Attacking & Self-Reassuring; SCS, self-compassion scale; TFEQ, Three-Factor Eating Questionnaire; AAQWP, Persian version of Acceptance and Action Questionnaires for Weight-Related Difficulties.

stages is not significant. Moreover, the inter-group efficacy for the Kg-free and control groups on the FBS at pre-test, post-test, and follow-up stages is insignificant. The inter-group efficacy for the Kg-free group on the HDL index at pre-test, post-test, and follow-up stages was significant, but it was insignificant for the control group.

As for the variables of the secondary outcomes, according to the contents of Table 4, the inter-group efficacy for the Kg-free group on the variable of quality of life at pre-test, post-test, and follow-up stages is significant, but it is not significant for the control group. Furthermore, the inter-group efficacy for the Kg-free group on the variable of sexual function at pre-test, post-test, and follow-up stages is significant.

As for the procedure variables, the inter-group efficacy for both Kg-free and groups on the variable of acceptance and action for weight-related difficulties at pre-test, post-test, and follow-up stages is significant. Also, the inter-group efficacy for the Kg-free and control groups on the variable of mindfulness, self-criticism, self-compassion, eating habits, and acceptance and action for weight-related difficulties at pre-test, post-test, and follow-up stages is significant.

## Bonferroni's Post Hoc Test

According to (Table 5), the contents of the pair-wise comparison of pre-test, post-test, and follow-up stages of the BMI index show that the average difference of the pre-test with post-test and follow-up is significant in the kg-free group. Still, the average difference between post-test and follow-up are not. Besides, the individuals' scores at the follow-up stage did not undergo a tangible and significant change compared to the post-test. The average difference is not significant for the TAU group between any of the test stages. As for the waistline index in the kg-free group, the average difference of pre-test with post-test and follow-up is significant. Yet, the average difference between the post-test and follow-up stages is insignificant.

On the other hand, the individuals' scores did not undergo a tangible and significant change at the follow-up stage compared to the post-test. Regarding the insignificance of the inter-subject efficacy for the TAU group, the post hoc test is invalid for the said group, hence not reported. As for the TG index in the Kg-free group, the average difference of pre-test with post-test and follow-up is significant. Yet, the average difference between the post-test and follow-up stages is insignificant. On the other hand, the individuals' scores did not undergo a tangible and significant change at the follow-up stage compared to the post-test.

Regarding the insignificance of the inter-subject efficacy for the TAU group, the post hoc test is invalid for the said group, hence not reported. As for the systolic index in the kg-free group, the average difference is significant only between pre-test and follow-up. For the TAU group, the average difference is not significant between any of the test stages. As for the HDL index in the kg-free group, the average difference is significant between all stages of the measurement. Regarding the insignificance of the inter-subject efficacy for the TAU group, the post hoc test is invalid for the said group, hence not reported.

As for the quality of life index in the kg-free group, the average difference of pre-test with post-test and follow-up is significant. Regarding the insignificance of the inter-subject efficacy for the TAU group, the post hoc test is invalid for the said group, hence not reported. Also, as

**Table 4.** Means, Standard Deviations, Within-Group T-test of Changes from Pre- to Post-treatment, and Cohen's d for the Effect Size for Each Group

| Variables | Intervention Group (Kg-Free) | | | | | | Control Group (TAU) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-intervention | Post-intervention | 3-month follow-up | F test | *P* | d | Pre-intervention | Post-intervention | 3-month follow-up | F | *P* | d |
| **Main Outcomes** | | | | | | | | | | | | |
| BMI | 30.22 (1.74) | 28.51 (1.33) | 27.76 (5.74) | 21.25 | 0.001 | 0.52 | 29.80 (2.55) | 30.12 (2.15) | 30.58 (2.43) | 4.94 | 0.025 | 0.24 |
| WC | 95.53 (5.74) | 95.11 (4.57) | 91.20 (5.11) | 44.98 | 0.001 | 0.70 | 94.50 (5.51) | 96.23 (5.19) | 97.18 (4.99) | 3.12 | 0.058 | 0.17 |
| TG | 204.76 (47.96) | 201.26 (47.14) | 206.30 (48.99) | 26.30 | 0.001 | 0.58 | 204.26 (46.65) | 207.65 (47.40) | 234.18 (49.31) | 2.58 | 0.128 | 0.14 |
| Systolic | 131.80 (1.57) | 131.38 (1.52) | 130.65 (1.52) | 7.13 | 0.005 | 0.27 | 131.03 (2.76) | 131.80 (2.93) | 131.87 (3.07) | 3.47 | 0.044 | 0.18 |
| Diastolic | 87.03 (2.78) | 85.69 (2.78) | 86.85 (2.78) | 4.69 | 0.057 | 0.19 | 90.15 (3.50) | 90.88 (3.30) | 90.62 (2.98) | 0.297 | 0.639 | 0.01 |
| FBS | 105.15 (27.49) | 106.15 (26.43) | 108.40 (27.59) | 0.695 | 0.435 | 0.03 | 99.88 (6.66) | 100.92 (6.56) | 100.25 (6.19) | 0.235 | 0.665 | 0.01 |
| HDL | 46.96 (5.03) | 44.42 (4.45) | 43.35 (4.18) | 24.52 | 0.001 | 0.56 | 43.65 (3.95) | 41.96 (3.82) | 39.37 (5.22) | 3.07 | 0.096 | 0.17 |
| **Secondary outcomes** | | | | | | | | | | | | |
| QoL | 59.07 (7.99) | 70.26 (6.90) | 69.90 (7.27) | 72.01 | 0.001 | 0.79 | 56.73 (13.08) | 52.03 (7.52) | 48.75 (6.28) | 3.94 | 0.060 | 0.20 |
| FSFI | 11.69 (6.13) | 19.38 (5.87) | 19.00 (5.64) | 40.36 | 0.001 | 0.68 | 11.88 (4.67) | 10.40 (4.61) | 10.12 (4.64) | 5.94 | 0.007 | 0.29 |
| **Process Measures** | | | | | | | | | | | | |
| FFMQ | 54.15 (9.38) | 71.23 (6.64) | 71.30 (6.86) | 126.93 | 0.001 | 0.87 | 49.42 (5.44) | 46.53 (5.72) | 47.00 (5.71) | 6.02 | 0.006 | 0.28 |
| FSCRS | 49.15 (6.47) | 39.26 (5.11) | 37.60 (2.83) | 76.09 | 0.001 | 0.80 | 48.07 (6.38) | 50.69 (6.21) | 53.62 (3.87) | 17.69 | 0.001 | 0.54 |
| SCS | 57.03 (13.58) | 67.07 (12.91) | 68.35 (12.72) | 157.37 | 0.001 | 0.89 | 52.57 (9.19) | 53.00 (9.46) | 50.06 (6.91) | 14.18 | 0.001 | 0.48 |
| TFEQ | 46.65 (5.81) | 36.23 (4.14) | 35.85 (3.89) | 138.39 | 0.001 | 0.87 | 45.73 (5.01) | 54.96 (6.23) | 57.37 (5.60) | 53.35 | 0.001 | 0.78 |
| AAQWP | 44.19 (4.74) | 30.69 (3.41) | 30.45 (3.06) | 177.76 | 0.001 | 0.90 | 47.73 (4.29) | 50.76 (6.12) | 51.37 (5.59) | 8.16 | 0.002 | 0.35 |

Data presented as mean ± SD.

*Note*. Kg-Free, treatment group; TAU, control group; BMI, body mass index; WC, waist circumference; TG, triglyceride; HDL, high-density lipoprotein; FBS, fasting blood sugar; HP, hypertension; QoL, quality-of-life; FSFI, Female Sexual Function Index; FFMQ, Five Facet Mindfulness Questionnaire; FSCRS, Forms of Self-Criticizing/Attacking & Self-Reassuring; SCS, self-compassion scale; TFEQ, Three-Factor Eating Questionnaire; AAQWP, Persian version of Acceptance and Action Questionnaires for Weight-Related Difficulties.

**Table 5.** Bonferroni's Post Hoc Test for Pairwise Comparisons of the Group

| Variables | Comparison between Groups | | Mean Difference (I-J) | *P* Value |
|---|---|---|---|---|
| | I | J | | |
| **Main outcomes** | | | | |
| BMI | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 1.68 | 0.001 |
| | | Follow-up | 2.23 | 0.001 |
| | Post | Follow-up | 0.54 | 0.008 |
| Control Group (TAU) | Pre | Post | -0.58 | 0.109 |
| | | Follow-up | -1.08 | 0.071 |
| | Post | Follow-up | -0.50 | 0.443 |
| WC | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 3.35 | 0.001 |
| | | Follow-up | 3.85 | 0.001 |
| | Post | Follow-up | 0.50 | 0.228 |
| Control Group (TAU) | Pre | Post | 0.58 | 0.258 |
| | | Follow-up | 0.53 | 0.238 |
| | Post | Follow-up | 0.51 | 0.230 |
| TG | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 3.60 | 0.001 |
| | | Follow-up | 6.05 | 0.001 |
| | Post | Follow-up | 2.45 | 0.027 |
| Control Group (TAU) | Pre | Post | 3.70 | 0.604 |
| | | Follow-up | 4.70 | 0.704 |
| | Post | Follow-up | 6.70 | 0.804 |
| Systolic | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 0.350 | 0.269 |
| | | Follow-up | 0.995 | 0.019 |
| | Post | Follow-up | 0.645 | 0.075 |
| Control Group (TAU) | Pre | Post | -1.06 | 0.209 |
| | | Follow-up | -1.31 | 0.088 |
| | Post | Follow-up | -0.250 | 0.001 |
| Diastolic | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 0.250 | 0.229 |
| | | Follow-up | 0.005 | 0.029 |
| | Post | Follow-up | 0.745 | 0.175 |
| Control Group (TAU) | Pre | Post | 5.06 | 0.509 |
| | | Follow-up | -1.56 | 0.078 |
| | Post | Follow-up | -0.230 | 0.211 |
| FBS | | | 0.350 | 0.169 |
| Intervention Group (Kg-Free) | Pre | Post | 0.925 | 0.119 |
| | | Follow-up | 0.545 | 0.065 |
| | Post | Follow-up | -2.06 | 0.219 |
| Control Group (TAU) | Pre | Post | 1.31 | 0.048 |
| | | Follow-up | 0.240 | 0.021 |
| | Post | Follow-up | 0.310 | 0.219 |
| HDL | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 2.30 | 0.001 |
| | | Follow-up | 3.20 | 0.001 |
| | Post | Follow-up | 0.90 | 0.017 |
| Control Group (TAU) | Pre | Post | 0.629 | 0.01 |
| | | Follow-up | 0.615 | 0.01 |
| | Post | Follow-up | 0.076 | 0.13 |
| **Secondary Outcomes** | | | | |
| QoL | | | | |
| Intervention Group (Kg-Free) | Pre | Post | -11.70 | 0.001 |
| | | Follow-up | -11.80 | 0.001 |
| | Post | Follow-up | -0.10 | 0.001 |
| Control Group (TAU) | Pre | Post | 0.639 | 0.01 |
| | | Follow-up | 0.665 | 0.01 |
| | Post | Follow-up | 0.096 | 0.17 |
| FSFI | | | | |
| Intervention Group (Kg-Free) | Pre | Post | -7.85 | 0.001 |
| | | Follow-up | -7.95 | 0.001 |
| | Post | Follow-up | -0.10 | 0.448 |
| Control Group (TAU) | Pre | Post | 1.66 | 0.114 |
| | | Follow-up | 2.13 | 0.030 |
| | Post | Follow-up | 0.467 | 1.00 |

**Table 5.** Continued

| Variables | Comparison between Groups | | Mean Difference (I-J) | *P* Value |
|---|---|---|---|---|
| | I | J | | |
| **Process Measures** | | | | |
| FFMQ | | | | |
| Intervention Group (Kg-Free) | Pre | Post | -17.20 | 0.001 |
| | | Follow-up | -18.10 | 0.001 |
| | Post | Follow-up | -0.90 | 0.435 |
| Control Group (TAU) | Pre | Post | 2.75 | 0.057 |
| | | Follow-up | 3.43 | 0.015 |
| | Post | Follow-up | 0.688 | 1.00 |
| FSCRS | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 10.10 | 0.001 |
| | | Follow-up | 11.05 | 0.005 |
| | Post | Follow-up | 0.95 | 0. 107 |
| Control Group (TAU) | Pre | Post | -3.31 | 0.008 |
| | | Follow-up | -5.62 | 0.001 |
| | Post | Follow-up | -2.31 | 0.074 |
| SCS | | | | |
| Intervention Group (Kg-Free) | Pre | Post | -10.45 | 0.001 |
| | | Follow-up | -12.85 | 0.001 |
| | Post | Follow-up | -2.4 | 0.001 |
| Control Group (TAU) | Pre | Post | 0.063 | 1.00 |
| | | Follow-up | 5.56 | 0.001 |
| | Post | Follow-up | -5.62 | 0.001 |
| TFEQ | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 10.15 | 0.001 |
| | | Follow-up | 11.00 | 0.001 |
| | Post | Follow-up | 0.85 | 0.033 |
| Control Group (TAU) | Pre | Post | -8.25 | 0.01 |
| | | Follow-up | -10.06 | 0.057 |
| | Post | Follow-up | -1.85 | 0.267 |
| AAQWP | | | | |
| Intervention Group (Kg-Free) | Pre | Post | 12.59 | 0.001 |
| | | Follow-up | 13.70 | 0.001 |
| | Post | Follow-up | 0.75 | 0.016 |
| Control Group (TAU) | Pre | Post | -1.00 | 1.00 |
| | | Follow-up | -3.81 | 0.005 |
| | Post | Follow-up | -2.81 | 0.058 |

*Note*. Kg-Free, treatment group; TAU, control group; BMI, body mass index; WC, waist circumference; TG, triglyceride; HDL, high-density lipoprotein; FBS, fasting blood sugar; HP, hypertension; QoL, quality-of-life; FSFI, Female Sexual Function Index; FFMQ, Five Facet Mindfulness Questionnaire; FSCRS, Forms of Self-Criticizing/Attacking & Self-Reassuring; SCS, self-compassion scale; TFEQ, Three-Factor Eating Questionnaire; AAQWP, Persian version of Acceptance and Action Questionnaires for Weight-Related Difficulties.

*The mean difference is significant at the 0.001 level

for the sexual function index in the kg-free group, the average difference of pre-test with post-test and follow-up is significant. Only the average difference between post-test and follow-up stages is significant for the TAU group.

As for the mindfulness index in the kg-free group, the average difference of pre-test with post-test and follow-up is significant. Only the average difference between post-test and follow-up stages is significant for the TAU group. Also, the average difference of pre-test with post-test and follow-up is significant for the self-criticism index in both groups. The changes move in a declining direction in self-criticism for the Kg-free group, and for the TAU group, these changes are in a rising trend. As for the eating behavior index for the Kg-free group, the average difference is significant between all stages of the test. The average difference between pre-test and post-test and between pre-test and follow-up is significant for the TAU group. As for the acceptance and action of the related difficulties index for the Kg-free group, the average difference is significant between all test stages. The scores of the TAU group, only the average difference between the pre-test and post-test are significant.

## Discussion

The present trial was carried out aiming to examine the efficacy of group intervention based on acceptance, mindfulness, and compassion on obese and overweighed women and its effect on the components of metabolic syndrome, including the waistline, BMI, BP, FBS, TG, HDL, the quality of life, and the sexual function. Our results showed that group intervention based on acceptance, mindfulness, and compassion could reduce the BMI of the individuals in the intervention group compared to the control group. This intervention helps the participants form a positive association with weight and internal experiences of eating and a tendency for

inflexibility and criticism, primarily upon encountering mistakes and failures. This may lead to weight self-stigma and help the participants perform and maintain healthy behaviors, which may, in turn, affect their BMI (12,26). The other related mechanism is reducing impulsivity; reduced impulsivity is a mediating variable between mindfulness and lower emotional eating scores and external eating (27). Mindfulness teaches momentary attention with a non-judgmental attitude towards thoughts and emotions, and this type of attention is contrary to impulsivity (28,29). The covariance analysis for the WC index showed that it was significantly declined in the intervention group compared to the control group at the post-test. Significantly, these differences were stable at the intervention follow-up stage. This finding does not go along with the previous study (12); there was no significant difference found between the intervention and control groups in terms of the waistline. No supporting research has shown that group interventions based on acceptance, mindfulness, and compassion may decline the waistline index. This effect takes place by different mechanisms, including the increased sensitivity to the internal signs of hunger and satiety that takes place in compliance with the findings of the conducted study, leading to a decline in external eating (27,30,31).

Results of the analysis test showed that the quality of life post-test scores in both intervention and TAU groups were significantly different, and the index of quality of life has increased significantly compared to the control group at the post-test. This finding is in line with a previous study (12). To clarify this assumption, one may state that because the overweighed and obese individuals have many dissatisfactions concerning their eating habits and their impact on their function and appearance, learning acceptance, mindfulness, and compassion skills and applying them in eating-related issues and correction of eating behaviors may create significant progress in reducing tensions resulted by unhealthy eating habits (32).

Moreover, mindful eating ultimately leads to positive consequences in augmenting the individual's general quality of life through increased flexibility and tolerance. When individuals with overweight and obesity enjoy more mindfulness in their eating behavior, their quality of life also increases. Yet, when these individuals adopt unhealthy eating behaviors, the positive influence of mindful eating on their life quality declines significantly (33-36).

The study results indicated that the post-test scores of TG levels in the intervention were reduced at the post-test compared to the TAU group. Still, the TG level increased significantly in the intervention group at the follow-up stage. But one of the fundamental presumptions of the interventions related to overweight and obesity is to correct the eating habits; that is, the starting point of obesity and overweight is the individual's foodstuff consumption. Therefore, the intervention based on acceptance, mindfulness, and compassion leads to a more mindful and mentally careful reflex of the individuals toward the environment and leads to a decline in the impulsive responses to unhealthy food, which increases the individuals' sense of control over the food, ad which is what is referred to as the weight-related self-efficiency (26,37).

The intervention group's BP index (systolic and diastolic indices) was significantly reduced at the post-test compared to the TAU groups. The cause of BP change (systolic and diastolic indices) through acceptance, mindfulness, and compassion interventions is unknown. However, it seems that the mindfulness training would lead to cutting or declining the adjustment of the individuals' psychological response to stressors that may, in turn, reduce the physiological stress response and consequently improve the BP (38).

Results showed that the post-test scores of FBS in both interventions based on acceptance, mindfulness, and compassion and TAU groups bear no significant difference after controlling the effect of pre-test scores. No study has been conducted on this subject so far. More studies are needed to examine the effectiveness of the group intervention based on acceptance, mindfulness and compassion on overweight and obese individuals on their FBS. However, similar studies have led to a decline in the FBS level through stress reduction intervention based on mindfulness, yet how the mechanism and reason for reduced FBS works are unknown. One possible explanation for this is that increasing mindfulness may facilitate observing the diet and doing exercises in individuals with overweight and obesity.

Furthermore, the results showed that the group intervention based on acceptance, mindfulness, and compassion for overweighed and obese individuals is not effective on the HDL level, which is in line with the previous study's (39,40).

The higher BMI foes and a lower sexual function index among women. Moreover, the studies indicated that obese women suffer from arousal and orgasm disorders. The present study results showed that the sexual functioning index in the intervention group increased significantly at the post-test compared to the control group. To explain this, it may be depicted that mindfulness reduces distraction, adjusts attention, leads to self-adjustment and listening to the body, and in a way, increases self-compassion and reduces self-judgment in overweighed and obese individuals. Furthermore, sexual satisfaction and function are increased by the improved quality of life in these individuals (41).

Additionally, the more positive the body perception of individuals with overweight and obesity, the higher their quality of life. These findings are supported by the results of the previous studies which realized positive body perception is associated with a higher quality of life (41,42).

### Limitations

The present study is one of the first studies that conducted three different but shares common components based on acceptance, mindfulness, and compassion to the components of metabolic syndrome, including the BMI, waistline, TG level, BP (systolic and diastolic indices), FBS, HDL, as well as the quality of life and sexual function in the overweighed and obese individuals.

This study encompasses limitations that should be addressed in future studies. First, the present study sample included only overweight and obese women. Hence, the generalization of the results to have male or adult samples should be made with caution. Second, the control group did not receive psychological interventions to be assessed comparatively. Therefore, it would be helpful in future studies to use psychological interventions as comparing this intervention with other psychological interventions. Future studies with large samples should be carried out in the next step.

Moreover, the researchers tried as much as possible to reduce obstacles. Yet, due to the nature of the randomized clinical trial of this study, it may not be claimed in complete confidence that the observed improvements in the intervention group are merely achieved through interventions. Moreover, the intervention follow-up was carried out three months after. Therefore, it is recommended to conduct intervention follow-up assessments in a longer duration and more intervals (6-month and 12-month follow-up). Future studies are recommended to focus more on the mechanisms of changes resulting from this intervention.

## Conclusion

This study shows that this intervention can be a valuable and evince-based intervention among the psychological interventions for overweight and obesity. This study showed psychological interventions plays an essential part in for individuals suffering from overweight and obesity.

#### Authors' Contribution

Conceptualization: AA, Methodology: AA, Validation: AOR, Formal Analysis: BGH, Investigation: AA, Resources: AA, Data Curation: AA, WritingOriginal Draft Preparation: AA, Writing-Review and Editing: BB , Visualization: RS, Supervision: MRP, Project, Administration: AA, Funding Acquisition: AA.

#### Conflict of Interests

Authors have no conflict of interest.

#### Ethical Issues

This article has been approved by the ethics committee of Iran University of Medical Sciences, Tehran, Iran (Code: IR.IUMS.REC.1398.049) and registered in the Iranian Registry of Clinical Trials (identifier: IRCT20190924044866N1). All participants provided a written informed consent after explaining the study purpose and assuring confidentiality.

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