Original Article

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Effects of The Integrative Information-Motivation-Behavioral Skills Program on Food Consumption, Exercise, and Emotional Control Behaviors Modification among University Personnel with Obesity: A Cluster Randomized Trial

Pornsuang Chotchuang, Ph.D., RN[1,2], Sureeporn Thanasilp, D.N.S., RN, Dip. APMSN[3,4], Pinhatai Supametaporn, Ph.D., RN[4]

[1]Doctor of Philosophy Program in Nursing Science, Faculty of Nursing, Chulalongkorn University, Bangkok 10300, Thailand.
[2]Adult and Gerontological Nursing, Faculty of Nursing, Suratthani Rajabhat University, Surat Thani 84100, Thailand.
[3]Asian Wisdom Care Research Unit, Faculty of Nursing, Chulalongkorn University, Bangkok 10300, Thailand.
[4]Adult and Gerontological Nursing, Faculty of Nursing, Chulalongkorn University, Bangkok 10300, Thailand.

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Abstract:

Objective: This study evaluated the effectiveness of the Integrative Information-Motivation-Behavioral Skills (IIMBS) program in modifying health behaviors among university personnel with obesity.

Material and Methods: This secondary analysis of a cluster-randomized controlled trial evaluated the effectiveness of the Integrative IIMBS program among obese university personnel. Eight faculties (clusters) were randomized to either the intervention group, receiving the 12-week IIMBS program, or the control group, receiving standard care. A total of 64 individuals participated. The intervention integrated face-to-face sessions and online activities (via LINE OA). Outcomes, including food consumption, exercise, and emotional control, measured at the individual level, were collected using the Health Behavior Questionnaire (S-CVI=0.96, Cronbach's alpha=0.74) and IIMBS program materials. Statistical analysis used repeated measures MANOVA.

Results: The IIMBS program significantly improved health behaviors over 12 weeks, with the greatest effects observed in food consumption (F=249.89, p-value<0.001, η^2=0.801), followed by exercise (F=100.88, p-value<0.001, η^2=0.619), and emotional control (F=8.267, p-value<0.001, η^2=0.118). The intervention group showed significantly greater improvements than the control group in total health behavior (F=216.97, p-value<0.001, partial η^2=0.778), and food consumption (F=109.33, p-value<0.001, η^2=0.638).

Contact: Sureeporn Thanasilp, D.N.S., RN, Dip. APMSN
Asian Wisdom Care Research Unit, Faculty of Nursing, Chulalongkorn University, Bangkok 10300, Thailand.
E-mail: s_thanasilp@hotmail.com; sureeporn.t@chula.ac.th

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Conclusion: The study demonstrated that the IIMBS program effectively promoted lasting behavioral changes in obese university personnel. This approach can serve as a comprehensive strategy for enhancing health behaviors in obese adults across various settings.

Keywords: emotional control behavior, exercise behavior, food consumption behavior, IMB model, university personnel with obesity

Introduction

Obesity continues to pose a growing global health challenge, with prevalence rates escalating despite preventive efforts[1-3]. Thailand's rising obesity rates, particularly among adults, highlight the urgent need for more effective strategies to address this issue[4]. Obesity is defined as excessive adipose tissue accumulation that impairs health[5,6], and is classified as a BMI of 25 kg/m^2 or higher for Asians[7,8]. Obesity increases the risk of chronic diseases, including type 2 diabetes, hypertension, cardiovascular diseases, and certain cancers, raising mortality risk by 2 to 3 times[9,10].

Health behavior encompasses actions and habits that directly influence an individual's physical and mental well-being. Among adults with obesity, 3 main health behaviors contribute to obesity and perpetuate its symptoms. Firstly, inappropriate food consumption behavior involves excessive intake of high-calorie, low-nutrient foods such as processed snacks, sugary beverages, and fast foods. Irregular eating patterns, such as skipping meals or binge eating, further exacerbate weight gain by causing energy imbalances[11]. Secondly, insufficient exercise is common among individuals with obesity. A sedentary lifestyle, characterized by prolonged sitting and lack of structured physical activity, reduces energy expenditure, decreases muscle mass, and promotes further weight gain[12,13]. Regular exercise is essential for maintaining a healthy weight and improving overall health[14]. Thirdly, poor emotional control related to eating, such as emotional eating in response to stress, anxiety, or other negative emotions, often leads to excessive consumption of high-fat or high-sugar foods, making weight management challenging[6,15-18].

Among university personnel, these behaviors are particularly problematic. Demanding schedules often lead to skipped meals, high-calorie snacks, and reliance on convenience store foods, resulting in energy imbalances and weight gain. Sedentary work, including teaching and administrative tasks, limits physical activity, thereby reducing energy expenditure and muscle mass. Additionally, stress and emotional challenges further promote emotional eating, exacerbating difficulties in weight management[19,20]. These behavioral patterns create a cycle of inactivity, poor diet, and emotional eating, increasing the risk of obesity and its associated health impacts.

Sustainable weight management relies on modifying health behaviors as a top priority. Addressing these behaviors requires a comprehensive approach that includes education on nutrition, promotion of regular exercise, and strategies to improve emotional regulation, such as mindfulness or stress management techniques[6,17,21-22]. The Information-Motivation-Behavioral Skills (IMB) model, developed by Fisher and Fisher (1992), provides a robust framework for promoting health behaviors, particularly in the context of chronic disease management[23]. This model suggests that health-related information, motivation, and behavioral skills are fundamental determinants of health behaviors. Individuals who are well-informed, motivated, and equipped with the necessary skills are more likely to

adopt and sustain health-promoting behaviors, leading to positive health outcomes. Conversely, those lacking these components are more prone to engaging in health-risk behaviors and experiencing negative health outcomes[23-24].

Face-to-face interventions for weight loss are effective but limited by logistical challenges, highlighting the need for complementary online strategies. Mobile applications like LINE provide accessible and scalable platforms for delivering behavioral programs[25-29]. To address obesity among university personnel, the Integrative Information–Motivation–Behavioral Skills (IIMBS) program was developed, combining face-to-face sessions with ongoing support through a LINE Official Account. The primary results of the IIMBS program, using a cluster-randomized controlled trial (CRCT) design, showed meaningful BMI reductions and improved body image among university personnel. This secondary analysis focused on individual behavioral outcomes, including specifically food consumption, exercise, and emotional control. Although outcomes were assessed at the individual level, the intervention was delivered at the cluster level. Faculties served as the unit of randomization to minimize contamination, leveraging peer dynamics within natural organizational structures to support behavior change.

Material and Methods

The reporting of this study conforms to the CONSORT 2010 statement: extension to cluster randomized trials[30]. This study was also registered with the Thai Clinical Trial Registry (Ref. no. TCTR20250417003).

Study design and population

This secondary analysis used the data from the original research study, a parallel-group, two-arm cluster-randomized controlled trial (CRCT), entitled "Effects of the IIMBS program on body mass index and body image among university personnel with obesity." which has been reviewed and approved by the Suratthani Rajabhat University Research Ethics Committee (Certification No. SRU-EC 2024/037). The study was conducted on obese university personnel at Suratthani Rajabhat University (SRU), Southern Thailand, from March to July 2024. Clusters were defined as university faculties, with each of the 8 faculties functioning as a distinct unit of randomization. Clustering at the faculty level was selected to minimize contamination between he intervention and control groups, as faculty members often interact closely, potentially influencing each other's health behaviors if randomized individually. By assigning entire faculties to either the intervention or control group, the design preserved the internal validity of the study. Eligibility criteria: each cluster involved academic and support staff aged 18–59 years with a BMI of ≥ 25 kg/m^2 (Asian standard). Participants also needed smartphone access and willingness to engage in the intervention. Exclusion criteria included serious illness that impairs the ability to exercise, pregnancy, and technical limitations.

Intervention condition:

The IIMBS program was a 12-week blended intervention implemented at the cluster level, with entire faculties assigned to either the intervention or control group. Intervention delivery involved both cluster-based activities (such as group sessions and shared motivational contests) and individual-level components (such as personal behavior tracking via Belly to Healthy Shape LINE OA, smartwatch monitoring, and individualized counseling). Participants attended in-person sessions at baseline, week 4, week 8, and week 12, focusing on food consumption, exercise, and emotional control, and engaged weekly through videos, self-monitoring tools, and motivational reminders. The program aimed to foster sustainable health behavior change by leveraging both social motivation at the cluster level and personal motivation at the individual level (Table 1).

Table 1 Summary of the IIMBS program for the intervention group

The integrative information – motivation – behavioral skills program on body mass index and body image Among university personnel with obesity	
Phase 1 Week 1 Face–to–Face at University	**Baseline Assessments** • Assessed the demographic data, and health status • Measured BMI • Assessed body image using the Thai–version Body Shape Questionnaire (Thai–ver. BSQ–34) • Assessed the Health Behaviors Questionnaire (HBQ) **Activity I:** Information • Participants added LINE OA "Belly to Healthy Shape." • Provided information via PowerPoint, infographics, lectures, and discussions: • Obesity and its health impacts • Principles of food consumption for weight loss (calories, diet types, food triggers, eating modifications) • Principles of exercise for weight loss (duration, intensity, types, tricks for adherence) • Emotional control strategies during weight loss (stress management, family support, relaxation techniques) **Activity II:** Motivation for Behavior Change (30 minutes) • Personal Motivation • Participants shared reasons for weight loss, set clear goals, and created a weekly plan (food, exercise, emotional control) • Social Motivation: • Introduced LINE OA features (tips, videos, infographics) • Announced the "Weight Loss Contest" for weeks 4, 8, and 12 **Activity III:** Health Behavior Practice (45 minutes) • Demonstrated and practiced health behavior skills: • Food menu selection using "Calories Checking" menu on LINE OA • Exercise selection using "Exercises Checking" menu on LINE OA • Emotional control skills training • Distributed smartwatch for heart rate monitoring during exercise
Phase 2 Week 2–12 Online via LINE OA	**Activity I:** Weekly Information Updates • Sent video links on weight loss strategies (e.g., behavioral change, success tips) **Activity II:** Motivation for Behavior Change • Shared motivational content (tips, videos, infographics) • Sent reminders for upcoming "Weight Loss Contests" (on weeks 4, 8, 12) **Activity III:** Continuous Health Behavior Practice • Sent video links and reminders for food, exercise, and emotional control practices • Encouraged daily use of "Calories Checking" and "Exercises Checking" menus on LINE OA • Sent reminders to wear smartwatch for heart rate monitoring
Phase 3 End of Week 4 & 8 Face–to–Face Monitoring at University	**Assessment** • Measured body weight. • Measured BMI (only week 8) • Assessed body image using the Thai–ver. BSQ–34 (only week 8) • Assessed the Health Behaviors Questionnaire (HBQ) **Activity I:** Motivation for Behavior Change • Reviewed recorded health behavior practices and heart rate trends from smartwatches • Provided counseling and additional tips for achieving weight loss • Encouraged participants to keep motivated and continue health behavior changes • Presented rewards and shared photos of contest winners on LINE OA. **Activity II:** Enhanced Health Behavior Practice • Checked recorded health behavior practices (food, exercise, emotional control) • Encouraged participants to use LINE OA menus ("Calories Checking" and "Exercises Checking") and wear smartwatch every day

Table 1 (continued)

The integrative information – motivation – behavioral skills program on body mass index and body image among university personnel with obesity	
Phase 4 End of Week 12 Face-to-Face Evaluation at University	**Final Assessment** • Measured body weight. • Measured BMI • Assessed body image using the Thai-ver. BSQ-34 • Assessed the Health Behaviors Questionnaire (HBQ) **Activity I:** Motivation for Behavior Change • Reviewed recorded health behavior practices and heart rate trends from smartwatch • Provided counseling and additional tips for achieving weight loss • Encouraged participants to keep motivated and continue health behavior changes • Presented rewards and shared photos of contest winners on LINE OA **Activity II:** Health behavior practices • Checked recorded health behavior practices (food, exercise, emotional control) • Encouraged participants to use smartwatch every day continuously • Enhanced Health Behavior Practice continuously

BMI=body mass index, BSQ=body shape questionnaire

Control condition

Participants in control clusters received standard care without additional intervention.

Outcomes measured

Individual-level outcomes were health behaviors that included food consumption, exercise, and emotional control, which were recorded at 4 time points (baseline, week 4, week 8, and week 12).

Sample size and clustering

The sample size was calculated based on a two-arm parallel cluster-randomized controlled trial design. The calculation assumed a moderate effect size of 0.7, a power of 80%, and a significance level (alpha) of 0.05, following the guidelines by Glasgow et al. (2006). It was planned with 8 clusters (university faculties), 4 per group (intervention and control), and equal cluster sizes of 8 participants per cluster. An intracluster correlation coefficient (ICC) of 0.01 was assumed based on values typically reported for health behavior interventions[31-33]. To address potential dropout and further uncertainty related to clustering effects, a 20% inflation was applied to the initial sample size estimate. Ultimately, a total of 64 participants (32 per group) were recruited, and all participants completed the 12-week study without dropout (Figure 1).

Randomization and allocation

An independent statistician generated a computer-based randomization sequence to assign 8 faculties (clusters) in a 1:1 ratio to intervention or control groups. Allocation concealment was maintained using sealed, opaque envelopes, randomly drawn by blinded faculty representatives. Within each cluster, 8 eligible academic and support staff were selected via simple random sampling. Pair matching by gender (1:1) between corresponding intervention and control clusters ensured balanced distribution. While participants and facilitators were unblinded due to the nature of the intervention, outcome assessors and data analysts remained blinded. Written informed consent was obtained prior to randomization, and recruitment was conducted through faculty communication channels.

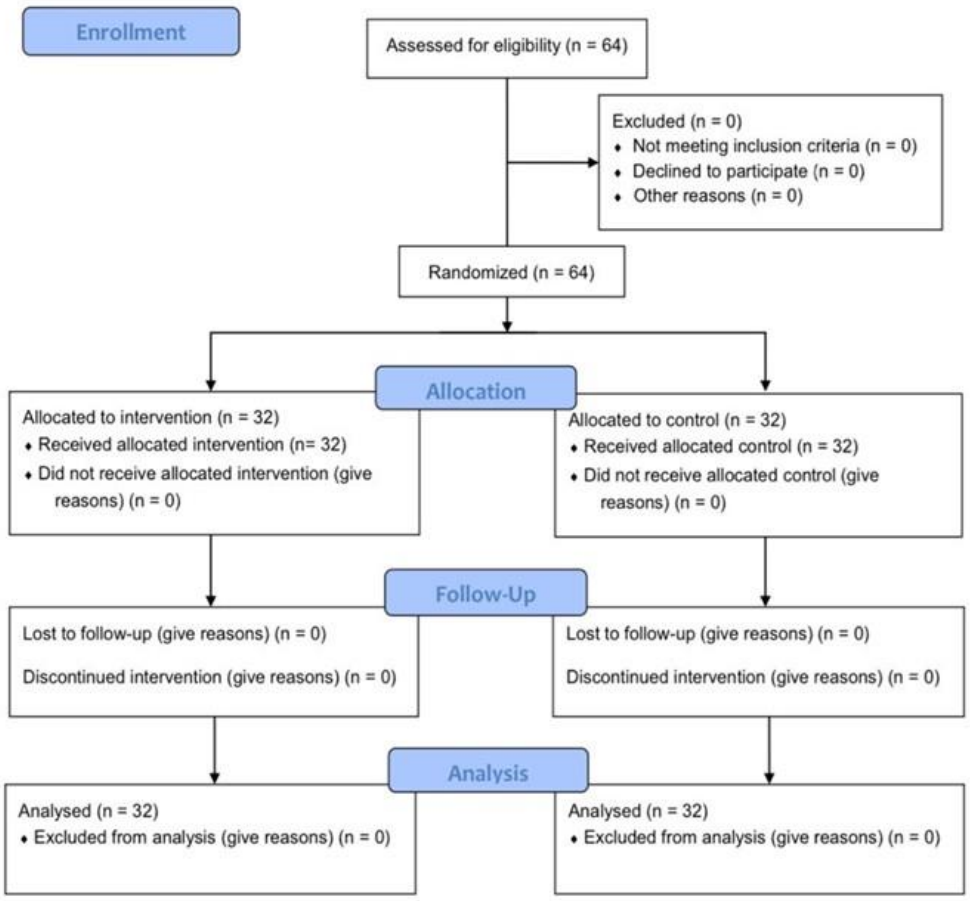

Figure 1 The flow diagram of the cluster sampling randomization study

Research instruments

The study used validated tools for both intervention delivery and data collection, with content confirmed by 5 experts.

Intervention instruments

The IIMBS program (Table 1), aimed to improve food consumption, exercise, and emotional control behaviors through:

Face-to-Face Sessions (Weeks 1, 4, 8, 12): Provided health information, demonstrated skills, and evaluated progress.

"Belly to Healthy Shape" LINE Official Account Activities (Weeks 2–12): Delivered interactive health content, BMI calculators, behavior tracking, motivational messages, videos, and weight loss contests.

Support Tools: Included smartwatches for heart rate monitoring, goal-setting features, and behavior tracking logs.

Data collection instruments

1) Demographic and Health Status Questionnaire: A self-reported, closed-ended questionnaire covering gender, age, occupation, education, income, smoking status,

supplement use, and anthropometrics (weight, height, BMI), validated by 5 experts.

2) Health Behavior Questionnaire (HBQ): A 29-item tool assessing food consumption (19 items), exercise (4 items), and emotional control (6 items), with a total score of 58. Content validity (S-CVI=0.96) and internal consistency (Cronbach's alpha=0.74 overall; 0.72–0.85 across domains) were confirmed.

Data collection procedure

Data collection occurred in 3 phases: preparation, implementation, and follow-up (Table 1).

Preparation phase: Two trained assistants managed the process after 6 training sessions. An independent statistician generated random allocations, with group assignments concealed in sealed envelopes. Eight faculties participated (4 intervention, 4 control), each contributing 8 randomly selected participants (N=64), matched 1:1 by gender. Participants gave electronic informed consent before accessing the study materials.

Implementation phase: Participants in the control group completed baseline assessments and continued usual care. In contrast, the intervention group completed baseline assessments and joined the 12-week IIMBS program (Table 1);

Phase 1 (Week 1, Face-to-Face): Education on obesity, nutrition, exercise, emotional control, goal-setting, introduction to the LINE OA platform, and smartwatches.

Phase 2 (Weeks 2–12, Online): Weekly motivational videos, reminders, and use of tracking tools via LINE OA.

Phase 3 (Weeks 4 & 8, Face-to-Face): Progress reviews, counseling, and motivational rewards.

Phase 4 (Week 12, Face-to-Face): Final assessments and encouragement to sustain behavior changes.

Follow-up phase: All participants in both groups were reassessed at weeks 4, 8, and 12 to monitor changes in food consumption, exercise, and emotional control.

Statistical analysis

All data analyses were conducted using SPSS version 29.0. Descriptive statistics (means, standard deviations, frequencies, percentages) were used to summarize baseline demographic and health characteristics. Between-group comparisons were made using independent t-tests for continuous variables and chi-square tests for categorical variables. Evaluating changes in health behaviors (food consumption, exercise, and emotional control) across 4 time points (baseline, weeks 4, 8, and 12), one-way repeated measures MANOVA was applied. Statistical significance was set at p-value<0.05.

Results

In this study, a total of 8 university faculties were randomized into 2 groups, with 4 clusters allocated to the intervention group and 4 clusters allocated to the control group. All 8 clusters (4 intervention, 4 control) were included in the final analysis. No clusters or individual participants were lost to follow-up or excluded after randomization. Thus, the number of clusters analyzed was equal to the number originally randomized, ensuring a complete dataset for the evaluation of outcomes at both the cluster and individual levels. No adverse events or unintended effects related to the intervention were reported in either the intervention or control groups throughout the 12-week study period. All participants completed the program without experiencing any physical, psychological, or technical complications attributed to the IIMBS program or the standard care procedures. Routine monitoring during face-to-face follow-ups and online interactions confirmed participant safety and program feasibility across all clusters.

Baseline characteristics of the participants:

At baseline, participants in both groups were comparable in all characteristics. The mean age was similar (control: 38.31±6.41 years; intervention: 38.84±5.51 years), with no significant difference (t=-0.356, p-value=0.723).

Gender distribution was identical (75% female, 25% male) (χ^2=0.00, p-value=1.00), and both groups had the same proportions of instructors (37.5%) and support staff (62.5%) (χ^2=0.00, p-value=1.00). Education levels were similarly distributed, with the majority holding master's degrees (62.5% control, 59.4% intervention), followed by bachelor's degrees (28.1% control, 31.2% intervention) and doctoral degrees (9.4% in both groups; χ^2=0.08, p-value=0.962). Eight participants came from each faculty. The control group comprised the Faculty of Law, Management Science, the Graduate School, and the International School of Tourism. Participants in the intervention group included the Faculty of Education, Humanities and the Social Sciences, Nursing, and Science and Technology. The length of work experience was similar between the groups, with most participants having worked 11–15 years (46.9% control, 37.5% intervention; χ^2=1.58, p-value=0.663). Income levels also showed no significant differences, with the majority earning more than 30,000 THB (65.7% control, 56.2% intervention; χ^2=1.46, p-value=0.834) (Table 2).

Table 2 Baseline characteristics of the participants (n=64)

Characteristics	Control group (n=32)	Intervention group (n=32)	χ2	t	p-value
	n (%)	n (%)			
Age (year), mean±S.D.	38.31±6.41	38.84±5.51		- .356	0.723
Gender			0.00		1.00
Female	24 (75.00)	24 (75.00)			
Male	8 (25.00)	8 (25.00)			
Work Position			0.00		1.00
Instructor	12 (37.50)	12 (37.50)			
Support	20 (62.50)	20 (62.50)			
Education Level			0.08		0.962
Bachelor degrees	9 (28.10)	10 (31.20)			
Master degrees	20 (62.50)	19 (59.40)			
Doctor degrees	3 (9.40)	3 (9.40)			
Faculty					
Education	0 (0.00)	8 (25.00)			
Humanities and Social Sciences	0 (0.00)	8 (25.00)			
Law	8 (25.00)	0 (0.00)			
Management Science	8 (25.00)	0 (0.00)			
Nursing	0 (0.00)	8 (25.00)			
Science and technology	0 (0.00)	8 (25.00)			
Graduate School	8 (25.00)	0 (0.00)			
International School of Tourism	8 (25.00)	0 (0.00)			
Length of work			1.58		0.663
<5 years.	10 (31.20)	10 (31.20)			
5–10 years.	7 (21.90)	9 (28.10)			
11–15 years.	15 (46.90)	12 (37.50)			
>15 years.	0 (0.00)	1 (3.20)			
Income			1.46		0.834
10,001–15,000 THB	2 (6.20)	1 (3.20)			
15,001–20,000 THB	2 (6.20)	3 (9.40)			
20,001–25,000 THB	2 (6.20)	2 (6.20)			
25,001–30,000 THB	5 (15.70)	8 (25.00)			
>30,000 THB	21 (65.70)	18 (56.20)			

S.D.=standard deviation, THB=Thai Baht

Baseline health status of the participants

At baseline, there were no significant differences between the groups. Underlying diseases were slightly more common in the intervention group (31.25%) than the control group (25%) (χ^2=0.309, p-value=0.578). Most participants were non-smokers (≥90%) (χ^2=0.217, p=0.641), and only 3.1% in the intervention group used weight-loss supplements (χ^2=1.772, p-value=0.183). A majority ate 3 meals daily (59.4% control, 75% intervention). Health indicators showed no significant differences, and included; 1) Blood pressure: intervention group had slightly higher systolic (126.25±20.80 mmHg) and diastolic (82.31±16.25 mmHg) values vs. control (123.63 ±17.54/79.09±12.83 mmHg); 2) Waist circumference: control: 36.47±4.50 in, intervention: 35.93±5.30 in (t=0.437, p-value=0.461); 3) Body Weight: control: 87.22±14.11 kg, intervention: 83.63±12.60 kg (t=1.072, p-value=0.288); 4) BMI: control: 33.27±5.27, intervention: 31.66±4.40 (t=1.33, p-value=0.188) (Table 3).

Table 3 Baseline health status of participants (n=64)

Characteristics	Control group (n=32) n (%)	Intervention group (n=32) n (%)	χ2	t	p-value
Underlying disease U/D			0.309		0.578
Not have U/D	24 (75)	22 (68.75)			
Have U/D	8 (25)	10 (31.25)			
Hypertension	1 (3.10)	1 (3.10)			
Dyslipidemia	7 (21.90)	5 (15.70)			
Migraine	0 (0.00)	1 (3.10)			
Glaucoma	0 (0.00)	1 (3.10)			
Fatty liver disease	0 (0.00)	1 (3.10)			
Allergy	0 (0.00)	1 (3.10)			
Smoking			0.217		0.641
No smoking	29 (90.60)	30 (93.80)			
Quit smoking >6 months	3 (9.40)	2 (6.20)			
Using medication or supplements for weight loss					
Never used	32 (100.00)	31 (96.90)			
Stop using >6 mths	0 (0.00)	1 (3.10)			
Number of meals eaten per day			1.772		0.183
2 meals per day	13 (40.60)	8 (25.00)			
3 meals per day	19 (59.40)	24 (75.00)			
Most important meal			1.893		0.388
Breakfast	5 (15.70)	5 (15.70)			
Lunch	18 (56.20)	13 (40.60)			
Dinner	9 (28.10)	14 (43.70)			
Blood pressure (mmHg), mean±S.D.					
Systolic BP M=124.94, S.D.=19.13	123.63 (17.54)	126.25 (20.80)		-0.546	0.520
Diastolic BP M=80.70, S.D.=14.61	79.09 (12.83)	82.31 (16.25)		-0.880	0.246
Waist Circumference (inches), mean±S.D. M=36.20, S.D.=4.89 Min=28.5, Max=52.0	36.47(4.50)	35.934 (5.30)		0.437	0.461
Body weight (kg.), mean±S.D. M=85.43, SD= 13.396 Min=63.50, Max=127	87.22 (14.114)	83.63 (12.60)		1.072	0.288
BMI (kg/m2), mean ±S.D. M=32.47, SD=4.89 Min=25.59, Max=49.61	33.27(5.27)	31.66 (4.40)		1.33	0.188

U/D=U/D = Underlying Disease, BP=blood pressure, M=mean, S.D.=standard deviation

Health behaviours (food consumption, exercise, and emotional control)

The IIMBS program demonstrated significant improvements in all health behavior components (total health behavior, food consumption, exercise, and emotional control). The most pronounced improvement was observed in food consumption behavior (F=249.89, p-value<0.001, partial η^2=0.801), followed by exercise (F=100.88, p-value<0.001, partial η^2=0.619), and emotional control (F=8.267, p-value<0.001, partial η^2=0.118). The repeated measures MANOVA revealed that these changes were sustained and strengthened across the 4 assessment points (baseline, week 4, week 8, and week 12), indicating the effectiveness of the IIMBS program in promoting long-term behavior modification.

The group-by-time interaction effect further confirmed the program's efficacy, with the intervention group achieving significantly greater and more consistent gains in total health behavior (F=216.97, p-value<0.001, partial η^2=0.778) and food consumption (F=109.33, p-value<0.001, partial η^2=0.638) compared to the control group. These findings highlight the effectiveness of the IIMBS program in sustaining behavioral changes, particularly in food consumption and exercise behaviors, over the 12-week period (Table 4).

According to pairwise comparisons of the health behaviors' mean difference, the IIMBS program demonstrated significant improvements in total health behavior, food consumption behavior, exercise behavior, and emotional control behavior across time points (baseline, week 4, week 8, and week 12) in the intervention group, as shown in Tables 5 and 6.

Total Health Behavior improved steadily, with mean differences from baseline to weeks 4, 8, and 12 at -8.94,

Table 4 Repeated measures MANOVA of health behaviors by group over time

Source of Variation	F	p-value	Partial η2	Power
Tests of between subjects				
Intercept				
Total health behavior	2966.73	<0.001	0.980	1.000
Food consumption	2824.25	<0.001	0.979	1.000
Exercise	482.69	<0.001	0.886	1.000
Emotional control	1215.82	<0.001	0.951	1.000
Group				
Total health behavior	67.70	<0.001	0.522	1.000
Food consumption	43.10	<0.001	0.410	1.000
Exercise	54.88	<0.001	0.470	1.000
Emotional control	17.84	<0.001	0.223	1.000
Tests of within subjects				
Time				
Total health behavior	315.04	<0.001	0.836	1.000
Food consumption	249.89	<0.001	0.801	1.000
Exercise	100.88	<0.001	0.619	1.000
Emotional control	8.267	<0.000	0.118	1.000
Time x Group				
Total health behavior	216.97	<0.001	0.778	1.000
Food consumption	109.33	<0.001	0.638	1.000
Exercise	63.60	<0.001	0.506	1.000
Emotional control	44.53	<0.000	0.418	1.000

−15.44, and −18.97, respectively (all p-value<0.01). At week 12, the intervention group scored significantly higher (49.62±2.600) than the control group (31.72±7.008), suggesting a large and meaningful effect.

Food Consumption Behavior showed the strongest effect, improving from baseline by −5.88 (week 4), −9.25 (week 8), and −11.25 (week 12) (all p-value<0.01). At week 12, the intervention group scored 31.66±1.537 compared to 22.25±4.333 in the control group.

Exercise Behavior followed a similar trend, with improvements of −1.66, −4.50, and −5.88 across the time points. At week 12, the intervention group had a significantly higher score (9.19±1.693) versus the control group (3.63±2.254), highlighting the role of motivation and structured engagement.

Emotional Control Behavior, though demonstrating smaller effects, also improved significantly over time (−1.41 to −1.84). At week 12, the intervention group's score (8.78±1.539) exceeded that of the control group (7.09±1.780), suggesting a delayed but positive impact on emotional control behavior.

In summary of these results, the IIMBS program was most effective in improving total health behavior and food consumption behavior, followed by exercise behavior and emotional control behavior. These improvements were consistent across all time points, with the intervention group showing significantly better outcomes compared to the control group at each stage, particularly at week 12.

Table 5 Pairwise comparisons of health behaviors within the intervention group

Time point	The mean differences in health behaviors		
	Baseline	Week 4	Week 8
Total health behavior			
Baseline	–	–	–
Week 4	−8.94**	–	–
Week 8	−15.44**	−6.50**	–
Week 12	−18.97**	−10.03**	−3.53**
Food consumption behavior			
Baseline	–	–	–
Week 4	−5.88**	–	–
Week 8	−9.25**	−3.38**	–
Week 12	−11.25**	−5.38**	−2.00**
Exercise behavior			
Baseline	–	–	–
Week 4	−1.66**	–	–
Week 8	−4.50**	−2.84**	–
Week 12	−5.88**	−4.22**	−1.38**
Emotional control behavior			
Baseline	–	–	–
Week 4	−1.41**	–	–
Week 8	−1.69**	−0.28	–
Week 12	−1.84**	−0.44	−0.16

*p-value<0.05

Table 6 Pairwise comparisons of health behaviors between the groups over time

Time point	Intervention		Control group		Mean dif.
	Mean	S.D.	Mean	S.D.	
Total health behavior					
Baseline	30.66	6.051	29.66	6.343	−1.00
Week 4	39.59	4.428	30.47	6.436	−9.13
Week 8	46.09	2.600	30.56	6.701	−15.53
Week 12	49.62	2.600	31.72	7.008	−17.91
Food consumption behavior					
Baseline	20.41	3.697	19.94	5.022	−0.47
Week 4	26.28	2.785	20.44	4.996	−5.84
Week 8	29.66	2.522	21.62	4.376	−8.03
Week 12	31.66	1.537	22.25	4.333	−9.41
Exercise behavior					
Baseline	3.31	2.389	2.78	2.136	−0.53
Week 4	4.97	1.732	3.06	2.094	−1.91
Week 8	7.81	1.786	3.06	1.831	−4.75
Week 12	9.19	1.693	3.63	2.254	−5.56
Emotional control behavior					
Baseline	6.94	2.257	6.94	1.848	0.00
Week 4	8.34	1.877	6.97	1.636	−1.38
Week 8	8.62	1.641	5.84	1.862	−2.75
Week 12	8.78	1.539	7.09	1.780	−2.94

*p−value<0.05, S.D.=standard deviation

Discussion

The implementation of the IIMBS program led to significant improvements in all targeted health behavior domains, namely, food consumption, exercise, and emotional control, among obese university personnel during a 12−week intervention period. These improvements were statistically significant and consistently observed across 4 time points (baseline, weeks 4, 8, and 12), with the most pronounced effects in food consumption, followed by exercise, and then emotional control. These findings align with the theoretical underpinnings of the Information−Motivation−Behavioral Skills (IMB) model. The IIMBS program was carefully designed to reflect these 3 components: providing clear health information, enhancing motivation through structured group activities, and developing practical skills for behavior change. The sustained improvements across all behavior domains suggest that this theoretical framework was effectively operationalized in the intervention.

Notably, the significant time−by−group interaction effects, especially for total health behavior and food consumption, emphasize the superior progress made by the intervention group over time. These findings support the IMB model's assertion that behavioral skills act as a mediator between knowledge/motivation and actual behavior change[34]. For instance, dietary behaviors, which are often concrete and easily monitored, responded quickly and effectively to the intervention strategies. In contrast, emotional control, while significantly improved, exhibited smaller changes likely reflecting the complexity and longer timeline typically required for emotional regulation[35]. Moreover, the program's blended delivery format, consisting of face−to−face sessions and online activities via the "Belly to Healthy Shape" LINE OA platform, likely enhanced accessibility and engagement. Digital tools, including smartwatches for exercise monitoring, enabled real−time feedback and reinforced participants' behavioral commitment. These elements not only increased

adherence but also encouraged social support and personal accountability, in line with previous studies emphasizing the role of social and emotional motivation in sustaining lifestyle change[36,37].

The program's integration of technology with behavior change theory provides evidence for the feasibility and efficacy of hybrid interventions in occupational health settings. The results suggest that digital health platforms can be strategically leveraged to bridge the gap between health education and sustainable behavior execution. In addition, quantitative findings support these conclusions. The intervention group demonstrated statistically significant improvements in healthy food consumption and structured physical activity compared to the control group (p-value<0.05). Engagement strategies, including a weight-loss contest and stress management components, further enhanced participation and outcomes, corroborating the literature that emphasizes multi-component designs as superior to single-focus approaches[38]. This study contributes theoretically by reaffirming the IMB model's relevance in adult obesity interventions and practically by offering a scalable framework for integrating digital health strategies into public health programming.

Despite the promising outcomes of this study, several limitations should be acknowledged. First, as a secondary analysis of a previously conducted cluster-randomized controlled trial, the study was not initially powered specifically to detect changes in individual health behaviors, such as food consumption, exercise, and emotional control. As a result, some subtle behavioral changes may not have been fully captured. Second, although the cluster design minimized contamination between the groups, it may have introduced intra-cluster correlations that could affect the precision of estimates. While statistical adjustments were made, residual clustering effects may still have influenced the findings.

Third, the study relied on self-reported data for health behavior assessments, which are subject to recall bias and social desirability bias. Although validated instruments were used, objective measures (e.g., accelerometers for physical activity or dietary recalls) could strengthen future evaluations. Fourth, the relatively short duration of 12 weeks limits conclusions about the long-term sustainability of behavior change. Follow-up beyond the intervention period would be necessary to evaluate whether improvements persist over time. Lastly, the study population was limited to university personnel at a single institution in Southern Thailand, which may restrict the generalizability of findings to other demographic or occupational groups. Future studies should include diverse settings and populations in order to enhance external validity.

Conclusion

The IIMBS program offers an effective, holistic approach to obesity management by combining face-to-face sessions with digital tools and addressing behavioral, social, and emotional determinants of health. The most substantial improvements were observed in food consumption and exercise behaviors, with moderate but consistent gains in emotional control.

These results reinforce the value of comprehensive, theory-based interventions, particularly those grounded in the IMB model, for promoting sustainable health behavior change among obese adult populations. Future research should investigate the long-term impact of such programs, explore strategies to further enhance emotional regulation, and assess their scalability across diverse populations and settings.

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Ethics approval

This study has been approved by the Suratthani Rajabhat University Research Ethics Committee (Certification No. SRU-EC 2024/037).

Trial registration

Registered at Thai Clinical Trials Registry, ID: TCTR20250417003 (https://www.thaiclinicaltrials.org/show/TCTR20250417003).

Full trial protocol

The original research study, a parallel-group, two-arm cluster randomized controlled trial (CRCT), entitled "Effects of the IIMBS program on body mass index and body image among university personnel with obesity".

Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.

References

1. Centers for Disease Control and Prevention. Overweight & Obesity [homepage on the Internet]. Atlanta: CDC; 2020 [cited 2025 Jan 5]. Available from: https://www.cdc.gov/obesity/index.html
2. World Health Organization. Obesity and overweight [homepage on the Internet] Geneva: WHO; 2015 [cited 2025 Jan 5]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
3. World Obesity Federation. Global Obesity Observatory [homepage on the Internet]. London: World Obesity Federation; 2022 [cited 2025 Jan 5]. Available from: https://www.worldobesity.org
4. Ministry of Public Health. Annual Report 2022. [homepage on the Internet]. Bangkok: Ministry of Public Health; 2022. Available from: https://apps-doe.moph.go.th/boeeng/annual/Annual/Annual_Report_2565.pdf
5. Wharton S. Weight management in obesity. Obes Rev 2020;21(Suppl1):e13092.
6. World Health Organization. Obesity and overweight: Key facts [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 Jan 5]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
7. Cheong KC. Prevalence of Obesity in Southeast Asia. Public Health Nutr 2014;17:112–20.
8. Teerawattananon Y, Luz A. Obesity prevention in low- and middle-income countries. Health Policy. 2017;121:552–60.
9. Department of Disease Control. National strategic plan for obesity prevention and control 2019–2023. Bangkok: Department of Disease Control; 2019.
10. Department of Health. Obesity and Public Health Guidelines. Bangkok: Department of Health; 2020.
11. Clark M. Behavioral approaches to obesity. J Obes 2015;2015:1–7.
12. Montesi L, El Ghoch M, Brodosi L, Calugi S, Marchesini G, Dalle Grave R. Long-term weight loss maintenance for obesity: a multidisciplinary approach. Diabetes Metab Syndr Obes 2016;9:37–46.
13. Parmar P, Can AS. Obesity Management Strategies. Nutr Rev 2022;80:451–61
14. Niemiro GM, Keating SE, Johnson NA. Exercise and weight loss in obesity. J Obes 2019;2019:1–8.
15. Dankyau M, Musa I, Suleiman H. Prevalence of obesity in Nigeria. Niger J Med 2016;25:123–9.
16. Surat K. Obesity Trends in Thailand. Thai J Public Health 2018;48:12–20.
17. Konttinen H. Emotional eating and obesity. Appetite 2020;149:104630.
18. Van Strien T. Causes and consequences of emotional eating. Appetite 2018;130:105–20.
19. Nitirat P, Sukprasert T, Detjob S, Boonchuaythanasit K. Obesity among university personnel in Thailand. Thai J Public Health 2018;48:18–25.

20. Detjob S, Boonchuaythanasit K. Emotional control and weight loss. J Behav Sci 2024;49:12–20.
21. Taksaphol Thamrangsi. The Impact of Obesity on Public Health. Thai J Health Policy. 2019;2:15–22.
22. Teixeira PJ, Silva MN, Mata J, Palmeira AL, Markland D. Motivation for weight loss. Obes Rev 2015;16:25–35.
23. Fisher JD, Fisher WA. Changing aids risk behavior. Psychol Bull 1992;111:455–74.
24. Montesi L, El Ghoch M, Brodosi L, Calugi S, Marchesini G, Dalle Grave R. Long-term weight loss maintenance for obesity: a multidisciplinary approach. Diabetes Metab Syndr Obes 2016;9:37–46.
25. Beleigoli AM, Andrade AQ, Cançado AG, Paulo MN, Diniz MFH, Ribeiro AL. Web-based digital health interventions for weight loss and lifestyle habit changes: systematic review and meta-analysis. J Med Internet Res 2019;21:e298. doi: 10.2196/298.
26. Beleigoli AM, Andrade AQ, Diniz MFHS, Alvares RS, Silva BP, Pena M, et al. Digital health interventions for weight loss. Obes Rev 2019;20:145–58.
27. Hurkmans E, Matthys C, Bogaerts A, Scheys L, Devloo K, Seghers J. Digital health for weight loss. Int J Obes 2018;42:1–8.
28. Opanasopit P, Suntornsuk J, Thanachaisethavut B. Behavior Modification Programs for Weight Loss. Thai J Pharm Sci 2021;45:123–30.
29. Pinchaleaw S. Technology for Obesity Management. Thai J Health Sci 2018;48:15–21.
30. Campbell MK, Piaggio G, Elbourne DR, Altman DG. Consort 2010 statement: extension to cluster randomised trials. BMJ 2012;345:e5661.
31. Zhou X, Liao Y, Stiles N, Wang B, Mason M, Diez Roux AV. Intraclass correlation coefficients in cluster randomized trials of health behaviors: a systematic review. J Clin Epidemiol 2023;158:47-56. doi: 10.1016/j.jclinepi.2023.02.003
32. Campbell MK, Mollison J, Steen N, Grimshaw JM, Eccles M. Analysis of cluster randomized trials in primary care: a practical approach. Fam Pract 2000;17:192–196. doi: 10.1093/fampra/17.2.192.
33. Patterson SS, Kong X, McDonald KM, McGlynn EA. Intraclass correlation coefficients in cluster randomized trials for pain outcomes: a systematic review. Pain Med 2020;21:309–318. doi: 10.1093/pm/pnz117.
34. Fisher JD, Fisher WA. The Information-Motivation-Behavioral Skills Model. In: DiClemente RJ, Crosby RA, Kegler MC, editors. Emerging theories in health promotion practice and research: Strategies for improving public health. 2nd ed. San Francisco: Jossey-Bass; 2009; p.40–70.
35. Gross JJ. Emotion regulation: Current status and future prospects. Psychol Inq 2015;26:1–26.
36. Knowles MS, Holton EF, Swanson RA. The adult learner: The definitive classic in adult education and human resource development. 8th ed. New York: Routledge; 2015.
37. Sallis JF, Owen N, Fisher EB. Ecological models of health behavior. In: Glanz K, Rimer BK, Viswanath K, editors. Health Behav Theory Res Pract 5th ed. San Francisco: Jossey-Bass; 2015. p. 43–64.
38. Glanz K, Rimer BK, Viswanath K, editors. Health Behav Theory Res Pract. 5th ed. San Francisco: Jossey-Bass; 2015.