

Development and Evaluation of a Mobile Health Application to Promote Healthy Lifestyle Behaviours

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ARTICLE INFO

Article history:

Received 27 April 2026

Revised 6 June 2026

Accepted 22 June 2026

Online first

Published 5 October 2026

Keywords:

Body Mass Index

Mobile Health Application

Non-Communicable Diseases

Healthy Lifestyle

Waterfall Model

DOI:

10.24191/mij.v7i2.11254

ABSTRACT

In recent years, the prevalence of non-communicable diseases has become a serious threat to Malaysians. Heart disease remains the primary cause of death, heavily influenced by risk factors such as high cholesterol, diabetes, high blood pressure, and obesity. Despite the importance of a healthy lifestyle, healthcare is often ignored by the community due to a lack of awareness. This paper details the development and evaluation of the "Healthy Lifestyle Application," a mobile platform designed to address these healthcare issues. Built on the Android platform and utilizing the English language, the application was developed using the sequential Waterfall Methodology. The platform integrates five functional modules: Health Information, Health Tests, Alarms, Fitness Plans, and a dedicated Healthy Lifestyle Behaviours Module. Functional verification via Black Box testing yielded a 100% success rate across 23 standardized test cases. Empirical usability evaluation among 35 target respondents demonstrated high user satisfaction, with over 90% of participants agreeing or strongly agreeing that the modules are highly intuitive and easy to navigate. Ultimately, this application addresses gaps in the mHealth market by consolidating fragmented features into a unified digital environment, serving as an effective tool to help users gain health-related knowledge and successfully adopt healthy behavioural practices.

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1. INTRODUCTION

In the contemporary digital era, mobile applications have become an integral component of daily life, transforming how communities access information and manage their routines. Research indicates that smartphone penetration is exceptionally high, with populations such as Malaysians spending an average of 5 hours and 47 minutes per day on digital media platforms. This high level of digital engagement makes smartphones an ideal medium for disseminating crucial health information and promoting wellness directly to individuals (Kemp, 2024). Consequently, mobile health (mHealth) applications have emerged as vital tools in modern healthcare, as they empower individuals to take proactive measures in managing their well-being, ultimately helping to reduce overall healthcare costs for both patients and service providers (Kao & Liebovitz, 2017).

The market for health and wellness applications has expanded exponentially to meet this growing community demand. Currently, there are more than 218,000 health, nutrition, and lifestyle applications available globally, with over 200 new health apps being added to the market every day. Among the most popular applications widely used by the public are diet trackers, pedometers, and habit-building tools. For instance, MyFitnessPal focuses heavily on tracking user diets, providing extensive nutritional data, and counting calories to manage weight. Other popular examples focus on short-term behavioural challenges to build healthy routines, or record exercises, walking steps, and water intake (Dute et al., 2016; Kao et al., 2025; Katsaliaki et al., 2025).

Despite the vast number of available applications, a critical limitation of current popular apps is their fragmented approach; the majority focus exclusively on either fitness tracking or dietary management. They often fail to provide a comprehensive platform that seamlessly integrates health education, physical assessments, and behavioural habit cultivation into one unified experience (Zakerabasali et al., 2021). Furthermore, users frequently struggle to maintain a healthy lifestyle because they set unrealistic goals, lack adequate health awareness, or have busy schedules that lead to stress and a subsequent reversion to bad habits. Existing applications generally do not address the psychological and behavioural persistence required to overcome these barriers, highlighting the necessity for a more holistic digital intervention (Dhinakaran et al., 2021; Kao et al., 2025).

To address these clear limitations, this study presents a novel, integrated mHealth prototype named the "Healthy Lifestyle Application" developed for the Android platform. The primary academic and practical contribution of this work lies in its comprehensive architectural consolidation of multiple health dimensions into a single mobile environment. By embedding structural behavioural challenges directly alongside empirical health tracking metrics (such as customized BMI and BMR calculators), the application establishes a continuous feedback loop that fosters behavioural persistence. This platform ensures that users possess sufficient foundational knowledge through accessible educational materials before launching customized physical activities, thereby bridging the operational gap between passive health monitoring and active lifestyle transformation.

2. LITERATURE REVIEW

According to recent national data, the prevalence of overweight and obesity in Malaysia has reached an alarming level. The National Health and Morbidity Survey (NHMS) 2023 reported that 54.4% of Malaysian adults are currently classified as overweight or obese, marking a significant increase from the 44.5% recorded in 2011. Similarly, abdominal obesity affected 54.5% of the adult population in 2023 (Institute for Public Health, 2024). This escalating health crisis is primarily driven by sedentary lifestyles and poor dietary habits, which serve as direct risk factors for non-communicable diseases such as heart disease,

diabetes, and high blood pressure. Consequently, there is an urgent need to prioritize lifestyle modifications and the consistent monitoring of health indicators to combat this growing epidemic and improve overall public health (Chong et al., 2022).

To address these systemic health challenges, mobile health applications have emerged as highly useful tools for the community. Given the ubiquitous presence of smartphones, mobile platforms provide an ideal and accessible medium for disseminating vital health information to the public. These applications empower users to independently monitor their physical condition, such as calculating their Body Mass Index (BMI) and Basal Metabolic Rate (BMR), enabling early and accurate interventions. By delivering continuous reminders, comprehensive educational content, and structured fitness plans, health apps help overcome common community barriers, such as a lack of time and insufficient health awareness, ultimately serving as everyday companions to sustain long-term healthy habits (Kao & Liebovitz, 2017).

Previous studies and market analyses have explored various applications aimed at improving health outcomes, though many focus solely on isolated behaviours without offering a holistic approach. As compared in Table 1, commercial applications demonstrate functional fragmentation. For instance, applications like MyFitnessPal emphasize dietary tracking, nutritional data, and calorie counting, but they lack dedicated frameworks for behavioural habit formation (Bozkurt, 2022; Zakerabasali et al., 2021). Conversely, alternative habit-building applications focus strictly on cultivating new behaviours through short-term challenges, yet they completely omit nutritional information, fitness tracking, and physical health tests. Specialized tracking tools like Health Pal successfully record daily activities such as step counting and water intake to manage fitness, but they fall short in providing comprehensive educational health knowledge to improve user awareness (Payne et al., 2015).

Despite the theoretical potential of mHealth platforms, previous studies and market analyses have revealed that a majority of existing applications fail to achieve sustained health outcomes due to a lack of a holistic approach. Instead of addressing lifestyle modification comprehensively, many commercial platforms focus solely on isolated behaviors, leading to deep functional fragmentation within the digital health market (Zakerabasali et al., 2021). For instance, widely adopted nutritional applications emphasize dietary tracking, extensive nutritional databases, and daily calorie counting, yet they completely lack dedicated cognitive or behavioral frameworks required to foster permanent habit formation (Bozkurt, 2022). Consequently, while users can log their caloric intake, the lack of behavioral reinforcement often results in low long-term engagement and a failure to sustain lifestyle changes.

Conversely, alternative behavioral platforms on the market focus strictly on cultivating new routines through short-term challenges or gamified streaks, yet they completely omit physical health metrics, fitness tracking, and crucial nutritional data. Similarly, specialized tracking tools successfully record specific daily physical activities, such as automated step counting and water intake logs to manage basic fitness parameters (Payne et al., 2015). However, these tracking tools fall short in providing comprehensive educational health knowledge or clinical parameter checks, leaving users unaware of the underlying physiological impacts of their activities. This separation of nutrition, behavior modification, and physical activity across different platforms forces users to navigate multiple fragmented apps, reducing the likelihood of a sustained, healthy lifestyle transformation.

This clear divide in the current digital landscape underscores the necessity for an integrated, multi-dimensional mHealth framework that consolidates these separated features into a single ecosystem. Research indicates that addressing weight management effectively requires a simultaneous triad of dietary literacy, physical activity tracking, and psychological habit-building principles. By synthesizing health measurement such as weight, height, BMI with holistic behavioral tracking and structured public health education, a unified mobile platform can bridge the gaps observed in single-behavior tools. Developing such a comprehensive application not only resolves the current market fragmentation but also provides the

Malaysian community with a scientifically structured, accessible tool capable of curbing the rising trajectory of non-communicable lifestyle diseases.

3. METHODOLOGY

The development of the Healthy Lifestyle Application was conducted using the Waterfall Model. This model is widely utilized for the development of mobile software and web applications due to its sequential and highly structured nature (Balaji & Murugaiyan, 2012; Demirag et al., 2023). In this model, each phase must be executed in detail to minimize architectural issues in subsequent stages, ensuring a very clear understanding of system requirements before a new phase begins. The development process was structured into four core operational phases:

- (i) **Planning and Analysis Phase:** Initial selection of the project topic and the formulation of app-related features, purposes, and user specifications. System requirements were identified by comparing competitive market trends, leading to the selection of the Android platform (Android 7.0 and above) and the English language to optimize accessibility.
- (ii) **Design Phase:** Focus on mapping the database schemas, logic algorithms, user interfaces, and the underlying system architecture based on the gathered requirements. A 3-Tier Client-Server Architecture was chosen to split the system into a Presentation Tier (User Interface), an Application Tier (Business Logic), and a Database Tier (Data Storage). This structural division enhances system scalability and updates, allowing backend enhancements to occur smoothly without disrupting the user-facing presentation layer (Guvensan et al., 2017).
- (iii) **Implementation and Programming Phase:** Technical coding of the application functions inside Android Studio using Java as the programming framework. Cyan was integrated as the primary colour theme to optimize visual comfort and minimize user eye strain. Backend data storage, secure credential authentication, and JSON synchronization were established via Google Firebase.
- (iv) **Testing Phase:** Rigorous technical and usability assessments. Functional verification was completed by the developer using Black Box testing techniques to confirm all internal logging mechanisms, authentication routes, and logic calculations operated precisely according to specification (Golian et al., 2022).

3.1 Evaluation Instrument and Sampling Justification

To measure user acceptance, a structured usability testing instrument was adapted based on standard system evaluation frameworks (Lewis, 2018). The evaluation questionnaire was divided into specific operational dimensions: Ease of Use, Usability of Application Modules, and Application Appearance. Items were rated using a 3-point classification scale consisting of "Unsure", "Agree", and "Strongly Agree" to capture user sentiment regarding layout clarity and operational simplicity.

The evaluation phase involved a targeted group of 35 respondents selected via a purposive sampling technique. The selection criteria restricted participants exclusively to the 20 to 40 age brackets. This age group represents prime smartphone consumers who experience high daily occupational schedules and elevated stress levels, making them the primary demographic that stands to benefit most from an integrated, mobile-driven lifestyle intervention platform.

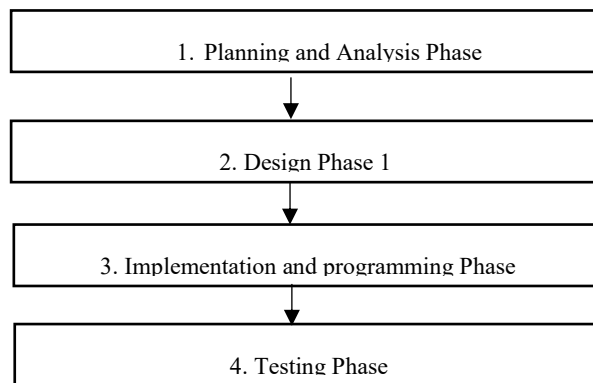


Fig. 1. The Four-Phase Waterfall Development Model

Source: Authors' illustration of the Waterfall development process adopted in this study

4. RESULTS

4.1 Functional Verification (Black Box Testing)

The developer evaluated 23 distinct test cases (TC001 to TC023) categorized under 7 primary testing procedures (P1 to P7). These procedures covered user registration, authentication formatting, health article display, calculation accuracy for the BMI/BMR engines, real-time database synchronization for the 21-day routines, and alarm notification triggers. Every single test case executed achieved a 100% success rate, resulting in a "PASS" across all entries, verifying that the prototype functions free of logical or systemic errors (Golian et al., 2022).

Table 1. Black Box testing

Procedure	Target Component	Test Cases	Result
P1 & P2	User Registration & Login	TC001–TC005	100% PASS
P3	Health Info Content Engine	TC006–TC009	100% PASS
P4	BMI / BMR / Water Engines	TC010–TC014	100% PASS
P5 & P6	21-Day Behaviour Tracks	TC015–TC020	100% PASS
P7	Real-Time Alarm Triggers	TC021–TC023	100% PASS

Source: Authors' functional testing of the Healthy Lifestyle Application across 23 test cases

4.2 Usability Evaluation and Demographics

Demographic evaluation showed that 82.6% of the 35 participants were female and 17.4% were male, all falling within the targeted 20 to 40 age brackets. While 65.71% of respondents possessed prior experience with lifestyle applications, 34.29% had never engaged with an mHealth tool, providing a balanced baseline of novel and experienced users.

Table 2. Ease of Use of Application Modules

Modules	Unsure	Agree	Strongly Agree
User Registration	2(5.71%)	16(45.71%)	17(48.57%)
Login	2(5.71%)	18(51.43%)	15(42.86%)
Health Knowledge Information	2(5.71%)	20(57.14%)	13(37.14%)
Health Test	5(14.29%)	13(37.14%)	17(48.57%)
Fitness Plan	3(8.57%)	18(51.43%)	14(40%)
Healthy Lifestyle Practice Plan	1(2.86%)	14(40%)	20(57.14%)
Alarm	1(2.86%)	16(45.71%)	18(51.43%)

Source: Authors' analysis of questionnaire responses from 35 participants

As detailed in Table 2, 90% or more of the respondents agreed or strongly agreed that all modules are easy to use. The highest cumulative rating reached 97% for both the healthy lifestyle practice plan and the alarm tracking tools, highlighting that the behavioural interfaces were highly intuitive for the target group.

Table 3. Usability of Application Modules

Modules	Unsure	Agree	Strongly Agree
User Registration	2(5.71%)	14(40%)	19(54.29%)
Login	3(8.57%)	14(40%)	18(51.43%)
Health Knowledge Information	4(11.43%)	15(42.86%)	16(45.71%)
Health Test	3(8.57%)	15(42.86%)	17(48.57%)
Fitness Plan	2(5.71%)	12(34.29%)	22(62.86%)
Healthy Lifestyle Practice Plan	1(2.86%)	13(37.14%)	21(60%)
Alarm	1(2.86%)	14(40%)	20(57.14%)

Source: Authors' analysis of questionnaire responses from 35 participants

Regarding operational usability (Table 3), positive scores remained consistently above the 90% threshold for almost all modules, confirming that the integrated features successfully supported user tasks. The application's interface design received strong positive validation (Table 4). Total satisfaction regarding the colour configuration reached 100%, demonstrating that the custom cyan colour palette successfully achieved an appealing look while reducing user eye strain. Furthermore, 74.29% strongly agreed that navigation buttons were straightforward, and 62.86% highly praised the clarity of integrated icons.

Table 4. Usability of Application Appearance

Appearance	Unsure	Agree	Strongly Agree
The colours used are suitable and attractive	2(5.71%)	18(51.43%)	15(42.86%)
Buttons in the application are easy to use	1(2.86%)	8(22.86%)	26(74.29%)
Usage of images and icons is suitable and clear	1(2.86%)	11(31.43%)	22(62.86%)
Usage of fonts is easy to read and visible	2(5.71%)	13(37.14%)	20(57.14%)

Source: Authors' analysis of questionnaire responses from 35 participants

Table 5. Results of Other General App Evaluations

Dimensions	Unsure	Agree	Strongly Agree
Instructions and explanations are clear to understand	1(2.86%)	15(42.86%)	19(54.29%)
The information provided is suitable	1(2.86%)	12(34.29%)	22(62.86%)
The language used is suitable and easy to understand	0	10(28.57%)	25(71.43%)
Feeling satisfied with using the application	0	10(28.57%)	25(71.43%)

Source: Authors' analysis of questionnaire responses from 35 participants

Other evaluations (Table 5) showed that 97% of participants found the written explanations and information context suitable for daily management. A total of 100% felt completely satisfied using the application, indicating that consolidating health parameters into a single environment is practically viable for community care.

5. DISCUSSION

The primary contribution of the "Healthy Lifestyle Application" centres on its architectural consolidation of multi-dimensional health tracks within a singular, highly intuitive ecosystem. Traditional commercial applications often force a fragmented user journey, compelling individuals to download separate platforms for dietary logging, fitness tracking, and habit monitoring. The high user satisfaction documented in this study across both ease of use and module usability strongly validates the core hypothesis of this research: a unified digital interface significantly reduces the cognitive friction associated with managing daily wellness routines. By providing immediate accessibility to educational materials, physical calculators, and behaviour plans under a single interface, the application lowers the operational barriers that frequently cause users to abandon health interventions.

A critical element of this application's design is the innovative deployment of the 21-day "Healthy Lifestyle Behaviours Plan". While mainstream fitness apps treat habit formation as a passive byproduct of data entry, this prototype elevates behavioural persistence to a primary structural module. The high user approval ratings for this specific challenge track achieving a 97% cumulative ease-of-use rating (Table 2) indicate that users highly appreciate structured, time-bound behavioural frameworks. Dividing habits into actionable, realistic milestones (such as junk food avoidance and regulated sleep schedules) addresses the psychological fatigue that typically derails long-term lifestyle shifts. By establishing a direct, closed feedback loop between empirical baseline calculations (BMI and BMR) and active behavioural milestones, the system transitions the user from passive awareness to structured execution.

The empirical feedback regarding application appearance and general satisfaction provides important insights into mobile-centric user experience design. Achieving a 100% satisfaction rate for the colour configurations highlights the immense practical importance of visual ergonomics in mHealth development. Incorporating cyan as the dominant visual theme directly supports visual comfort, mitigating the digital eye strain often exacerbated by prolonged interactions with mobile layouts. This design approach directly responds to design concerns raised in contemporary human-computer interaction studies, which link complex navigation paths and overwhelming interfaces to high user attrition rates. The high marks for button clarity (74.29% strongly agree) and text readability (57.14% strongly agree) demonstrate that prioritizing clean layouts directly enhances operational usability.

When contextualized within the broader landscape of digital healthcare, these results present an effective strategy for addressing public health issues in developing countries. Given the alarming statistics from the National Health and Morbidity Survey (NHMS) 2023, which indicates that over 54% of Malaysian adults struggle with obesity, accessible digital interventions are critically necessary. While commercial apps are frequently critiqued for locking premium tracking features behind paywalls or ignoring local health trends, this prototype provides a scalable model for community-based preventative care. Consolidating these modules ensures that users are structurally educated before starting strenuous physical activities, preventing injuries and promoting long-term habit retention.

However, despite the strong positive data, several technical and structural limitations remain that must be carefully evaluated. Operating exclusively within the Android environment inherently restricts the application's utility, preventing deployment to users on the iOS platform. Furthermore, relying strictly on English limits accessibility for non-English speaking regional communities who could benefit heavily from localized healthcare resources. Finally, as noted in Table 3, the Health Knowledge Information module received a slightly higher "Unsure" rating (11.43%) compared to other modules. This suggests that while the interface is clear, the current content database is constrained and needs more comprehensive, diverse articles to maintain long-term user engagement. Future versions will focus on building cross-platform compatibility, integrating multi-language support, and adding a detailed data visualization dashboard to track user health patterns over time.

6. CONCLUSION

The Healthy Lifestyle Application was successfully developed and empirically tested, proving to be a highly functional and well-received digital tool for promoting wellness. By combining educational resources, physical health assessments, fitness plans, and behavioral challenges into a single cohesive platform, the application serves as a comprehensive aid for users aiming to cultivate and sustain healthy practices. Future updates will focus on cross-platform deployment, multi-language expansion, and advanced visual dashboards to track long-term health trends.

7. ACKNOWLEDGEMENTS/FUNDING

The authors would like to express their sincere gratitude to Universiti Teknologi MARA, Sabah Branch and Universiti Kebangsaan Malaysia for the financial assistance.

8. CONFLICT OF INTEREST STATEMENT

No conflict of interest.

9. AUTHORS' CONTRIBUTIONS

S.A. HANAWI: conceptualization, methodology, writing—original draft, and project supervision. L. W. SHENG: software development, data curation, and writing—original draft. H. HANAFIAH: formal analysis and data validation. R. JENAL: methodology support and technical supervision. N.Z.M. SAAT: writing—review & editing, validation, and final approval.

10. DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

During the preparation of this work, the authors used, Quillbot was employed to refine the phrasing and enhance the linguistic clarity of the manuscript.

11. DATA AVAILABILITY/SUPPLEMENTARY MATERIALS

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

12. ETHICS STATEMENT

This study was conducted in accordance with general research ethics principles. Participation was voluntary, and informed consent was obtained before data collection. Participants were informed of the study's purpose and their right to withdraw without penalty. Confidentiality was maintained, and the collected data were used solely for research purposes. Findings were reported honestly and transparently.

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