

ORIGINAL ARTICLE

Effects of a Health Behavior Modification Program Based on the Transtheoretical Model Among Overweight Healthcare Personnel at Amnatcharoen Hospital

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ABSTRACT

Overweight and obesity are major public health problems leading to non-communicable diseases. As key role models in health promotion, public health personnel must manage their own health to maintain credibility and effectively promote healthy behaviors in communities. A health behavior modification program can help improve personnel's overall health. Therefore, this quasi-experimental study aimed to examine the effects of a health behavior modification program on overweight personnel at Amnatcharoen Hospital, using the Stages of Change Theory. The sample included 70 overweight personnel ($\text{BMI} \geq 23 \text{ kg/m}^2$), evenly assigned to the experimental and control groups, with 35 participants in each group. The experimental group received a 12-week health behavior modification program that included awareness-raising, reinforcement, training in diet and exercise skills, and monitoring and feedback. In contrast, the control group received regular care. The research instruments consisted of a program tested for content validity and a questionnaire with a reliability of 0.76. The data was analyzed using descriptive statistics and Analysis of Covariance (ANCOVA), with $p < 0.05$ for statistical significance. The study found that after participating in the health behavior modification program, statistically significant between-group differences were observed in knowledge of health behavior modification ($F(1, 64) = 17.415$, $p < 0.001$, $\eta^2 = 0.214$) and body fat percentage ($F(1, 64) = 6.297$, $p = 0.015$, $\eta^2 = 0.090$), with the experimental group demonstrating more favorable outcomes than the comparison group. No statistically significant differences were found in health behaviors ($F(1, 64) = 1.396$, $p = 0.242$), attitudes toward health behavior modification ($F(1, 64) = 1.700$, $p = 0.197$), or body mass index (BMI) ($F(1, 64) = 2.329$, $p = 0.132$). In conclusion, the program based on the stages of change theory was effective in enhancing knowledge and reducing body fat percentage among overweight personnel. However, no significant differences were observed in health behaviors, attitudes, or BMI during the study period. This study highlights the feasibility of applying the proposed approach within health promotion systems, particularly in the systematic development of workplace health promotion programs for personnel. Furthermore, the findings support the formulation of policies or practical guidelines for healthcare institutions to implement staff health promotion initiatives alongside the provision of services to the public.

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Introduction

Overweight and obesity are major public health problems both nationally and globally, leading to the increasing severity of chronic diseases. Overweight and obesity are increasingly common and are contributing factors to complications and diseases such as diabetes, hypertension, hyperlipidemia, gout, and fatty liver, which can lead to cardiovascular disease and stroke¹. A 2022 report from the World Obesity Federation found that approximately 800

million people worldwide are obese. Of these, 39 million are children under 5 years of age, and approximately 340 million are children and adolescents aged 5-19 years. Meanwhile, the World Health Organization (WHO) reported that in 2016, the prevalence of overweight and obesity among adults was 39%, or more than 1.9 billion people. Thailand is also facing this problem. Currently, Thailand has the second-highest obesity rate in ASEAN, after Malaysia, and this number continues to increase—according to data from the Division of Non-

Communicable Diseases, Department of Disease Control, Ministry of Public Health. The prevalence of overweight or obesity in adults in 2021 was reported to be 47.2%, an increase from 34.7%². The incidence of obesity in Thailand has increased by more than 30 percent, or there are more than 20 million obese patients in the total population. The results of the 6th Thai National Health Examination Survey 2019-2020 found that 42.2% of Thais aged 15 years and over are obese, and 39.4%³ are centrally located—data from the Department of Health. The Ministry of Public Health reported that during the period 2021–2023, the prevalence of overweight and obesity among individuals aged 18–59 years showed an increasing trend⁴.

The aforementioned problems in the working-age population require resolution and prevention, particularly among personnel. As the Ministry of Public Health is the primary organization responsible for public health, it places great importance on the health of its personnel. It supports and encourages personnel to develop a positive awareness of health care, ensuring strong physical and mental health, enabling them to provide effective services and serve as good examples for the public. In addition to providing health care to the public, Ministry of Public Health personnel are expected to be good role models for health, embodying appropriate health behaviors, such as exercising, eating healthy foods, and avoiding behaviors that put health at risk⁵. Medical and public health personnel are crucial in caring for patients and the public. It is imperative that these personnel maintain healthy behaviors and be role models for the public. Poor health behaviors can negatively impact their image and credibility in providing health care advice to the public.

A 2020 study by Puntiya⁶ on obesity in the medical profession found that 40% of all physicians in the United States are overweight, a relatively high number. Overweight and obesity have many causes, including high-energy diets, decreased exercise, overtime or shift work, and work and school stress. Some of these are due to occupational and daily behavioral factors that are difficult to address. This is consistent with the study by Somnuk et al.⁷, which studied the Prevalence and Factors Related to Metabolic Syndrome in Personnel of Somdejphrajaotaksinmaharaj Hospital. They found that exercise frequency was associated with central obesity. A literature review revealed that applying the Stage of Change Theory to health behavior modification programs can improve individual health behaviors.

Data from annual health examinations among personnel at Amnatcharoen Hospital revealed that some personnel had abnormal results, such as weight, waist circumference, and blood lipid levels. Data from five-year health examinations revealed that overweight personnel were overweight. That is, the body mass index (BMI) was ≥ 23 kg/m². In 2018, there were 336 people; in 2019, 317; in 2020, 333; in 2021, 405; and in 2022, 353. It was found that 1 in 3 personnel are overweight (BMI ≥ 23 kg/m²). Abnormal results from the annual health examination of Amnatcharoen Hospital personnel may lead to future disease. When personnel become ill, it affects their work. Therefore, to help Amnatcharoen Hospital personnel adopt healthy behaviors, promote good health, and serve as role models for the public, the researcher implemented a health behavior modification program for overweight personnel at the Hospital. The results of the study will help promote and modify the health behaviors of Amnatcharoen Hospital personnel.

This study aimed to evaluate the effect of a health behavior modification program on health behavior knowledge, attitudes, BMI, and body fat percentage among overweight hospital personnel.

Materials and Methods

Study design

This study employed a quasi-experimental research design with a two-group pretest-posttest approach. Seventy overweight personnel (BMI ≥ 23 kg/m²) from Amnatcharoen Hospital were allocated into an experimental group and a comparison group, with 35 participants in each group. The experimental group participated in a 12-week health behavior modification program, while the comparison group received usual care. Data were collected before and after the intervention from August to November 2024. This design allowed for comparison of the effects of the program on health behaviors, knowledge, attitudes, BMI, and body fat percentage.

Population and sample

The study population consisted of personnel working at Amnatcharoen Hospital with a body mass index (BMI) of 23 kg/m² or higher. Eligible participants were aged 20–59 years, had no chronic diseases or health problems preventing exercise, and voluntarily agreed to participate in the program for the entire 12-week duration. Personnel who were relocating, resigning, or pregnant were excluded. The sample size was calculated using the formula for comparing two independent means, resulting in 27 participants per group. To account for potential dropouts, 10% was added, yielding 35 participants per group, for a total of 70 participants. Participants were assigned to either the experimental group or the comparison group, with 35 participants in each. The experimental group received the 12-week health behavior modification program, while the comparison group received usual care.

Sample size calculation

The sample size calculation formula was used to compare the population means of two independent groups⁸. The sample size was 27 participants per group. However, to prevent problems with participants not being able to participate in the program every time or withdrawing from the study, the sample size was increased by 10 percent, resulting in 35 participants per group, for a total of 70 participants.

Research instruments

The research consisted of two types of instruments: (1) The experimental tools consisted of a health behavior modification program for overweight personnel at Amnatcharoen Hospital. This program applied the theory of behavior change. The activities included education on health behavior modification, obesity and its health effects, nutrition education and food samples, emotional and stress management education, exercise education and demonstrations, exercise training, goal-setting activities for health behavior modification, encouragement and support, and recommendations for appropriate health behavior modification. Data collection included weight, height, and body fat percentage. A supplementary knowledge manual was also provided, along with a health behavior recording form, a behavior change stage assessment form, and a

health promotion behavior assessment questionnaire. (2) The tools used for data collection include a questionnaire, which is created by the researcher and divided into five parts as follows:

Part 1: General Information Questionnaire. This section consisted of a demographic questionnaire developed by the researcher. It collected data on gender, age, length of employment, position, type of work, shift work, marital status, income, education level, and average weekly physical activity. The questionnaire contained 14 items in multiple-choice and fill-in-the-blank formats.

Part 2: Health Behavior Questionnaire. This instrument measured health behaviors across three subscales: diet, exercise, and stress management. The questionnaire consisted of 30 items, divided equally into three subscales: diet (10 items), exercise (10 items), and stress management (10 items). Each item was rated on a 5-point Likert scale ranging from 1 (no practice at all) to 5 (regular practice, 6–7 days per week). Subscale scores ranged from 10 to 50 points, and the total score ranged from 30 to 150 points. Higher scores indicated better health behaviors.

Part 3: Knowledge and Understanding of Health Behavior Modification Questionnaire. This questionnaire assessed knowledge and understanding of health behavior modification. It consisted of 15 items in a yes/no format. Each correct answer received 1 point, and each incorrect answer received 0 points. The total score ranged from 0 to 15 points, with higher scores indicating greater knowledge and understanding.

Part 4: Attitudes Toward Health Behavior Modification Questionnaire. This instrument measured attitudes toward health behavior modification. It consisted of 10 items rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total possible score ranged from 10 to 50 points. Higher scores reflected more positive attitudes toward health behavior modification.

Part 5: Body Mass Index and Body Fat Percentage Data Recording Form. This form recorded anthropometric data, including weight, height, body mass index (BMI), and body fat percentage. Body weight and body fat percentage were measured using a body composition analyzer.

Instrument quality assessment

Content validity was evaluated by five experts using the Index of Item-Objective Congruence (IOC). Items with IOC values ≥ 0.50 were retained after revision. Reliability was assessed through a pilot test with 30 public health personnel using Cronbach's alpha and KR-20. The overall reliability coefficient of the entire questionnaire was 0.76. The reliability coefficient for the attitude scale was 0.79, and the knowledge questionnaire yielded a KR-20 value of 0.74.

Data collection

Data collection was divided into two phases, as detailed below:

Experimental preparation phase

For the experimental group, the researcher sent a letter to the administrators of Amnatcharoen Hospital requesting permission to conduct the experiment and collect data. Upon receiving permission for the experiment and data collection, the researcher met with the subjects to explain the purpose, procedures, and timeframe for data collection, and to explain their rights to accept or refuse research participation. Upon consent, the researcher had them sign a consent form, for comparison group the researcher sent a letter to the administrators of Yasothon Hospital requesting permission to conduct the experiment and collect data. Upon receiving permission for the experiment and data collection, the researcher met with the subjects to explain the purpose, procedures, and timeframe for data collection, and to explain their rights to accept or refuse research participation. Upon consent, the researcher had them sign a consent form.

Experimental phase

The researcher conducted the experiment over a total period of 12 weeks. Participants in the experimental group participated in a health behavior modification program, while those in the comparison group were advised to maintain their usual lifestyle and work practices without any intervention from the research program. Outcome measurements were obtained by collecting data on health behaviors, stages of behavior change, body mass index (BMI), and body fat percentage. These variables were assessed both before and after the intervention in both the experimental and comparison groups.

Data analysis

After collecting all data, the researcher verified its accuracy and analyzed it using a statistical software package. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to describe the general characteristics of the sample. Differences between the experimental and comparison groups were analyzed using ANCOVA, controlling for baseline values.

Results

A total of 70 participants were enrolled in the study, as shown in the CONSORT flow diagram (Figure 1). No participants withdrew or were lost to follow-up; therefore, all participants were included in the final analysis.

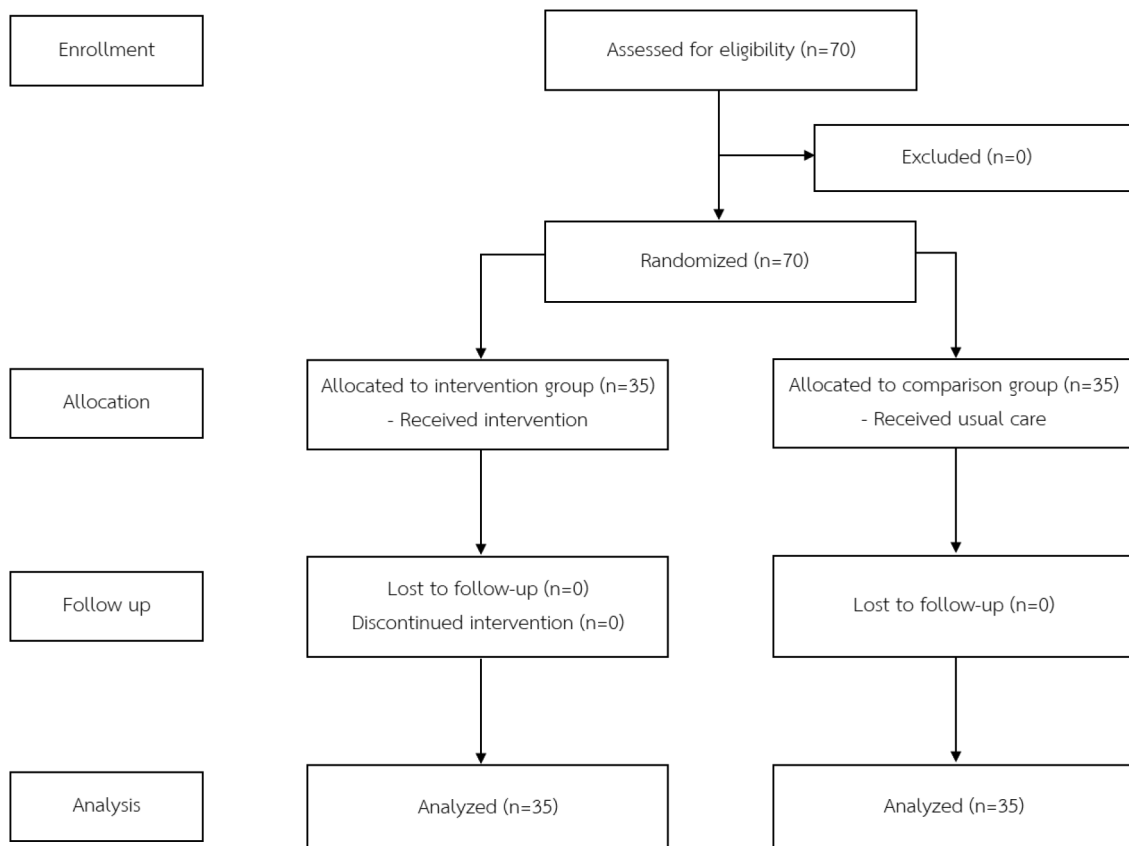


Figure 1 CONSORT flow diagram of this study

This study found that the majority of the experimental group (91.4%) were female, with an average age of 42.34 years and an average working length of 17.07 years. The majority of the subjects were Ministry of Public Health employees (57.1%), and 62.9% worked shifts. Marital status was married 48.6%. The majority of participants reported a monthly income of 15,000 baht or less (58.6%). Most participants held an educational qualification below a bachelor's degree (38.5%). Exercised an average of 1-2 times per week, 54.3%. The average sleep hours were 6.89 per day. Average phone screen time was 3.54 hours per day 100%. They ate regular food 85.7% of the time and did not purchase dietary supplements 82.9% of the time.

The comparison group was predominantly female (85.7%), with an average age of 43.14 years and an average length of service of 9.58 years. Most participants were temporary employees (61.5%), 82.9% worked shifts, 68.6% were married or in a partnership, and 57.1% had a monthly income between 5,001–10,000 baht. The largest proportion

held an educational qualification below a bachelor's degree (38.5%). More than half (51.4%) did not exercise regularly. The average number of hours sleeping was 5.93 hours per day, with an average daily screen time of 3.40 hours. All participants (100%) ate regular food, and 82.9% did not purchase dietary supplements.

Comparison of the mean and standard deviation of body mass index (BMI) and body fat percentage of the experimental and comparison groups before and after the experiment. Before the experiment, the experimental group had an average body mass index of 29.03 and an average body fat percentage of 39.84; the comparison group had an average body mass index of 29.12 and an average body fat percentage of 38.44. After the experiment, the experimental group had an average body mass index of 28.71 and an average body fat percentage of 39.26; the comparison group had an average body mass index of 29.20 and an average body fat percentage of 38.64, as shown in Table 1.

Table 1 The mean and standard deviation of body mass index (BMI) and body fat percentage in the experimental and comparison groups, measured before and after the intervention

Variables	Experimental group (n = 35)				Comparison group (n = 35)			
	Before		After		Before		After	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body mass index (BMI)	29.03	4.81	28.71	5.03	29.12	4.46	29.20	4.79
Body fat percentage	39.84	4.81	39.26	5.19	38.44	7.68	38.64	7.43

Comparing the number and percentage of behavioral stages according to the Stages of Change Theory of the experimental and comparison groups before and after the experiment, the experimental group's behavioral stages before and after the experiment were as follows: Before the experiment, the most participants were in the Contemplation stage 57.1%, followed by the Maintenance stage 28.6%, the Pre-contemplation stage 11.4%, and the least number was in the Action stage 2.9%. After the experiment, the largest number of participants were in the Maintenance stage (54.3%), followed by the Contemplation stage (25.7%),

the Action stage (14.3%), and the smallest number in the Pre-contemplation stage (5.7%).

The comparison group's behavioral stages before and after the experiment were as follows: Before the experiment, most participants were in the Action stage (31.4%), followed equally by the Pre-contemplation and Contemplation stages (28.6% each), and the Maintenance stage had the fewest participants (11.4%). After the experiment, most people were in the Action stage (31.4%), followed by the Maintenance stage (28.6%), and the Pre-contemplation and Contemplation stages had the least number (20.0%), as shown in Table 2.

Table 2 Number and percentage of behavioral stages according to the stages of change theory in the experimental and comparison groups before and after the experiment

Behavioral stages according to the stages of change theory	Experimental group (n = 35)		Comparison group (n = 35)	
	Before	After	Before	After
	Frequency (Percent)	Frequency (Percent)	Frequency (Percent)	Frequency (Percent)
Pre-contemplation stage	4 (11.40)	2 (5.70)	10 (28.60)	7 (20.00)
Contemplation stage	20 (57.10)	9 (25.70)	10 (28.60)	7 (20.00)
Preparation stage	0 (0)	0 (0)	0 (0)	0 (0)
Action stage	1 (2.90)	5 (14.30)	11 (31.40)	11 (31.40)
Maintenance stage	10 (28.60)	19 (54.30)	4 (11.40)	10 (28.60)

A one-way analysis of covariance (ANCOVA) was conducted to compare the effectiveness of the intervention on health behaviors, knowledge and understanding regarding health behavior modification, attitudes toward health behavior modification, body mass index (BMI) and body fat percentage between the experimental and control groups, while controlling for baseline covariates including pre-test scores, income, education level, and job position. After adjusting for the covariates, there was a statistically significant difference in knowledge and understanding

regarding health behavior modification between the two groups, $F(1, 64)=17.415$, $p<0.001$, $\eta^2=0.214$, and body fat percentage, $F(1, 64)=6.297$, $p=0.015$, $\eta^2=0.090$. The experimental group demonstrated a greater reduction in body fat compared to the control group. After adjusting for the covariates, no statistically significant difference was found in BMI between the experimental and control groups, $F(1, 64)=2.329$, $p=0.132$. Similarly, no significant differences were found for attitudes ($p=0.197$) or health behaviors ($p=0.242$), as shown in Table 3.

Table 3 ANCOVA results comparing the experimental group and the comparison group

Outcome variable	F (1,64)	p-value	Partial η^2
Health behaviors	1.396	0.242	0.022
Knowledge and understanding regarding health behavior modification	17.415	<0.001	0.214
Attitudes toward health behavior modification	1.700	0.197	0.026
Body mass index (BMI)	2.329	0.132	0.035
Body fat percentage	6.297	0.015	0.090

Discussion

The results of the ANCOVA comparing the experimental and comparison groups, after controlling for baseline scores, revealed statistically significant differences in knowledge and understanding regarding health behavior modification ($F=17.415$, $p<0.001$, Partial $\eta^2=0.214$) and body fat percentage ($F=6.297$, $p=0.015$, Partial $\eta^2=0.090$). These findings indicate that the program had a clear and meaningful effect on enhancing participants' knowledge and understanding, with a relatively large effect size observed for the cognitive outcome. The structured educational content covering diet, stress management, exercise, and the benefits of behavior modification likely contributed to these improvements. This finding is consistent with the studies of Tiaotrakul⁹, Chantawat et al.¹⁰, and Charoenbut et al.¹¹, which demonstrated that structured health behavior modification programs and integrated learning innovations significantly improved knowledge and health-related behaviors among participants.

The observed stage progression in the experimental group from predominantly Contemplation (57.1%) at baseline to Maintenance (54.3%) post-intervention is consistent with the Stages of Change model, which conceptualizes behavior change as a progression through five stages: pre-contemplation, contemplation, preparation, action, and maintenance, with meta-analytic evidence supporting the applicability of this model across a wide range of health behaviors, as demonstrated by Hall and Rossi¹². In addition, systematic reviews by Hutchison et al.¹³ have demonstrated that stage-matched interventions, which tailor strategies to an individual's readiness to change, can effectively improve behavioral outcomes, including adherence and sustained behavior change. The program's structured components, including awareness-raising, goal-setting, and reinforcement, appear to have effectively addressed key mechanisms underlying behavior change, such as decisional balance and self-efficacy, facilitating meaningful movement from pre-action to action and maintenance stages. This is consistent with Johnson and colleagues¹⁴, who demonstrated that tailored Stages of Change-based interventions significantly impacted healthy eating, exercise, and managing emotional distress, with participants progressing to Action or Maintenance stages at 24 months. However, a Cochrane systematic review by Mastellos et al.¹⁵ noted that while Stages of Change-based interventions produced positive changes in dietary habits and physical activity, evidence for sustainable weight loss beyond one year remains inconclusive. These findings suggest that a 12-week program, as implemented in the present study, may be sufficient to initiate stage progression and improve knowledge and body composition, but a

longer intervention duration and extended follow-up would be necessary to achieve and sustain broader behavioral, attitudinal, and anthropometric changes among overweight hospital personnel.

In addition, the significant reduction in body fat percentage suggests that the program was effective in improving body composition beyond the changes observed in the comparison group. Although the effect size was moderate, it reflects measurable physiological improvements resulting from behavioral changes in diet and physical activity. This result is consistent with the studies of Poonperm and Banchonhattakit¹⁶ and Mekpreedawong and Sarayuthpitak¹⁷, which reported significant reductions in body fat percentage following behavior modification interventions.

However, no statistically significant differences were found between groups in overall health behaviors ($F=1.396$, $p=0.242$, Partial $\eta^2=0.022$), attitudes toward health behavior modification ($F=1.700$, $p=0.197$, Partial $\eta^2=0.026$), or body mass index (BMI) ($F=2.329$, $p=0.132$, Partial $\eta^2=0.035$). Although the experimental group demonstrated improvements in mean scores and slight reductions in BMI after program participation, these changes were not statistically significant when pretest scores were controlled. This may suggest that behavioral and attitudinal changes, as well as BMI reduction, require a longer intervention period or more intensive strategies to produce significant between-group differences. These findings are in line with the studies of Sridawruang et al.¹⁸, Thipkratok and Phatisena¹⁹, and Samart and Sota²⁰, which found that although improvements occurred after intervention, the differences were not always statistically significant when compared between groups.

Interestingly, the study found a significant reduction in body fat percentage ($p=0.015$) despite no significant change in BMI ($p=0.132$). This discrepancy may be attributed to the nature of the physical activity intervention, which likely promoted muscle maintenance or growth while reducing fat mass. Since muscle is denser than fat, BMI (which is based solely on weight) may not sensitively reflect positive changes in body composition over a short duration.

Despite the positive findings, several limitations of this study should be acknowledged. The relatively short duration of the intervention may not have been sufficient to capture long-term changes in health behaviors, attitudes, and anthropometric outcomes such as body mass index. In addition, the study was conducted among a specific group of hospital personnel, which may have limited the generalizability of the findings to other populations with different characteristics. Future studies should consider extending the follow-up period to evaluate the sustainability of behavior change and its long-term effects on health

outcomes. Furthermore, the health behavior modification program should be adapted and applied to other populations experiencing overweight, such as school-aged children, adolescents, older adults, and individuals with chronic diseases, in order to assess its broader applicability and effectiveness across diverse groups.

Conclusions

After controlling for baseline differences using ANCOVA, the experimental group demonstrated statistically significant improvements in knowledge and understanding regarding health behavior modification ($p < 0.001$) and body fat percentage ($p < 0.05$) compared with the comparison group. However, no significant between-group differences were found in overall health behaviors, attitudes toward health behavior modification, or body mass index (BMI) ($p > 0.05$). These findings suggest that the program was particularly effective in improving cognitive outcomes and certain aspects of physical health, while longer-term or more intensive interventions may be necessary to achieve broader behavioral and anthropometric changes.

Ethical statement

The study was approved by the Institutional Human Research Ethics Committee of Ubon Ratchathani Rajabhat University (protocol code HE662079; approval date: 26 March 2024). Informed consent was obtained from all participants or their legal representatives.

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