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Mobile health-based digital intervention to improve ARV compliance and nutritional intake in PLHIV at Bandarharjo Health Center

Intervensi digital berbasis mobile health untuk meningkatkan kepatuhan ARV dan asupan nutrisi pada ODHA di Puskesmas Bandarharjo

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Abstract

Low adherence to antiretroviral (ARV) therapy and inadequate nutritional intake remain persistent challenges among People Living with HIV/AIDS (PLHIV) in Indonesia, contributing to suboptimal treatment outcomes and reduced quality of life. Mobile health (mHealth), which utilizes mobile devices for health interventions, offers a promising solution by facilitating personalized, accessible, and continuous patient support. This study aimed to assess the effectiveness of an Android-based mHealth application, SEHAT+, in improving ARV adherence and nutritional intake among PLHIV at the Bandarharjo Health Center, Semarang. A total of 41 active PLHIV undergoing ARV therapy were recruited from March to May 2025. Descriptive and paired t-test analyses were conducted to compare adherence and intake before and after the intervention. The mean ARV adherence score increased from 62,3 (SD = 10,5) to 84,9 (SD = 8,1), and the nutritional intake score improved from 58,7 (SD = 11,2) to 79,2 (SD = 9,6), both showing statistically significant changes ($p < 0,001$). SEHAT+ features included medication reminders, dietary logs, multimedia-based nutrition education, and online consultation forums. The findings indicate that mHealth interventions can significantly enhance both medication compliance and nutritional behavior in PLHIV. Community-driven digital tools such as SEHAT+ have the potential to strengthen primary healthcare responses to HIV/AIDS in resource-constrained settings.

Keywords: mHealth, ARV Adherence, HIV/AIDS, Mobile App-Based Adherence Support, Nutrition Monitoring, SEHAT+ Application

Abstrak

Rendahnya kepatuhan terhadap terapi antiretroviral (ARV) dan buruknya asupan nutrisi masih menjadi tantangan yang terus-menerus dihadapi oleh Orang dengan HIV/AIDS (ODHA) di Indonesia, yang berkontribusi pada hasil pengobatan yang tidak optimal dan penurunan kualitas hidup. Mobile health (mHealth), yang memanfaatkan perangkat seluler untuk intervensi kesehatan, menawarkan solusi yang menjanjikan dengan menyediakan dukungan pasien yang bersifat personal, mudah diakses, dan berkelanjutan. Penelitian ini bertujuan untuk mengevaluasi efektivitas aplikasi mHealth berbasis Android, SEHAT+, dalam meningkatkan kepatuhan ARV dan asupan nutrisi pada ODHA di Puskesmas Bandarharjo, Semarang. Sebanyak 41 ODHA aktif yang sedang menjalani terapi ARV direkrut pada Maret hingga Mei 2025. Analisis deskriptif dan uji paired t-test digunakan untuk membandingkan tingkat kepatuhan dan asupan sebelum dan sesudah intervensi. Skor kepatuhan ARV rata-rata meningkat dari 62,3 (SD = 10,5) menjadi 84,9 (SD = 8,1), dan skor asupan nutrisi meningkat dari 58,7 (SD = 11,2) menjadi 79,2 (SD = 9,6), keduanya menunjukkan perubahan yang signifikan secara statistik ($p < 0,001$). Fitur SEHAT+ meliputi pengingat minum obat, pencatatan makanan, edukasi gizi berbasis multimedia, dan forum konsultasi daring. Temuan ini menunjukkan bahwa intervensi

mHealth dapat secara signifikan meningkatkan kepatuhan konsumsi obat dan perilaku nutrisi pada ODHA. Alat digital berbasis komunitas seperti SEHAT+ memiliki potensi besar untuk memperkuat respons layanan kesehatan primer terhadap HIV/AIDS, terutama di wilayah dengan keterbatasan sumber daya.

Kata Kunci: mHealth, Kepatuhan ARV, HIV/AIDS, Dukungan Kepatuhan Berbasis Aplikasi Mobile, Pemantauan Gizi, Aplikasi SEHAT+.

Introduction

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) are major global health problems, particularly in developing countries such as Indonesia (Jocelyn et al., 2024). HIV progressively weakens the immune system by destroying CD4 + cells, leaving the body highly vulnerable to opportunistic infections and other complications. Antiretroviral therapy (ARV) is a proven strategy for suppressing viral replication, reducing mortality, and improving the quality of life. However, its success is heavily dependent on lifelong adherence to treatment regimens (Ansyori et al., 2024; Balasubramaniam et al., 2019).

In addition to strict medication adherence, nutritional status also plays a central role in the effectiveness of ARV therapy. Adequate and balanced nutrition enhances immune function, accelerates clinical recovery, and reduces side effects of treatment (Konstantinou et al., 2020). Conversely, malnutrition can weaken the immune system, hasten disease progression, and diminish the efficacy of ARV drugs. Therefore, comprehensive HIV/AIDS care should not be limited to pharmaceutical interventions but must also incorporate sustained nutritional support as part of integrated therapy for People Living with HIV/AIDS (PLHIV) (Okolo et al., 2024; Goldstein et al., 2023).

In Indonesia, ARV therapy is widely available through primary healthcare facilities such as community health centers (puskesmas). However, adherence remains suboptimal due to complex treatment schedules, lack of nutritional awareness, poorly managed side effects, social stigma, and limited access to reliable health information (Jocelyn et al., 2024). While various digital health interventions have been developed to improve medication adherence, few have addressed the dual challenge of ARV compliance and nutritional management on a single platform. To date, there is a lack of integrated mobile health (mHealth) solutions tailored to the needs of PLHIV in Indonesia that simultaneously support both treatment adherence and nutritional behavior. This study seeks to fill this gap by evaluating the effectiveness of a locally developed mHealth application, SEHAT+, which combines ARV reminders, dietary tracking, and interactive education for PLHIV in a community-based setting (Bhatti et al., 2016).

The Bandarharjo Health Center in Semarang City is one of the primary healthcare facilities that manages the highest number of active PLHIV in the region. According to internal monitoring data recorded through the center's electronic medical records (EMR) and monthly nutrition counseling reports in early 2025, 41 PLHIV were actively enrolled in ARV therapy and nutritional supervision programs. Of these, only 11 individuals (26,8%) demonstrated high adherence to both the medication intake and nutritional recommendations provided by health workers. In contrast, 30 individuals (73,2%) exhibited irregular ARV consumption patterns and poor dietary practices, which did not align with the principles of balanced nutrition. These findings, derived from routine patient progress reports and validated by the local nutrition team, highlight the pressing need for innovative intervention strategies that offer personalized, real-time, and sustainable supportideally through an integrated medical and nutritional approach (Ahmed et al., 2020).

Along with the development of information and communication technology, the concept of mobile health (mHealth) is a digital solution that offers a new approach to community-based chronic health management. mHealth refers to the use of mobile devices such as smartphones and tablets to support health interventions. The features offered in the mHealth application include medication reminders, symptom monitoring, health education, and online consultations with medical personnel. In the context of HIV/AIDS, mHealth enables two-way communication between patients and healthcare workers, accelerates responses to therapeutic problems, and provides a safe space for patients to receive information

and social support without fear of stigma (Qudah & Luetsch, 2019; Marcolino et al., 2018).

However, the mHealth app is not only relevant for managing ARV compliance, but also offers potential in addressing nutritional challenges among PLHIV. The integration of features such as daily nutritional intake monitoring, education on balanced diets, and self-reporting of nutrition-related symptoms makes mHealth a promising platform for supporting the nutritional dimension of HIV/AIDS care (Cunha & Duarte, 2022). In this approach, patients are not only reminded to take their medication but are also guided to adopt healthier eating habits, understand the importance of macro- and micronutrient intake, and actively track weight, body mass index (BMI), and other relevant physical indicators. Multimedia-based education, delivered through videos, infographics, and short articles, has shown promise in enhancing message retention even among patients with low health literacy (Kowalska et al., 2024; Whitney et al., 2019).

Nevertheless, the effectiveness of mHealth interventions is not without its limitations. User engagement can vary widely, depending on individual motivation, digital literacy levels, and the perceived usefulness of the app. Additionally, unequal access to smartphones, unstable Internet connections, and privacy concerns may hinder optimal use among vulnerable populations. These challenges must be acknowledged and addressed during the design and implementation phases to ensure that mHealth tools equitably reach and support PLHIV in diverse settings.

Considering this potential, this study aimed to develop and implement an Android-based mHealth application specifically designed to support treatment compliance and nutritional management of PLHIV in the working area of the Bandarharjo Health Center, Semarang City. This application is named SEHAT+ and was developed through a participatory approach involving patients, medical personnel, and nutritionists in the design, testing, and evaluation processes. This application is expected to become a medium that not only facilitates clinical monitoring but also becomes an educational and supportive space for patients in forming sustainable healthy living behaviors.

The problem formulation in this study focuses on how mobile health (mHealth) applications can improve treatment adherence while improving nutritional status in people with HIV/AIDS (PLHIV) at the Bandarharjo Health Center, Semarang. This research is expected to be able to make a significant contribution to the development of a digital intervention model that not only emphasizes the clinical aspect, but also strengthens the integration of nutrition approaches and psychosocial support in HIV/AIDS governance, especially at the community-based and participatory primary health service level (Duthely & Sanchez-Covarrubias, 2020).

Methods

This study employed a mixed-methods research and development design, combining both qualitative and quantitative approaches to develop and evaluate an Android-based mobile health (mHealth) application that functions as a digital intervention tool to improve treatment adherence and nutritional status among People Living with HIV/AIDS (PLHIV) (Turale, 2020). The quantitative component involved measuring changes in ARV adherence and nutritional intake using descriptive statistics and paired t-tests, before and after the intervention. The qualitative component explored user experiences, perceptions, and behaviors related to the application, focusing on how the app influenced their medication routines, dietary habits, and health literacy.

This dual approach also allowed for a deeper understanding of the social and cultural contexts influencing the adoption and effectiveness of mHealth tools in the field, including factors such as stigma, digital access, nutritional knowledge, and family or community support (Iismayanti et al., 2022; Koh et al., 2000). The integration of both data types enabled a more comprehensive evaluation of the SEHAT+ application, capturing not only outcome measures, but also contextual insights that may inform future scaling and implementation strategies.

Research Location and Time

This study was conducted in the working area of the Bandarharjo Health Center, Semarang City, Central Java, from March to May 2025. The selection of the location was based on the consideration of the high number of active PLHIV in the region, as well as the availability of health workers with experience in HIV/AIDS management and nutrition-monitoring services

at the primary service level. This health center also has a routine patient monitoring system, including ARV therapy and assessment of basic nutritional status such as weight and daily intake.

Research Subjects and Participants

The subjects in this study comprised two main groups. The first group was People Living with HIV/AIDS (PLHIV) who were direct users of the mHealth application. The selection criteria for this group included being an actively registered patient at the Bandarharjo Health Center, owning an Android device, willing to participate in the entire research process, and under regular monitoring for antiretroviral (ARV) therapy and nutritional counseling. The second group consisted of healthcare workers, including doctors, nurses, HIV counselors, and nutritionists, who played an active role in the development, testing, and evaluation of SEHAT+ application content.

The sampling technique used in this study was purposive sampling, and participants were selected based on specific criteria relevant to the research objectives, namely, being actively enrolled in ARV therapy and nutrition counseling programs at the Bandarharjo Health Center, owning an Android smartphone, and being willing to engage with the mHealth application over the study period. A total of 41 active PLHIV patients participated in the study, consisting of 11 individuals with high adherence to ARV therapy and nutritional recommendations and 30 individuals with lower levels of adherence.

Although purposive sampling is appropriate for exploratory and qualitative research, it is important to acknowledge its inherent limitations. The sampling approach may have introduced a self-selection bias, as participants who were more motivated or technologically literate may have been more likely to participate. Additionally, the requirement for Android smartphone ownership may have excluded individuals with limited access to digital devices or those with low digital literacy, potentially affecting the generalizability of the findings. These limitations highlight the need to carefully consider equity and accessibility in future studies and implementations.

Application Development Procedure

The application was developed using the Agile Development method, which is an iterative and incremental approach that allows continuous improvement based on user feedback. The development stages were systematically conducted as follows (Kirmani, 2017):

The first stage was needs identification, conducted through exploratory interviews with PLHIV and healthcare workers, including nutritionists, to formulate both functional and nonfunctional application requirements relevant to the context of ARV therapy and nutrition management. The second stage involved developing user interface (UI) prototypes and application wireframes based on the principles of simplicity, ease of navigation, and responsiveness to the health and nutritional information needs of patients.

In the development stage, an Android-based application called SEHAT+ was created, featuring key components, such as ARV and healthy meal reminders, daily symptom tracking, food logging, multimedia education on HIV and nutrition, online discussion forums, and online consultation services with medical personnel and nutrition officers.

The next stage was testing, in which a two-week trial was conducted by users, focusing on the usability of the features, system stability, and the effectiveness of educational message delivery. User activities are recorded using usage logs and direct feedback. The final stage was evaluation and iteration, where application improvements were made based on the results of functionality and content evaluation, including feedback from patients and nutritionists regarding the relevance of educational materials to field needs.

Data Collection Techniques

The data in this study were collected using the following techniques. First, participatory observations were conducted during the application testing period to monitor user interactions with various features, such as meal reminders, daily consumption logs, and nutrition discussion forums.

Second, in-depth interviews were conducted with PLHIV and health care workers, including nutritionists, to explore their perceptions of the effectiveness of the application in improving medication adherence and healthy eating practices.

Third, an evaluative questionnaire was used to assess user satisfaction, ease of navigation, psychosocial impact, and perceptions of nutritional understanding before

and after using the application. These techniques were chosen to obtain both qualitative and quantitative data, enabling triangulation of information from multiple perspectives.

Data Analysis Techniques

Qualitative data were analyzed thematically through transcription, coding, categorization, and narrative interpretation. Quantitative data, such as ARV adherence and nutritional intake scores, were analyzed using descriptive statistics (means and standard deviations). To evaluate the impact of SEHAT+, a paired t-test was used to compare pre- and post-intervention scores within the same group. Statistical significance was set at $P < 0,05$.

Ethical Considerations

This study was approved by the Health Research Ethics Committee of Universitas Widya Husada Semarang (approval No: ST-20/LPPM-Lit/UWHS/II/2025). Given that the study involved a vulnerable population—People Living with HIV/AIDS (PLHIV)—all procedures were conducted in accordance with established ethical principles, including respect for autonomy, beneficence, justice, and protection from harm.

Prior to participation, all respondents were provided with detailed verbal and written explanations of the objectives, procedures, potential benefits, and risks of the study, including the use of the SEHAT+ mobile application as an intervention tool. Participation was voluntary and written informed consent was obtained from each participant. All participants retained the right to withdraw at any time without any impact on their access to healthcare services at Bandarharjo Health Center.

To ensure confidentiality and privacy of the data, all personal identifiers were removed and replaced with unique participant codes. Data were securely stored in password-protected systems and accessible only to the research team. No financial incentives are provided. All research procedures adhered to institutional ethical guidelines and complied with the national standards for HIV/AIDS service delivery at the primary-care level.

Result and Discussion

The mobile health (mHealth) application developed in this study is named SEHAT+ and is specifically designed to improve treatment adherence and improve the nutritional status and quality of life of People with HIV/AIDS (PLHIV) in the working area of the Bandarharjo Health Center, Semarang.

This application was built on Android because the results of an initial survey of 41 PLHIV showed that as many as 35 people (85%) stated that they owned and actively used Android smartphones in their daily lives. The high penetration of Android devices is a strong basis for choosing this platform as the primary medium for digital intervention.

Key Features of the App

The SEHAT+ application is equipped with several key features designed based on the results of exploring the needs of users, medical personnel, and nutrition workers.

PLHIV Discussion Forum and Support Group

This feature provides a safe space for PLHIV to share experiences, discuss obstacles, and motivate each other to manage therapy and daily nutritional intake. The forum also facilitates discussions about nutritious food recipes, management of therapeutic side effects through diet, and tips for maintaining ideal weight. Of the total number of application users, 28 (68,3%) were actively involved in forum discussions at least twice a week. These findings support the literature stating that digital-based social support can strengthen psychosocial resilience and increase self-care awareness including nutritional adherence (Barbancho, 2022).

Reminders of Medication Consumption and Balanced Nutritional Intake

This feature provides daily notifications that are adjusted to the ARV drinking time while suggesting nutritious meal times according to the recommended diet. In addition, there is a control reminder to the health center for periodic checks, including the evaluation of nutritional status by officers. Based on in-depth interviews, as many as 11 respondents with high compliance stated that this feature was very helpful in forming a routine of taking medication and eating healthy consistently. This reinforces the study by Choudhry et al., which showed that digital reminders are able to increase adherence to long-term therapies by up to 40%.

Nutrition and HIV Education in the Form of Interactive Articles and Videos

The digital education feature in this application includes topics on the relationship between nutrition and immunity, the importance of nutrition in supporting the effectiveness of ARVs, and daily healthy menu guidelines for people with disabilities. The material was packaged in the form of popular articles, short videos, and interactive infographics that are easy to understand. A content evaluation by three health workers (doctors, HIV counselors, and nutritionists) stated that the content of the material was relevant, informative, and in accordance with the needs of the field. A total of 34 of 41 users (82,9%) stated that they gained new knowledge, especially regarding the types of foods that are recommended and what to avoid during ARV therapy (Maggini et al., 2018).

Online Health and Nutrition Consultation

This feature allows patients to conduct private online consultations with medical personnel and nutrition officers either through scheduled instant messaging or teleconsultation. This feature is very important, especially for patients with limited mobility or those who experience social barriers to coming directly to health facilities. During the two-week trial period, 21 medical consultation sessions and 14 nutrition consultation sessions were conducted. Officers reported that this feature sped up the treatment of symptoms of mild nutritional disorders, such as sudden weight loss or decreased appetite, as well as increased patient awareness in monitoring their nutritional status independently.

Application Implementation Impact

The implementation of the mHealth SEHAT+ application has shown a significant impact on the treatment behavior, nutritional awareness, and psychosocial well-being of users. Based on triangulation of data from field observations, in-depth interviews, and evaluative questionnaires of 41 PLHIVs, three main aspects of change were identified:

Increased Adherence to Medication and Healthy Eating

Of the 41 PLHIV who participated in the SEHAT+ application trial, 11 (26,8%) showed a high adherence to ARV consumption and followed the guidelines for a nutritious diet recommended by nutrition officers. The average ARV adherence score before the intervention was 62,3 (SD = 10,5), which increased to 84,9 (SD = 8,1) after intervention. Similarly, the mean nutritional intake score improved from 58,7 (SD] = 11,2) to 79,2 (SD = 9,6). The paired t-test showed that both improvements were significant ($p < 0,001$). This showed a 14,6% increase in compliance over the two-week intervention period.

This improvement is driven by the integration of structured medication consumption and meal reminder features as well as article- and video-based education that emphasizes the link between nutrition and the success of ARV therapy. The reminder feature not only helps patients avoid forgetting to take medication but also suggests appropriate meal times and types of food based on the principles of balanced nutrition. Nutrition education presented in a simple and contextual format helps users understand the consequences of poor food consumption as well as the importance of nutrition for maintaining an optimal immune system (Grosvenor & Smolin, 2017).

In addition, the in-app discussion forum encourages interaction between patients who share experiences related to how they cope with drug side effects with better dietary arrangements, such as increased consumption of fruits, vegetables, and fluids. These social interactions form a collective and supportive spirit that strengthens the motivation of users to undergo therapy and improves their daily eating behaviors.

Reduced Levels of Anxiety and Social Isolation related to Access to Nutrition Information and Emotional Support

The psychosocial impact of the SEHAT+ application was reflected by a significant reduction in anxiety levels and feelings of isolation as measured using the GAD-7 instrument. The average anxiety score decreased from 11.4 (moderate) before the intervention to 6,7 (mild) post-intervention.

This decline is not only due to social support through discussion forums but also to the availability of reliable and easy-to-understand information about HIV and nutrition. Many users state that, before using the app, they feel worried about the type of food that can and should not be consumed during therapy. After the intervention, they felt more confident because they could access food guides, ask nutrition officers directly through the

consultation feature, and discuss with fellow PLHIV without fear of stigma (Huber, 2021).

The online consultation feature provides a safe space for patients to share the nutritional issues they are facing—for example, loss of appetite, nausea after ARVs, or weight loss. Quick access to responses from health care workers contributes to reducing anxiety and reinforcing patients' perceptions of self-control over their condition.

Improving Self-Efficacy in HIV Management and Nutritional Status

The majority of application users, 34 out of 41 patients (82,9%), stated that they felt more confident in managing their health conditions after using the SEHAT+ application. This increase in self-efficacy concerns not only adherence to ARV therapy but also the ability to understand and apply basic nutritional principles in daily life.

Nutrition education features such as short articles, visual videos, and illustrations on the composition of healthy foods, the role of micronutrients, and the effect of food on the effectiveness of ARVs are helpful for patients with low health literacy. Many participants stated that they had just learned the importance of eating before taking medication, the benefits of plant and animal proteins, and simple ways to increase calorie intake during weight loss.

Furthermore, the discussion forum in the application serves as a forum for collective learning, where participants exchange recipes, share tips for cooking healthy foods with affordable ingredients, and encourage each other to maintain a balanced lifestyle. The synergy between individual learning from educational features and social learning from the community creates an empowerment ecosystem that strengthens patients' psychological readiness and adaptive behavior.

Table 1. Summary of the Impact of the implementation of the SEHAT+ application on PLHIV at the Bandarharjo Health Center

Variable	Before intervention (n=41)	After Intervention (n=41)	Δ Changes
ARV Adherence Score	Mean = 62,3 (SD = 10,5)	Mean = 84,9 (SD = 8,1)	Δ Mean = +22,6 p < 0,001
Nutritional Intake Score	Mean = 58,7 (SD = 11,2)	Mean = 79,2 (SD = 9,6)	Δ Mean = +20,5 p < 0,001
Self-Efficacy (positive perception)	21 people (51,2%) felt able to	34 people (82,9%) felt able to	+31,7%
Discussion Forum Activities	0 (not yet active)	28 active people (68,3%)	+68,3%

These findings were statistically supported by paired t-tests, confirming significant improvements in both adherence and dietary intake with SEHAT+ intervention ($p < 0,001$). The findings of this study are in line with various previous studies that confirm the effectiveness of the mobile health (mHealth) approach as a long-term assistance strategy for patients with chronic diseases, including HIV/AIDS.

However, this study expands this perspective by emphasizing that the effectiveness of mHealth is not only limited to improving medication adherence but also plays an important role in strengthening the nutritional aspects of patients. In the context of HIV/AIDS management, where good nutritional status has been shown to correlate positively with the immune response and the success of ARV therapy, an approach that integrates nutrition education and nutrition monitoring is crucial (Kini & Ho, 2018).

A study by van der Kop et al. in Kenya showed that short-message-based interventions (SMS) can significantly improve patient adherence to ARV therapy (van der Kop et al., 2018; Fitriani et al., 2023). Although the study focused on medication reminders, these findings reinforce the understanding that ongoing digital support, even in a simple form, is capable of transforming patients' health behaviors. This study further developed these findings by proving that mHealth interventions that include nutrition education components, meal reminders, and food recording features can have a broader impact on disease management and improved quality of life.

In the Indonesian context, the effectiveness of the mHealth approach has also been locally proven. Research by Watkins and Baulch in Jakarta showed that mobile applications with educational and reminder

features increased the involvement of PLHIV in long-term treatment and improved patients' self-perception of therapy (Watkins & Baulch, 2018; Garg et al., 2020). However, this study did not explicitly include nutritional components. In this study, the SEHAT+ application not only succeeded in increasing adherence to ARV drinking schedules but also encouraged changes in eating behavior by providing information on healthy eating, the benefits of micronutrients, and the management of ARV side effects through appropriate nutritional intake. These results show that mHealth can be used as a dynamic nutrition education tool that can be personalized according to patient needs.

The local context at the Bandarharjo Health Center, Semarang, provides a powerful illustration of how mHealth can function optimally when developed in a participatory manner and rooted in the needs of the community (McLean, 2020). SEHAT+ has been proven to address various structural challenges in HIV/AIDS services at the primary level, including the limited number of nutrition counselors, geographical distance, and transportation barriers that often hinder patients from attending regularly. Moreover, the social stigma that often makes PLHIV reluctant to directly access services can be overcome through digital features that provide a safe and anonymous space to ask questions, discuss, and obtain relevant emotional support and education.

The SEHAT+ application has also been proven to bridge the gap in nutrition knowledge that has often been overlooked in handling HIV/AIDS. Many patients do not understand the importance of eating before taking medication, how to manage their decreased appetite, or how to increase protein and calorie intake to maintain an ideal weight. Through educational features and in-app discussion forums, this information is delivered contextually and easily, even in patients with low nutritional literacy (Haddad & Gillespie, 2001). This reinforces the role of mHealth not only as a reminder of drug consumption but also as a nutritional companion tool capable of shaping healthy eating behaviors in the long term (Metcalf & Krohn, 2021).

With a flexible, personalized, and community-based approach, mHealth shows great potential as an innovation adaptive to local contexts, especially in resource-constrained communities. Therefore, the integration of the mHealth system into health center services by strengthening the education and nutrition monitoring components should be considered as part of the national strategy to strengthen the response to HIV/AIDS and other chronic diseases. This approach not only improves clinical outcomes but also empowers patients to manage their health holistically.

Conclusion

The findings of this study confirm that the SEHAT+ Android-based mobile health (mHealth) application has a significant positive impact on improving the treatment adherence, nutritional behavior, and psychosocial well-being of People Living with HIV/AIDS (PLHIV) in the working area of the Bandarharjo Health Center, Semarang. Statistical results using paired t-tests confirmed that SEHAT+ significantly improved ARV adherence and nutritional intake among PLHIV.

By integrating features, such as ARV medication reminders, daily food tracking, multimedia-based health and nutrition education, online discussion forums, and direct consultation with healthcare providers, the application provides a comprehensive support system that addresses both medical and nutritional needs. The results showed increased ARV compliance, a better understanding of balanced nutrition, reduced anxiety levels, and enhanced self-efficacy among users. This indicates that mHealth can serve as an effective tool to support holistic, patient-centered HIV care at the primary healthcare level.

It is recommended that SEHAT+ be adopted more widely in community health settings to support long-term HIV treatment and nutritional management. Future developments should focus on expanding interactive features using artificial intelligence (AI), integrating the platform with electronic medical records, and providing personalized nutritional recommendations. Larger-scale and longer-duration studies are suggested to validate and strengthen these findings in different healthcare contexts.

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