Mobile Fitness Apps in Promoting Habit Formation: A Systematic Literature Review

Wang Dagang[1*] and Diyana Zulaika Abdul Ghani[2]

[1*,2]School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia
[1]*Corresponding Authors Email: wangdagang71@gmail.com

Abstract
Background: Mobile fitness applications are increasingly used to promote health behaviors; however, their role in supporting long-term habit formation remains underexplored. Objective: This systematic literature review aims to examine how mobile fitness apps contribute to the development and maintenance of health-related habits, particularly in promoting physical activity and diet management, and to identify the motivational mechanisms and design strategies underlying sustainable behavior change. Methods: A systematic search and analysis of relevant studies were conducted, focusing on behavior change techniques (BCTs). A conceptual framework was developed to synthesize the findings. Results: The review identified a growing trend toward personalized and adaptive design strategies in mobile fitness apps. However, implicit, context-aware interaction strategies were found to be underutilized. While mobile fitness apps demonstrated potential in supporting habit formation, ethical concerns related to passive data collection emerged as a challenge.
Keywords: Mobile Fitness Applications, Physical Activity, Habit Formation, Behavior Change Techniques, eHealth

Introduction
In recent years, there has been a growing global emphasis on healthy lifestyle management. The widespread adoption of fitness tracking applications and the rise of health influencers on social media platforms have fueled public interest in personal health and well-being (Liu & Avello, 2021). Regular physical activity yields substantial benefits at both the individual and societal levels. Individually, it enhances muscular and cardiorespiratory fitness, reduces symptoms of depression and anxiety, and lowers the risk of coronary heart disease. It also plays a critical role in preventing and managing non-communicable diseases such as heart disease, stroke, diabetes, and certain cancers. On a broader scale, physically active societies contribute to environmental and economic benefits, including reduced fossil fuel consumption, cleaner air, and improved public health outcomes (WHO, 2019).

Literature Review

In this context, mobile fitness applications (apps) have emerged as powerful tools to support and sustain healthy behaviors. Their usage has surged, particularly following the COVID-19 pandemic, with an estimated 86.3 million users in the United States alone (Rossi, 2021). These apps—such as Runkeeper, MyFitnessPal, Nike Run Club, and Sworkit—utilize wearable devices, smartphones, and tablets to track physical activity, monitor health metrics, and provide personalized feedback (Vantage Market Research, 2022). Central to their functionality is the premise that real-time tracking and feedback can enhance users' self-awareness and motivation, thereby promoting the adoption of healthier routines (Yfantidou et al., 2024). According to Self-Determination Theory (SDT), sustained behavior change is closely linked to the fulfillment of three basic psychological needs: competence, autonomy, and relatedness (Ryan & Deci, 2000). When these needs are satisfied, individuals are more likely to internalize motivation and persist in behavior change. In the early stages of engagement when intrinsic motivation may be low—extrinsic motivators such as app-based feedback, rewards, or reminders can play a vital role in prompting initial adoption and continued use (Plangger et al., 2019; Molina & Myrick, 2020). For instance, smoking cessation studies have shown that users who receive digital support from apps are more successful in reducing or eliminating their smoking behaviors (Haskins et al., 2017; Morriscey et al., 2019).

Although motivational technologies are being widely trialed, there are challenges in encouraging their long-term use and adoption to develop and sustain users' healthy habits (Parker-Pope, 2020). A key question, however, remains: How do these apps facilitate the formation and maintenance of long-term health habits? The habit formation literature suggests that behaviors can become automatic through repetition and learning, ultimately requiring minimal cognitive effort (Verplanken & Aarts, 1999; Limayem et al., 2007; Bargh, 2014). Once established, such habits enable individuals to act consistently without deliberate intention (Lally et al., 2011). While the above studies contribute to the broader understanding of mobile health technologies, few studies have specifically focused on how mobile fitness apps support the development and maintenance of health-related habits. Therefore, this review aims to fill this gap. Therefore, this systematic literature review aims to explore how mobile fitness apps help users develop and maintain health-related habits. We aimed to synthesize the existing evidence by systematically reviewing the existing mobile fitness app literature from a habit formation perspective to identify incentive mechanisms and design features that contribute to sustained behavior change in areas such as physical activity and dietary management.

Research Methodology

This systematic literature review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, ensuring transparency and methodological rigor at each stage of the review process (Moher et al., 2015). A comprehensive search was carried out in April 2025 using two major bibliographic databases: Web of Science and Scopus. These databases were selected due to their broad multidisciplinary coverage, high indexing quality, and extensive inclusion of peer-reviewed journal articles relevant to technology, health, and behavioral sciences (Falagas et al., 2008; Singh et al., 2021).

Search Strategy

To identify relevant studies for this systematic literature review, a comprehensive search strategy was developed based on the research focus: mobile fitness applications and their role in promoting habit formation. The search process followed structured logic using Boolean operators to ensure comprehensive coverage of the topic. Specifically: (1) Within each concept category, synonymous keywords were combined using the OR operator, and (2) Keywords across different categories were connected using the AND operator. Accordingly, the general structure of the search string was: ("fitness app") AND ("behavior change" OR "habit*" OR "form habit" OR "formation of habits").

Inclusion and Exclusion Criteria

To ensure the relevance and quality of the studies included in this review, a set of inclusion and exclusion criteria was established based on the study's aim: to explore how mobile fitness applications promote habit formation and sustained behavioral change. All inclusion criteria were strictly applied; only studies meeting all inclusion criteria advanced to the data extraction phase. The criteria are as follows (Table 1):

Table 1
Criteria

Inclusion and exclusion criteria	
Inclusion criteria	IC1: The article focuses on mobile fitness applications used to promote physical activity, health behavior change, or habit formation.
	IC2: The article presents original empirical research (e.g., experimental, observational, or mixed methods studies).
	IC3: The article is written in English.
	IC4: The study was published in a peer-reviewed journal or presented at a peer-reviewed academic conference.
	IC5: The article contains a substantial amount of original analysis or data, rather than being purely theoretical or a commentary.
	IC6: The full text of the article is available via institutional access or open access platforms.
Exclusion criteria	EC1: The article focuses primarily on hardware usability (e.g., wearable device sensors) without addressing behavioral outcomes or habit formation.
	EC2: The article is theoretical only, without evaluating a real mobile fitness app or providing empirical findings related to habit formation.
	EC3: The article discusses general health apps not specifically aimed at promoting physical activity, exercise, or fitness-related habits.

Paper Selection

A total of 38 articles met all inclusion criteria and were deemed eligible for review. The complete screening process is illustrated in Figure 1. Duplicate records were identified and removed using Microsoft Excel. For each included study, the following predefined information was extracted: (a) first author and year of publication, (b) country, (c) sample characteristics, (d) research methods, (e) study design, (f) type of mobile fitness app examined, (g) key outcome measures, and (h) main findings. During the full-text screening stage, studies were excluded if they lacked sufficient detail regarding the intervention content, did not focus on mobile fitness app use for promoting physical activity or habit formation, or failed to explicitly or implicitly incorporate behaviour change techniques (BCTs).
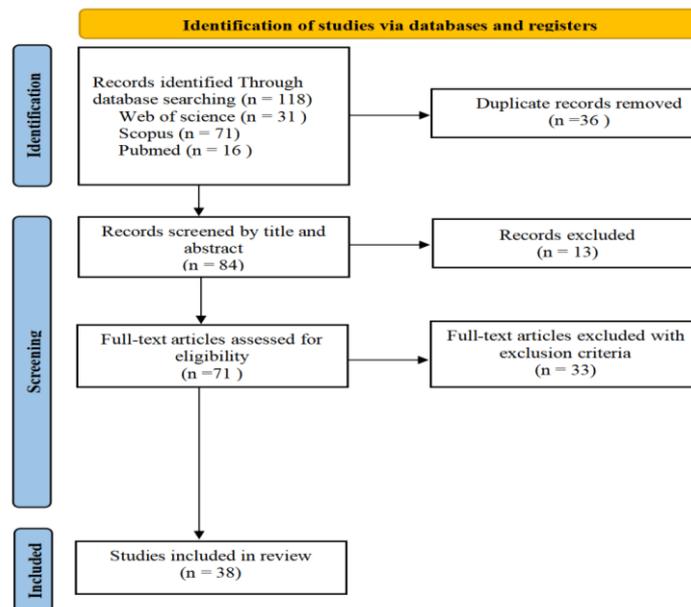
Figure 1. PRISMA Flow Diagram

A total of 38 studies were included and systematically analyzed using the Behaviour Change Techniques Taxonomy version 1 (BCTTv1). This taxonomy, developed by Michie et al. (2013), includes 93 techniques across 16 clusters and provides a validated framework for identifying behavior change components. BCTTv1 has been validated and widely applied in both the design and post-intervention evaluation of digital health interventions, including mobile and web-based platforms (Michie et al., 2015).

Results

Habit and Measurement

Habit refers to the tendency of individuals to perform certain behaviors frequently and repetitively, often without active awareness or intentional decision-making (de Guinea & Markus, 2009). According to Ouellette and Wood (1998), the automatic nature of habits makes them strong predictors of future behavior. Once habits are established, they operate independently of conscious thought, enabling individuals to continue the behavior with minimal cognitive effort. These patterns emerge through consistent repetition, eventually transforming into automatic responses to specific cues. Such automaticity is especially important in the context of sustained technology use, as it lowers the mental effort required to decide whether to use the technology (Anderson & Wood, 2021). Once formed, a habit tends to reinforce behavioral stability and persistence, thereby increasing the likelihood of continued engagement. In the context of health and fitness apps, cultivating habitual app usage can greatly enhance users' continuance intention. When users incorporate fitness app into their daily routines, the apps become embedded in their lifestyle and contribute to ongoing health behaviors (Bellary et al., 2024).

Context Analysis

The context analysis shows a clear upward trend in publications on this topic from 2012 to 2024. Research output was limited before 2016 but grew notably from 2018, peaking that year with seven publications. Interest remained strong from 2019 onward, especially in 2021, 2022, and 2024, highlighting the topic's growing academic relevance (see Figure 2).
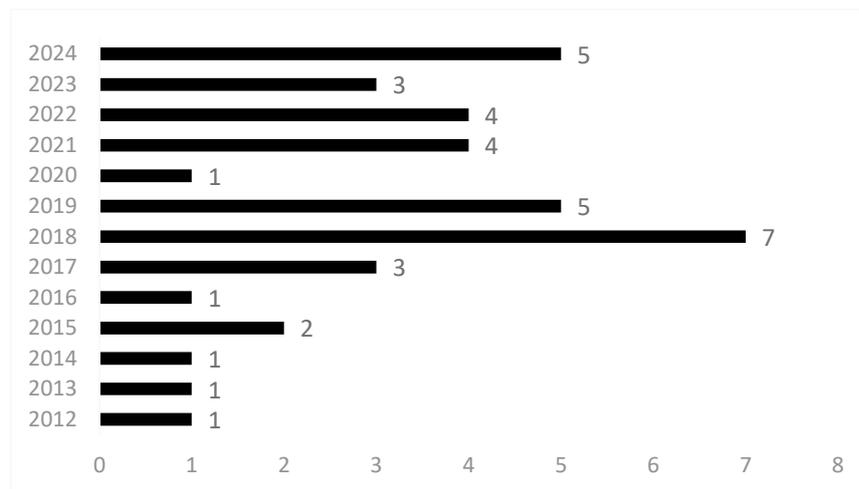
Figure 2. Publication by Year

In terms of geographical distribution, the majority of publications originated from the United States (n=12), followed by Canada (n=6), Germany and China (n=4 each). These countries appear to be the leading contributors to research in this field, indicating a strong academic interest and investment in related health promotion strategies. Other countries such as the United Kingdom, Switzerland, and Japan had minimal representation, suggesting a more regionally concentrated research landscape (see figure 3).
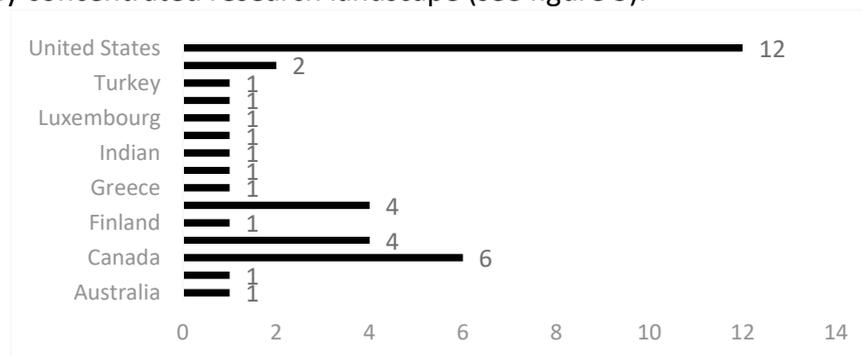

Figure 3. Area Distribution

BCTs Application

Among the 38 selected studies, the most frequently applied BCT group was Feedback and monitoring, led by techniques such as Self-monitoring (24/39, 62%) and Feedback (16/39, 41%), as shown in Figure 4. This group appeared in at least 33 out of 39 studies (85%). This was followed by Goals and planning, featured in Goal setting (25/39, 64%) and Action planning (9/39, 23%), with a total occurrence in approximately 31 studies (79%). These results highlight a predominant use of goal-oriented and self-regulation techniques in mobile fitness application, supported by social and motivational components.
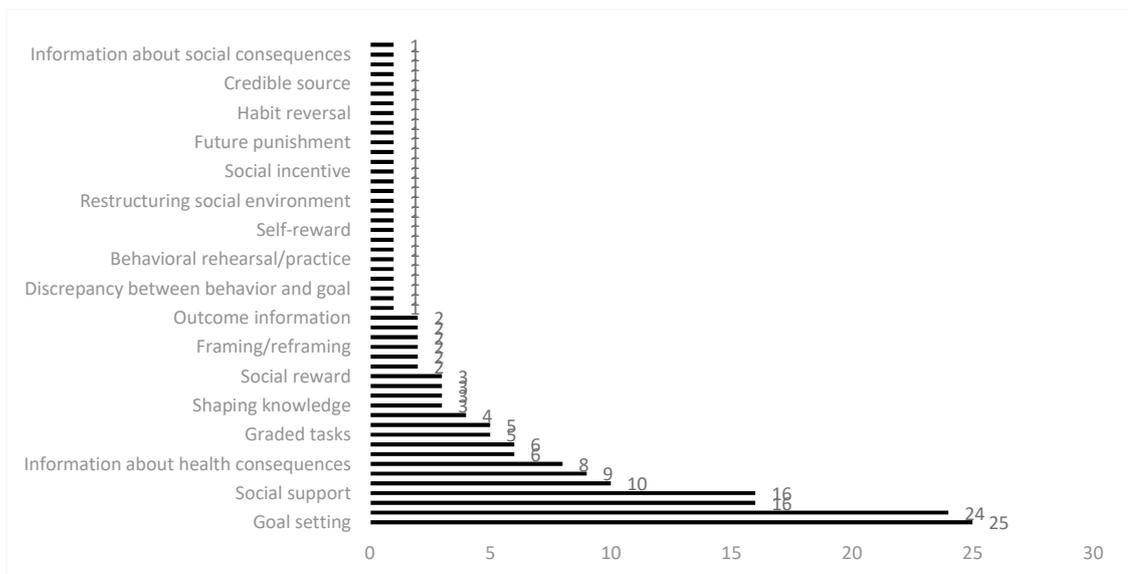
Figure 4. BCTs Frequency

Validation of the Existing Studies

To visually summarize the design objectives and strategies of the 39 included studies, Figure 5 (adapted from Bae et al., 2022; Zhu et al., 2024) highlights their research methods, outcome measures, and validation features. Most studies adopted quantitative approaches, with fewer using qualitative or mixed methods. The primary outcome targeted was physical activity, while fewer studies addressed broader health behaviors or nutrition. In terms of validation strategies, multiple BCTs were most commonly applied, followed by gamification, personalization, and social features. Additionally, user behavior was analyzed from five distinct perspectives.
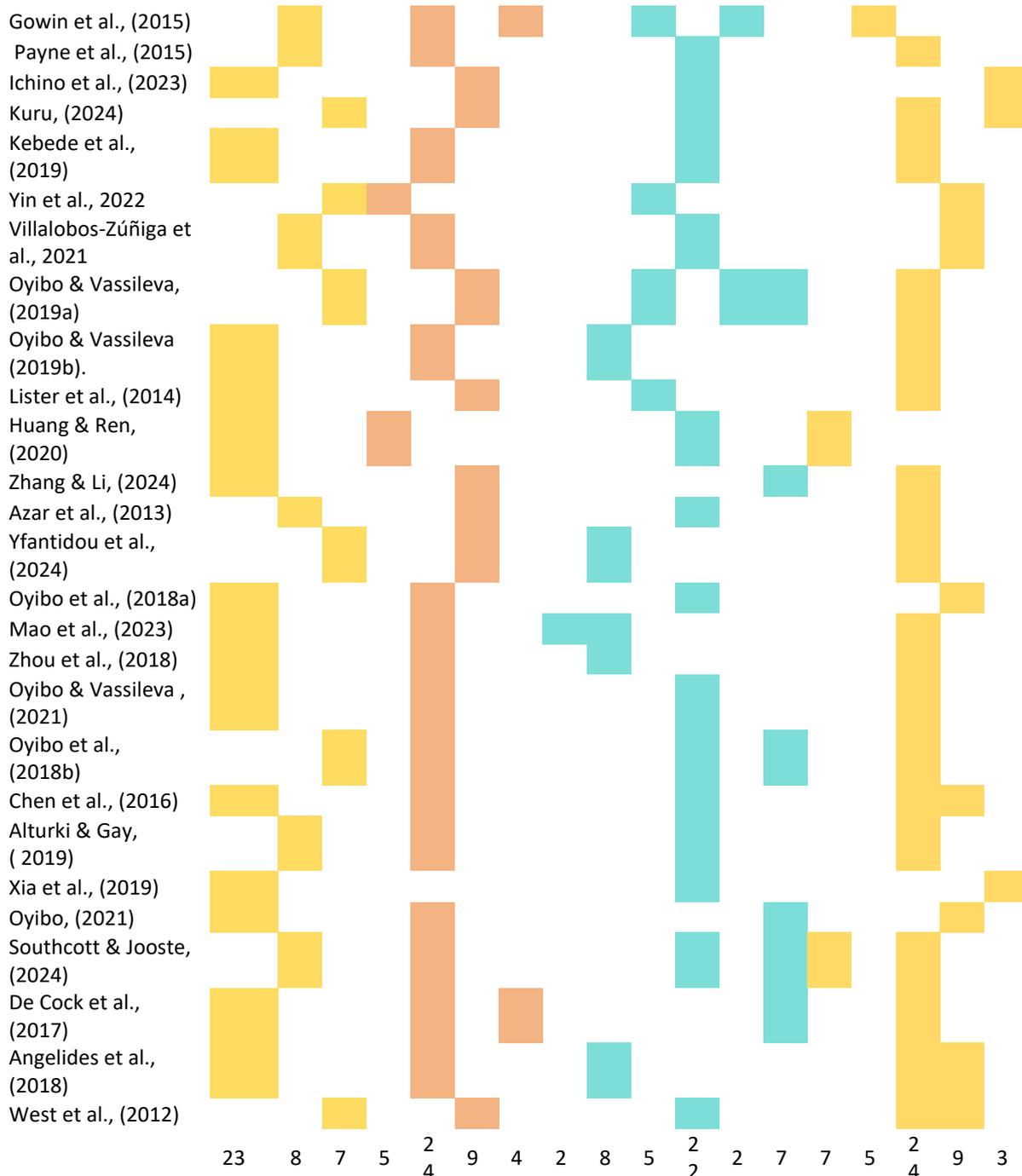
Figure 5. Summary of the Research Method, Outcome Measures, and Validation

Design Strategies of Habit Formation Techniques
Habits are formed through repeated behaviors in consistent contexts, progressing through three phases: initiation, learning, and stability (Verplanken, 2006; Gardner et al., 2012). In the initiation phase, individuals decide to act and select a context. Motivation, small goals, and simple actions are key to initiating behavior. In the learning phase, consistent repetition in the same context strengthens situational-behavior links, leading to automaticity (Lally & Gardner, 2013). Over time, behaviors become cue-driven and less reliant on conscious intentions. In the stability phase, habits persist automatically even with reduced motivation, supporting long-term behavior maintenance (Gardner et al., 2012; Lally & Gardner, 2013).

Design Strategies Aligned with Habit Phases

Table 2 maps common behavior change techniques (BCTs) in mobile fitness apps across three habit formation phases: Initial, Learning, and Stability. This categorization, grounded in behavioral theory and evidence, illustrates how digital interventions support sustained health behaviors like regular physical activity. Although personalization is widely recognized as a key design strategy, its role in sustaining user engagement and long-term behavior change remains underexplored. Recent studies have demonstrated that adaptive goal setting (e.g., Zhou et al., 2020) and interface personalization (e.g., Adibuzzaman et al., 2022) can enhance habit retention by aligning app features with individual needs and performance trajectories.

Table 2

BCTs and Features during Habit Formation Processing

Phase	Common BCTs or Features	Example	Reference
Initial	- Goal setting (1.1) - Instruction on how to perform behavior (4.1) -Information about health consequences (5.1) - Motivation prompts (7.1) - Educational content	-Initial goal-setting interface -Educational modules (e.g., exercise demonstration videos) - Health risk alerts - Motivational notifications - Onboarding guidance or interactive Q&A	Villalobos-Zúñiga et al., (2021); Huang & Ren, (2020); Alturki & Gay, (2019); Kuru, (2024); Kebede et al., (2019); Oyibo & Vassileva (2019a); Oyibo & Vassileva (2019b).
Learning	- Self-monitoring (2.3) - Feedback on behavior (2.2) - Social comparison (6.2) - Personalized feedback -Rewards/incentives (10.4) - Gamification elements	- Activity/meal logging and tracking charts -Daily behavior feedback and progress analysis -Leaderboards and friend challenges -Tailored content and reminders -Game-like features (levels, badges)	Southcott & Jooste, (2024); Xia et al., (2019); Chen et al., (2016); Angelides et al., (2018); Lister et al., 2014; Yin et al., (2022); Oyibo & Vassileva (2019a); Oyibo & Vassileva (2019b); Bellary et al., (2024）
Stability	- Habit formation (8.3) - Identity associated with behavior (13.1) -Environmental restructuring (12.1) - Prompts/cues (7.1) -Context-aware personalization	-Integrating behavior into daily routine (e.g., exercising after waking up) -Identity reinforcement through labels (e.g., "I'm a runner") -Environment adjustment to support behavior (e.g., deskhydration reminders) -Time-/location-sensitive smart prompts	Kuru, (2024); Lister et al., (2014); Mao et al., 2023; Vairavasundaram et al., (2022); Olsen et al., (2019); Yfantidou et al., (2024)

Research Framework

The proposed conceptual framework (Table 3) integrates Self-Determination Theory (SDT) with the habit formation process by aligning psychological needs (autonomy, competence, relatedness) with the three key phases of behavior change: Initiation, Learning, and Stability. It systematically maps representative Behavior Change Techniques (BCTs) such as goal setting,

feedback, and social comparison — to each phase, and illustrates how concrete app features (e.g., personalized plans, habit tracking, achievement badges, and social cues) can support sustained engagement and long-term health behavior formation.

Table 3
Habit Formation Framework

SDT	Phase 1: Initiation	Phase 2: Learning	Phase 3: Stability
Autonomy	Goal setting	Personalized plan	Context-aware cues
	Provide choice	Self-reflection	Routine integration
	Rationale	planning	Habit auto-tracking
Competence	Instruction	Graded tasks	Habit strength
	Small challenges	Informative feedback	Self-efficacy focus
	Feedback	Achievement badges	Mastery reflection
Relatedness	Onboarding with peer invitation	Social comparison	Group challenges
		Likes, comments	Social recognition
	User stories		Community streaks

Limitation
While we employed the standard systematic review methodology to identify relevant articles, there are still some limitations in this study, such as the scope of the databases and the availability of data perspectives. Since our focus is on reviewing the design implementations of Behavior Change Techniques (BCTs), they could have been more targeted to the design processes and techniques of interventions. Another limitation is that we only focus on the English language. Therefore, future research could expand by considering the efficacy of individual techniques or combinations of BCTs.

Conclusion
This systematic review examines how mobile fitness apps support habit formation for physical activity through behavior change strategies. It highlights a gap between theoretical frameworks and practical design implementations and proposes a conceptual framework outlining effective habit-supportive features. Personalized, user-centered designs are increasingly emphasized, while implicit, context-aware interactions remain underexplored. Ethical concerns around passive data collection are also noted. The findings offer guidance for designing apps that foster long-term engagement, with future research encouraged to focus on cue-behavior associations through adaptive technologies. Future research is encouraged to explore cue-behavior associations using advanced technologies such as wearable sensors and AI-driven personalization, which enable real-time detection of behavioral patterns and adaptive intervention delivery. In addition, longitudinal study designs are recommended to better understand how these dynamic app features influence habit consolidation over time.

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