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Mobile App Engagement and Effective Weight Management

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Abstract:

Objective: This study aimed to investigate the relationship between mobile application engagement and lifestyle outcomes, specifically physical activity and dietary habits, during a 36-day virtual competition designed to promote healthier behaviors, including increased physical activity and adherence to a plant-based, whole-food diet.

Material and Methods: A secondary data analysis of the ThaiSook prospective cohort study was conducted. Participants were divided into 2 groups based on their engagement with the mobile application: "High-engagement Users" (>50% of challenge days) and "Low-engagement Users" (<50% of challenge days).

Results: Among 154 participants (74.7% female; mean age 39.1±10.7 years; median body mass index 23.1 kg/m^2), "High-engagement Users" (n=97) had significantly higher average daily step counts (4,921.64±5,721.22 steps) compared to "Low-engagement Users" (n=57) (3,508.81±4,270.00 steps, p-value<0.001). Similarly, High-engagement Users had longer average daily workout durations (35.55±49.59 minutes) than Low-engagement Users (14.14±34.29 minutes, p-value<0.001). High-engagement Users also achieved greater weight loss, with a mean reduction of −0.77 kg. Multiple logistic regression revealed that using the application for more than 18 days was significantly associated with weight loss, with an adjusted odds ratio of 3.64 (p-value=0.017).

Conclusion: High engagement with a mobile application is positively associated with improved physical activity and weight loss outcomes. These findings underscore the potential of mobile health applications to drive healthier lifestyle behaviors, highlighting the critical role of consistent usage.

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Introduction

Non-communicable diseases (NCDs) are a major global health concern, responsible for around 70% of all deaths and 85% of premature deaths worldwide[1]. NCDs refer to chronic conditions that are not caused by infectious agents and cannot be transmitted from one person to another. These diseases, including cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes, result from a combination of genetic and lifestyle factors, typically progressing slowly with a gradual accumulation of symptoms. Major behavioral risk factors include tobacco use, excessive alcohol consumption, poor diet, and physical inactivity. However, evidence[2-5] suggests that leading a healthy lifestyle, such as maintaining a balanced diet, exercising frequently, and avoiding tobacco and excessive alcohol consumption, can significantly reduce the risk of developing NCDs and improve health outcomes. Studies have shown that lifestyle changes can improve metabolic health, reduce inflammation, and enhance overall disease prevention. These preventive measures are particularly relevant to the outcomes of this study, highlighting how crucial behavioral change is in reducing the risks associated with NCDs.

In Thailand, NCDs are the leading cause of death, accounting for an estimated 71% of total deaths related to cancer, cardiovascular diseases, and cerebrovascular diseases. According to a 2014 report from the World Health Organization[6], the top causes of death for men were cerebrovascular diseases and road accidents, while for women, they were diabetes, cerebrovascular diseases, and coronary artery disease. The incidence and impact of NCDs and their associated risk factors are projected to escalate[7]. If NCDs are not effectively prevented and managed, the consequences could be profound, both socially and economically. From a societal perspective, NCDs reduce quality of life, increase the burden on caregivers, and contribute to mental health challenges and health inequalities[8]. Economically, they place a burden on individuals, families, and national economies by increasing healthcare expenses and decreasing worker productivity[8,9]. Preventing and managing NCDs is essential for both public health and economic stability because the long-term effects can lead to increased poverty, raise insurance premiums, and slow economic growth.

Adopting healthier lifestyle habits, such as regular exercise, dietary changes, smoking cessation, and reducing alcohol consumption, presents a global challenge due to various barriers, including lack of motivation, social and environmental influences, financial constraints, and psychological resistance to change. Many individuals struggle with maintaining long-term behavioral modifications, highlighting the need to comprehend the process of change. A key study by Prochaska and DiClemente in 1983 explored smoking behavior and integrated insights from various psychotherapy theories, leading to the development of the Transtheoretical Model or Stages of Change Model[10]. This model outlines 5 stages individuals typically progress through when changing behavior: precontemplation, contemplation, preparation, action, and maintenance. This theory has since become widely accepted in behavioral health change, helping to tailor strategies that support individuals at different stages of change. In recent years, mobile health (mHealth)—the use of mobile devices, such as smartphones, tablets, and wearable sensors, to deliver healthcare and public health services—has become increasingly common in both medicine and public health,

leading to the creation of various devices and apps that track health data, such as physical activity, body measurements, menstrual cycles, medication adherence, and mobility[11–12]. These technologies target both healthy individuals and those living with NCDs.

Progress has been made in developing mHealth applications for managing NCDs. Examples include apps specifically designed for diabetes management to monitor glucose levels[13–15] and apps for managing high blood pressure[16], which assist in tracking and controlling hypertension. These technologies often focus on digital behavior change interventions and weight management. Apps like Noom[17–19] and Sidekick[20] have demonstrated effectiveness in promoting weight loss through features like meal and exercise tracking, step counting, and communication with coaches.

In Thailand, the National Science and Technology Development Agency (NSTDA) launched the ThaiSook app[21] in 2020. Designed to encourage users to improve their diet and exercise habits, ThaiSook aims to reduce the risk of NCDs by addressing poor nutrition, physical inactivity, and obesity. The app uses an online competitive framework, allowing users to engage in friendly challenges and track their progress alongside others, fostering behavioral change while increasing health literacy through education and user engagement. Furthermore, its design encourages consistent user interaction. ThaiSook differentiates itself by integrating gamification elements, such as leaderboards and milestone rewards, to sustain motivation. The app also promotes social engagement through shared activity feeds, enabling users to interact, support each other, and exchange health tips. By combining self-monitoring with a structured challenge system, ThaiSook enhances user adherence and long-term behavior changes. More than 30 organizations, such as the *Ministry of Public Health of Thailand, Faculty of Medicine, Prince of Songkla University, Pranangklao Hospital,* and other government agencies, have incorporated ThaiSook into their lifestyle change programs.

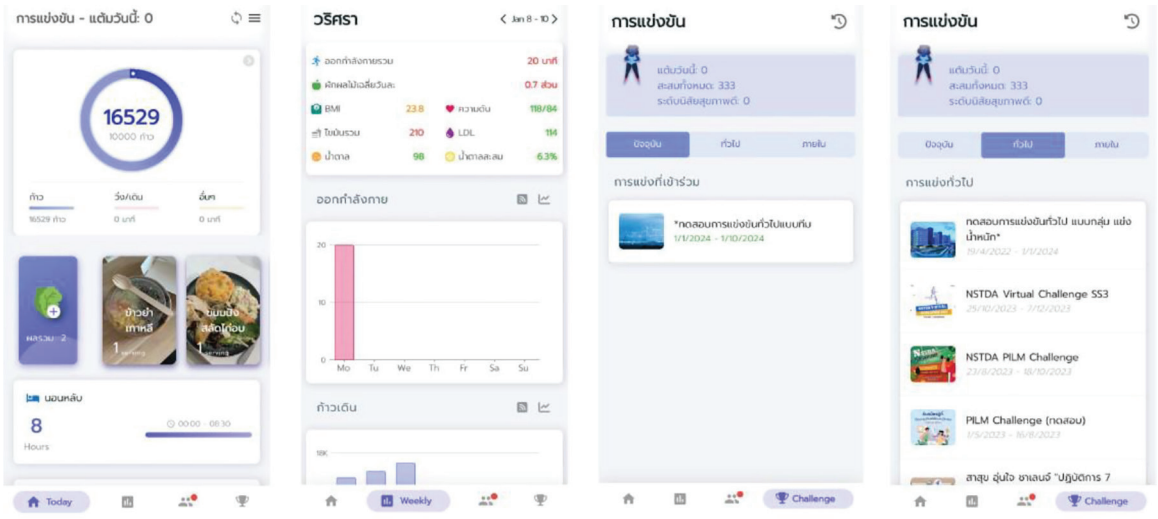

Figure 1 Shows the user interface of the ThaiSook application

This study aimed to examine the relationship between user engagement with a mobile app and lifestyle indicators within the context of a virtual competition. The competition, which lasted for 36 days, focused on motivating participants to increase physical activity and adopt a healthier, plant-based, whole-food diet. Participants competed individually, with health-related prizes and other incentives awarded for achieving milestones. These rewards were intended to enhance user engagement and sustain motivation throughout the program. All participants followed the same intervention procedure, which involved daily activity tracking. The app provides tools to track physical activity, dietary intake, and progress toward health goals. Additionally, interactive features such as leaderboards and challenges foster a sense of community and friendly competition. We hypothesize that greater engagement with the mobile app will be positively associated with improvements in lifestyle indicators.

Material and Methods

Data collection

The dataset for this study was initially collected from the ThaiSook mobile application. The experiment was conducted according to the principles of the Declaration of Helsinki, the Belmont Report, and the International Conference on Harmonization Good Clinical Practice. The study was approved by the Ethics Committee of NSTDA, Thailand (NIRB-075-2565), and the Human Research Ethics Committee of the Faculty of Medicine of Songkla University (REC.65-395-9-2). All participants provided electronic consent to participate in the study. The clinical trial was registered with the WHO International Clinical Trials Registry Platform (WHO-ICTRP) at the Thai Clinical Trials Registry (TCTR), under registry ID TCTR20220611001.

A secondary data analysis of the results was conducted from a 36-day virtual competition held from April 27, 2022, to June 1, 2022. The cohort comprised 154 participants, all aged ≥20 years, with the necessary capability to access and use the ThaiSook application. Participants were primarily employees of the Thailand Science Park (NSTDA) and their relatives. The competition was promoted through posters and internal mail distributed within the Thailand Science Park, encouraging voluntary enrollment. Upon registration, the participants received instructions on app usage and were required to provide consent for data collection for research purposes. Only individuals with sufficient recorded data were included in the complete case analysis. This method provided consistency in assessing engagement patterns because missing data mostly indicated non-engagement rather than random missingness, though it may have excluded users with irregular app usage.

This study explored the association between user engagement (independent variable) and various lifestyle indicators (dependent variables), including plant-based whole food consumption, water intake, physical activity, and sleep patterns. These lifestyle factors have been widely studied in relation to NCD risk reduction[2-5]. Additionally, the analysis accounted for confounding variables, including participants' demographic and baseline health behaviors, which could influence both engagement levels and lifestyle improvements. Each dependent variable was measured using the following self-reported data recorded in the ThaiSook application:

- Physical activity: The ThaiSook app measures activity through daily step counts and workout durations, which can be self-reported or recorded with smartphone sensors.
- Plant-based whole food consumption: Logged by the participants through a dietary tracking feature in the app.
- Water intake: Users self-reported their daily water consumption.
- Sleep patterns: Users self-reported sleep duration and consistency.

Participants were divided into 2 groups based on their engagement with the application: "High-engagement Users" (n=97), comprising those who used the app for more than 50% of the competition days (over 18 d), and "Low-engagement Users" (n=57), comprising those who used the app for ≤18 d, representing less than 50% of the study period. On average, participants engaged with the ThaiSook app for approximately 26 d or 72% of the available days during the study. This stratification allowed for a detailed analysis of potential differences and correlations between the 2 groups and the collected data, providing valuable insights into the impact of user engagement on the various aspects of the competition.

Statistical analysis

Data analysis was performed using R software version 4.2.1 and Python. Descriptive statistics were used to summarize demographic characteristics and logging data: means with standard deviations (S.D.) for continuous variables, medians with interquartile ranges (IQR) for non-normally distributed continuous variables, and counts (n) with percentages (%) for categorical variables. Statistical comparisons between the "High-engagement Users" and "Low-engagement Users" groups were made using the t-test, Mann–Whitney U test, chi-square test, or Fisher's exact test, as appropriate.

Additionally, multiple logistic regression was performed to identify factors associated with weight loss. Independent variables with p-values<0.2 from univariable analysis were included as covariates in the initial model, and a manual backward stepwise approach was applied to derive the final model. The variance inflation factor was calculated to assess multicollinearity among predictor variables. This comprehensive data analysis approach enabled an in-depth investigation into user behavior, app usage, and health outcomes, providing valuable insights for the study.

Results

Table 1 provides a comprehensive overview of the demographic characteristics of the participants, divided into 2 groups based on their level of engagement with the ThaiSook application: "High-engagement Users", who used the application over 50% of the time, and "Low-engagement Users" (n=57), who used it less frequently. A significant proportion of participants, approximately 74.7%, were women. The analysis revealed notable demographic differences between the 2 groups. For instance, sex distribution was significantly skewed, with 80.0% of "High-engagement Users" being women compared with 62.50% of "Low-engagement Users" (p-value=0.0305).

Regarding age, "High-engagement Users" had a mean age of 40.5 years (S.D.=10.6), which was significantly higher than the 35.5 years (S.D.=10.4) of "Low-engagement Users" (p-value=0.0419*). Age distribution also differed across specific age brackets, with 25.26% of "High-engagement Users" in the 40–49-year age range, compared with only 7.14% of "Low-engagement Users." Notably, a considerable portion of participants did not report their age, 35.79% of "High-engagement Users" and 48.21% of "Low-engagement Users."

Regarding body mass index (BMI), which was self-reported at baseline, "High-engagement Users" had a median BMI of 22.6 kg/m^2 (IQR=4.3), significantly lower than the median BMI of 24.3 kg/m^2 (IQR=6.7) of "Low-engagement Users" (p-value=0.0154*). Specifically, 55.79% of "High-engagement Users" were in the normal BMI range (<22.9), compared with 37.50% of "Low-engagement Users." Meanwhile, 42.86% of "Low-engagement Users" were classified as overweight (>25.0), compared with 21.05% of "High-engagement Users."

Table 2 presents a comparative analysis of the frequency of logging key health behaviors, such as plant-based food consumption, water intake, physical activity, and sleep routines, between the 2 user groups. Physical activity,

as measured by daily steps, differed significantly between the groups. "High-engagement Users" averaged 4,921.64 steps per day (S.D.=5,721.22), whereas "Low-engagement Users" averaged 3,508.81 steps (S.D.=4,270.00), with a highly significant difference (p-value<0.001*). Similarly, the average daily exercise time for "High-engagement Users" was 35.55 min (S.D.=49.59), significantly higher than the 14.14 min (S.D.=34.29) reported by "Low-engagement Users" (p-value<0.001*). "High-engagement Users" also consumed an average of 4.32 servings of fruits and vegetables daily (S.D.=2.87), compared with 2.86 servings (S.D.=2.17) by "Low-engagement Users" (p-value<0.001*).

However, no significant difference was observed in sleep duration, with both "High-engagement Users" and "Low-engagement Users" averaging approximately 7.77 and 7.71 h of sleep, respectively (p-value=0.5383). The health points system, which reflects performance in key areas, such as fruit and vegetable intake, exercise, and sleep, showed a notable difference: "High-engagement Users" earned an average of 6.79 points per day (S.D.=2.88), significantly higher than the 4.15 points (S.D.=2.78) achieved by "Low-engagement Users" (p-value<0.001*). These findings suggest that more high-engagement use of the application is associated with healthier lifestyle behaviors, as indicated by the superior health outcomes among "High-engagement Users."

Table 3 provides a comparison of weight reduction between the 2 user groups. A significant difference was found, with "High-engagement Users" experiencing a mean weight loss of 0.82 kg (S.D.=1.71), compared with only 0.05 kg (S.D.=1.44) by "Low-engagement Users" (p-value=0.0039*). No participant in the study transitioned to the underweight category, which ensured that the observed weight changes remained within a healthy range.

Table 1 Demographics of participants stratified into 2 distinct categories based on their level of application usage: "High-engagement Users" and "Low-engagement Users"

Demographics	Number of participants, n (%)			p-value
	Total (n=151)	High-engagement User[1] (n=95)	Low-engagement User[2] (n=56)	
Sex				0.0305*
Female	111 (73.50%)	76 (80.00%)	35 (62.50%)	
Male	40 (26.50%)	19 (20.00%)	21 (37.50%)	
Age (years)				0.0419*
Total, Mean±S.D.	39.1±10.7	40.5±10.6	35.5±10.4	
20–29	15 (9.93%)	6 (6.32%)	9 (16.07%)	
30–39	32 (21.19%)	20 (21.15%)	12 (21.43%)	
40–49	28 (18.54%)	24 (25.26%)	4 (7.14%)	
50–59	12 (7.95%)	8 (8.42%)	4 (7.14%)	
>60	3 (1.99%)	3 (3.16%)	0 (0)	
Unspecified	61 (40.40%)	34 (35.79%)	27 (48.21%)	
BMI (kg/m^2)				0.0154*
Total, Median (IQR)	23.1 (4.9)	22.6 (4.3)	24.3 (6.7)	
Normal (<22.9)	74 (49.01%)	53 (55.79%)	21 (37.50%)	
Borderline (23.0–24.9)	33 (21.85%)	22 (23.16%)	11 (19.64%)	
Overweight (>25.0)	44 (29.14%)	20 (21.05%)	24 (42.86%)	

*p-value<0.05, BMI=body mass index, IQR=interquartile range, [1]Participants who used the application for >50% of the challenge days, [2]Participants who used the application for <50% of the challenge days. BMI was self-reported at the beginning of the study.

Table 2 Logged key health behavior data: plant-based whole food consumption, water intake, physical activity, and sleep routines

Health indicators	Logged data (daily average)			p-value
	Total (n=151)	High-engagement User[1] (n=95)	Low-engagement User[2] (n=56)	
Consumption				
Fruit and vegetable (serving)				<0.001*
Mean±S.D.	4.21±2.86	4.32±2.87	2.86±2.17	
Median (IQR)	4.0 (3.0)	4.0 (3.0)	2.0 (3.0)	
Physical Activity				
Step				<0.001*
Mean±S.D.	4,772.59±5,602.31	4,921.64±5,721.22	3,508.81±4,270.00	
Median (IQR)	3,032 (7,541.5)	3,174.5 (7,871.0)	2,098.0 (5,614.0)	
Exercise time (minutes)				<0.001*
Mean±S.D.	32.91±48.48	35.55±49.59	14.14±34.29	
Median (IQR)	0.0 (55.0)	20.0 (60.0)	0.0 (20.0)	
Lifestyle				
Sleep (hours)				0.5383
Mean	7.77±1.56	7.78±1.53	7.71±1.87	
Median (IQR)	8.0 (1.0)	8.0 (1.0)	8.0 (1.0)	

*p-value<0.05, S.D.=standard deviation, IQR=interquartile range, BMI=body mass index, [1]Participants who used the application for >50% of the challenge days, [2]Participants who used the application for <50% of the challenge days

Table 3 Weight reduction of the "High-engagement Users" and "Low-engagement Users" groups

Demographics	Weight reduction (kg), Mean±S.D.			p-value
	Total (n=151)	High-engagement User[1] (n=95)	Low-engagement User[2] (n=56)	
Overall	0.54±1.66	0.82±1.71	0.05±1.44	0.0039*
Sex				
Female	0.57±1.76	0.91±1.79	-0.06±1.69	0.0075*
Male	0.34±1.08	0.44±1.29	0.24±0.86	0.5735
Age (years)				
20–29	0.07±2.31	1.12±1.44	-1.00±3.00	0.0926
30–39	0.68±1.42	0.72±1.56	0.61±1.15	0.8180
40–49	0.29±0.93	0.35±0.99	0.00±0.00	0.1022
50–59	0.68±1.34	0.79±1.09	0.48±1.71	0.7546
>60	0.80±0.61	0.80±0.61	—	—
Unspecified	0.69±1.83	1.17±2.32	0.10±0.39	0.0126*
BMI (kg/m^2)				
Normal (<22.9)	0.49±1.91	0.79±1.73	-0.29±2.10	0.0429*
Borderline (23.0–24.9)	0.49±1.29	0.74±1.81	0.00±0.00	0.0697
Overweight (>25.0)	0.66±1.32	0.96±1.63	0.38±0.95	0.1668

*p-value<0.05, S.D.=standard deviation, BMI=body mass index, [1]Participants who used the application for >50% of the challenge days, [2]Participants who used the application for <50% of the challenge days

When analyzed by sex, female "High-engagement Users" showed a mean weight reduction of 0.91 kg (S.D.=1.79), significantly more than the –0.06 kg (S.D.=1.69) of female "Low-engagement Users" (p-value=0.0075*). However, no significant difference was observed in weight reduction between male participants in the 2 groups (p-value=0.5735).

Age-based analysis revealed no significant differences in weight reduction across most age groups, except for those who did not specify their age. In this category, "High-engagement Users" experienced an average weight loss of 1.17 kg (S.D.=2.32), compared with only 0.10 kg (S.D.=0.39) by "Low-engagement Users" (p-value=0.0126*). Among participants with a borderline BMI (23.0–24.9 kg/m^2), "High-engagement Users" lost an average of 0.74 kg (S.D.=1.81), while "Low-engagement Users" showed no significant weight change (mean=0.00 kg), with a trend toward significance (p-value=0.0697). In the overweight BMI group (>25.0), "High-engagement Users" lost an average of 0.96 kg (S.D.=1.63), compared with 0.38 kg (S.D.=0.95) by "Low-engagement Users," though this difference was not significant (p-value=0.1668). Further analysis of weight changes between "High-engagement Users" and "Low-engagement Users" was conducted by categorizing participants into 3 groups: those who gained weight, lost weight, or maintained their weight, as shown in Table 4. In this study, maintained weight was defined as having the same body weight from the beginning to the end of the competition. This detailed examination revealed that a significantly larger proportion of "High-engagement Users" than "Low-engagement Users" experienced weight loss. In terms of sex, 56.58% of female and 63.16% of male "High-engagement Users" achieved weight loss, contrasting sharply with only 14.29% of female and 9.52% of male "Low-engagement Users." Age-based analysis demonstrated similar patterns, with the most prominent differences observed in the 20–29- and 50–59-year age groups, where "High-engagement Users" showed a significantly greater weight loss than "Low-engagement Users." Examining BMI categories, "High-engagement Users" in both the normal (58.49%) and overweight (65.00%) ranges exhibited notably higher rates of weight loss than "Low-engagement Users" (9.52% and 20.83%, respectively).

The multiple logistic regression analysis in Table 5 further reinforces the role of application usage frequency in weight reduction among participants of the virtual competition. The key finding was that the number of days participants used the application was significantly associated with weight loss. Participants who used the application for more than 18 days had a significantly higher likelihood of weight loss, with an adjusted odds ratio of 3.64 (95% confidence interval: 1.26, 10.50; p-value=0.017). This suggests a strong positive relationship between the frequency of application use and weight loss. Interestingly, the analysis revealed that other factors, such as sex, age, initial BMI, and the frequency of logging various health indicators, did not significantly impact weight change.

Discussion

Principal findings and previous studies

This study demonstrates a clear and significant association between consistent mobile application use and successful weight management. High-engagement users of the ThaiSook app, defined as those engaging with the app for more than 18 days during the 36-day virtual competition, experienced greater weight reduction and higher physical activity levels than low-engagement users. The adjusted odds ratio of 3.64 for high-engagement app usage underscores the critical role of consistent engagement in driving these health outcomes.

Table 4 Participants who gained, lost, or maintained weight in the "High-engagement Users"[1] and "Low-engagement Users"[2] groups

Demographics	Number of participants, n (%)					
	Lost weight		Gained weight		Maintained weight	
	High-engagement User (n=55)	Low-engagement User (m=7)	High-engagement User (n=14)	Low-engagement User (n=3)	High-engagement User (n=26)	Low-engagement User (n=26)
Sex						
Female	43 (56.58%)	5 (14.29%)	10 (13.16%)	2 (5.71%)	23 (30.26%)	28 (30.00%)
Male	12 (63.16%)	4 (21.05%)	4 (13.16%)	1 (4.76%)	3 (15.79%)	18 (88.71%)
Age (years)						
20–29	4 (66.67%)	0 (0.00%)	1 (16.67%)	1 (11.11%)	1 (16.67%)	8 (88.89%)
30–39	12 (60.00%)	3 (25.00%)	4 (20.00%)	0 (0.00%)	4 (20.00%)	9 (70.00%)
40–49	13 (54.17%)	7 (29.17%)	9 (27.17%)	4 (16.67%)	4 (10.00%)	4 (100.00%)
50–59	6 (75.00%)	1 (25.00%)	2 (50.00%)	0 (50.00%)	0 (0.00%)	1 (25.00%)
>60	3 (100.00%)	—	—	—	—	—
Unspecified	17 (50.00%)	3 (11.11%)	2 (5.88%)	0 (0.00%)	15 (44.12%)	24 (88.89%)
BMI (kg/m^2)						
Normal (<22.9)	31 (58.49%)	2 (9.52%)	8 (15.09%)	3 (14.29%)	14 (26.42%)	16 (76.19%)
Borderline (23–24.9)	11 (50.00%)	0 (0.00%)	5 (22.73%)	0 (0.00%)	6 (27.27%)	11 (100.00%)
Overweight (>25.0)	13 (65.00%)	5 (20.83%)	1 (5.00%)	0 (0.00%)	6 (30.00%)	19 (79.17%)

BMI=body mass index, [1]Participants who used the application for >50% of the challenge days, [2]Participants who used the application for <50% of the challenge days

Table 5 Factors influencing weight reduction

Number of days the application was used	Adjusted odds ratio (95% confidence interval)	p-value
High-engagement User[1]	1	
Low-engagement User[2]	3.64 (1.26, 10.50)	0.017*

*p-value<0.05, [1]Participants who used the application for >50% of the challenge days, [2]Participants who used the application for <50% of the challenge days, Note: The initial model included the following variables: sex, age, baseline BMI group, and engagement level.

Our findings are consistent with the prior research on mHealth interventions, which have shown the effectiveness of mobile applications in promoting physical activity and facilitating weight loss through features such as step tracking, dietary monitoring, and motivational feedback. For instance, apps like Noom[17–19] and Sidekick[20] have similarly demonstrated positive outcomes in weight management programs. The unique competitive framework employed by the ThaiSook app aligns with studies highlighting gamification and social interaction as effective strategies for increasing user engagement in health interventions.

High-engagement users demonstrated greater improvements in dietary habits compared to low-engagement users. Additionally, high-engagement users reported substantially higher intakes of fruits and vegetables, indicating that regular app use may promote

improved adherence to dietary guidelines. Despite these positive findings, sleep duration did not differ significantly between the 2 groups. The ThaiSook app primarily focused on diet and physical activity, which may explain the lack of significant differences in sleep outcomes. Additionally, weight reduction was more pronounced in individuals with a higher baseline BMI, a trend commonly observed in weight management studies. Importantly, no participants transitioned to the underweight category, ensuring that weight loss remained within a healthy range.

Strengths and limitations

A major strength of this study lies in its focus on real-world applications, analyzing user engagement with the ThaiSook app in a practical setting. The inclusion of a multiple logistic regression model allowed for a robust analysis of the relationship between app usage frequency and weight management outcomes. Furthermore, the study employed a clear and practical categorization of users into high-engagement and low-engagement groups, facilitating meaningful comparisons.

However, several limitations must be acknowledged. First, the reliance on self-reported data for dietary intake, physical activity, and weight measurements introduces potential biases and inaccuracies. The smaller sample size of "Low-engagement Users" limits statistical power and may reduce the generalizability of the findings. Additionally, unmeasured confounding variables, such as psychological factors and environmental conditions, may have influenced the results. The short study duration and absence of a follow-up period restrict the ability to assess the long-term sustainability of the observed weight loss and behavioral changes. Lastly, we applied complete case analysis, including only participants with sufficient logged data. Since missing data indicated non-engagement rather than random missingness, this approach ensured consistency but may have introduced selection bias by excluding dropouts and irregular users.

Further studies

Future research should address these limitations by employing larger, more diverse participant samples in order to improve the generalizability of findings. Incorporating objective measures, such as wearable device data or biochemical markers, would enhance data accuracy and reliability. Randomized controlled trials with control groups should be conducted to establish causal relationships between app usage and weight management outcomes.

Additionally, exploring the psychological mechanisms underlying app engagement, such as motivation, self-efficacy, and habit formation, could provide insights into user behavior and inform the design of more effective interventions. Long-term studies that include follow-up periods are also essential in order to evaluate the sustainability of weight loss and lifestyle changes achieved through mobile health applications.

Implications

The findings of this study have important implications for the development and implementation of mHealth interventions. Mobile applications like ThaiSook represent a scalable and cost-effective solution for addressing non-communicable diseases by promoting healthier lifestyle choices. Policymakers and healthcare providers should consider integrating such apps into public health programs to enhance their reach and impact.

Design improvements, such as personalized feedback, tailored goal-setting, and gamification features, could further increase user engagement and efficacy. Efforts should also focus on addressing barriers to engagement among underrepresented groups, such as men and individuals with lower initial motivation. Finally,

the demonstrated success of ThaiSook in fostering weight management highlights the potential for similar digital interventions to address other health behaviors, contributing to global efforts to combat non-communicable diseases.

Conclusion

Consistent use of a mobile application is strongly associated with effective weight management, as evidenced by increased physical activity and greater weight loss among high-engagement users. This study highlights the potential of mobile health tools to drive healthier lifestyle choices, with sustained engagement playing a critical role. Future research should explore ways to enhance application effectiveness and address long-term outcomes for diverse populations.

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Conflict of interest

There are no potential conflicts of interest to declare.

References

1. World Health Organization. Noncommunicable diseases [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 February 25]. Available from: http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
2. Yu E, Malik VS, Hu FB. Cardiovascular disease prevention by diet modification: JACC health promotion series. J Am Coll Cardiol 2018;72:914-26.
3. Lordan R, Grant WB. Dietary patterns, physical activity, and lifestyle in the onset, prevention, and management of noncommunicable diseases. Nutrients 2023;15:2540.
4. Ruthsatz M, Candeias V. Non-communicable disease prevention, nutrition and aging. Acta Biomed 2020;91:379-88.
5. Brumana L, Arroyo A, Schwalbe NR, Lehtimaki S, Hipgrave DB. Maternal and child health services and an integrated, life-cycle approach to the prevention of noncommunicable diseases. BMJ Glob Health 2017;2:e000295.
6. World Health Organization. Noncommunicable Diseases (NCD) Country Profiles 2014 [monograph on the Internet]. Geneva: WHO; [cited 2025 February 25]. Available from: https://iris.who.int/bitstream/handle/10665/128038/9789241507509_eng.pdf
7. Ministry of Public Health of Thailand, World Health Organization, United Nations Development Programme. Prevention and control of noncommunicable diseases in Thailand: the case for investment [monograph on the Internet]. 2021 [cited 2025 February 25]. Available from: https://www.undp.org/sites/g/files/zskgke326/files/migration/th/UNDP_TH_WHO_THAILAND_NCD-IC-REPORT_v06_231121.pdf
8. García-Morales C, Heredia-Pi I, Guerrero-López CM, Orozco E, Ojeda-Arroyo E, Nigenda G, et al. Social and economic impacts of non-communicable diseases by gender and its correlates: a literature review. Int J Equity Health 2024;23:274.
9. Zhao P, Li K, Coyte PC. The impact of non-communicable chronic diseases on the earned income of working age Chinese residents. Humanit Soc Sci Commun 2023;10:476.
10. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. J Consult Clin Psychol 1983;51:390-95.
11. Vo V, Auroy L, Sarradon-Eck A. Patients' perceptions of mHealth apps: meta-ethnographic review of qualitative studies. JMIR Mhealth Uhealth 2019;7:e13817.
12. Apple Inc. Empowering people to live a healthier day [monograph on the Internet]. Cupertino (CA): Apple Inc.; 2022

[cited 2025 Feb 25]. Available from: https://www.apple.com/newsroom/pdfs/Health-Report-October-2023.pdf

13. Ku EJ, Park JI, Jeon HJ, Oh T, Choi HJ. Clinical efficacy and plausibility of a smartphone-based integrated online real-time diabetes care system via glucose and diet data management: a pilot study. Intern Med J 2020;50:1524-32.
14. Cui M, Wu X, Mao J, Wang X, Nie M. T2DM self-management via smartphone applications: a systematic review and meta-analysis. PLOS ONE 2016;11:e0166718.
15. Lunde P, Nilsson BB, Bergland A, Kværner KJ, Bye A. The effectiveness of smartphone apps for lifestyle improvement in noncommunicable diseases: systematic review and meta-analyses. J Med Internet Res 2018;20:e162.
16. Xu H, Long H. Effect of smartphone application based intervention in patients with hypertension: a systematic review and meta-analysis [preprint]. JMIR mHealth uHealth 2020;8:e21759.
17. Mitchell ES, Yang Q, Ho AS, Behr H, May CN, DeLuca L, et al. Self-reported nutritional factors are associated with weight loss at 18 months in a self-managed commercial program with food categorization system: observational study. Nutrients 2021;13:1733.
18. Lee J, Bae S, Park D, Kim Y, Park J. The effectiveness of a monetary reimbursement model for weight reduction via a smartphone application: a preliminary retrospective study. Sci Rep 2020;10:15714.
19. Kim J, Kam HJ, Kim Y, Lee Y, Lee JH. Understanding time series patterns of weight and meal history reports in mobile weight loss intervention programs: data-driven analysis. J Med Internet Res 2020;22:e17521.
20. Amin TH, Rathnayake V, Ramil M, Spinner SM. An innovative application of a computer aided design and manufacture implant for first metatarsal phalangeal joint arthrodesis: a case report. J Foot Ankle Surg 2020;59:1287-93.
21. National Science and Technology Development Agency (NSTDA). Thaisook platform – behavioral modification tool to mitigate the risk of chronic non-communicable diseases [homepage on the Internet]. Pathum Thani: NSTDA; [cited 2025 February 25]. Available from: https://www.thaisook.org/about-thaisook/