EVALUATING THE IMPACT OF THE NYALA APP ON DEPRESSIVE SYMPTOMS AND SUICIDAL RISK AMONG ADOLESCENTS

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Disubmit: 19 Oktober 2025 Diterima: 29 November 2025 Diterbitkan: 01 Desember 2025
Doi: https://doi.org/10.33024/mnj.v7i12.23168

ABSTRACT

Adolescent depression and suicide remain pressing global health concerns, particularly in low- and middle-income countries where access to mental health services is limited. Digital interventions have emerged as promising, accessible, and stigma-free alternatives for promoting youth mental health. This study aimed to evaluate the impact of the Nyala app on depressive symptoms and suicidal risk among adolescents. A posttest-only control group design was employed involving 40 adolescents aged 12–15 years from a private junior high school in Surakarta. Participants were divided into intervention (n = 20) and control (n = 20) groups. The intervention group used the Nyala app—which integrates psychoeducation, mood tracking, thought diary, and SOS crisis support—for two weeks. Depressive symptoms and suicidal risk were measured using the PHQ-9 and SBQ-R. Data were analyzed using the Mann–Whitney U test. The intervention group showed significantly lower mean scores for depressive symptoms (M = 2.35, SD = 2.64) compared to the control group (M = 8.50, SD = 7.02; $p < 0.001$). Similarly, suicidal risk scores were lower in the intervention group (M = 4.00, SD = 0.00) than in the control group (M = 4.55, SD = 2.84; $p < 0.001$). The Nyala app effectively reduced depressive symptoms and suicidal risk among adolescents. These findings support the integration of digital tools like Nyala into adolescent mental health services, especially in resource-limited and stigma-sensitive settings.

Keywords: Adolescent Mental Health, Depression, Suicide Risk, Digital Intervention, Mobile Health, Nyala App.

INTRODUCTION

Adolescents face substantial mental health challenges, with suicide identified as the second leading cause of death among individuals aged 10–24 years (Antonio et al., 2020). Depression plays a major role in this statistic, being strongly linked to suicidal ideation and attempts (Findling et al., 2017). Individuals with depressive disorders are nearly five times more likely to experience suicidal thoughts than those without depression (Kesehatan Republik Indonesia, 2023).

Globally, concern for children's and adolescents' mental health is increasing due to its

profound impact on emotional, social, and cognitive development (Fernández-Batanero et al., 2025). About 450 million people experience mental or neurological disorders, with 154 million suffering from depression. In low- and middle-income countries, adolescents are particularly vulnerable to depression, anxiety, and stress, with risks often exacerbated by factors such as adolescent pregnancy (Fernández-Batanero et al., 2025). Evidence also shows a high prevalence of these disorders among youth (Mbithi et al., 2025).

According to the 2023 Indonesian Mental Health Survey, in Indonesia, depression prevalence in 2023 was 1.4%, highest among youth aged 15–24 (2%). The proportion of young people (aged 15–24) with depression who had suicidal thoughts in the past month was 61%, which is 36 times higher than those without depression (1.7%). Depression is a leading cause of disability and suicide—the fourth leading cause of death among adolescents worldwide. Many cases remain undiagnosed and untreated, highlighting the need for early detection and accessible interventions (Kesehatan Republik Indonesia, 2023).

The growing gap between mental health needs and service availability is especially concerning. Increasing wait times for care, even among those with mild-to-moderate suicidal ideation, highlight the urgent demand for timely and accessible interventions (Kennedy et al., 2025). For instance, Malaysia recorded 1,081 suicide attempts in 2020, a sharp increase from pre-pandemic levels. Studies among Malaysian university students reported heightened levels of depression, anxiety, and stress during the pandemic, with prevalence rates surpassing pre-COVID-19 figures, further indicating vulnerability to psychosocial deterioration (Hasan et al., 2023). Similar upward trends in adolescent depression and suicidality have been observed worldwide, with 19.6% to 30.6% of adolescents experiencing depression and 18% to 26.4% reporting suicidal ideation (Hou et al., 2022). This burden is projected to result in 42 million lost years of healthy life globally for adolescents by 2030 (dos Santos & dos Santos, 2025).

Adolescence represents a critical period as nearly 70% of mental disorders emerge before the age of 18, with many persisting into adulthood (Mougharbel et al., 2023). Currently, approximately 792 million people worldwide live with a mental disorder, accounting for 16% of the total disease burden among those aged 10–19 years (Mabrouk et al., 2022). Clinically significant depression and anxiety symptoms are now reported in about 25% and 20% of adolescents, respectively (Fält-Weckman et al., 2024). These figures underscore the urgent need for innovative, accessible, and youth-friendly mental health interventions (Gopinathan et al., 2022; Hasan et al., 2023).

Digital mental health solutions have emerged as promising approaches to address this crisis. Technologies such as mobile apps, chatbots, telemedicine, serious games, and virtual reality have shown potential in alleviating depression and anxiety, although their efficacy may vary by condition (Chen et al., 2024). Mobile applications are particularly appealing for adolescents due to their accessibility, scalability, cost-effectiveness, and alignment with youth's high engagement with smartphones (Andersson & Titov, 2014; Buntrock, 2024). Evidence suggests that digital interventions,

especially computerized cognitive behavioral therapy, can achieve outcomes comparable to traditional face-to-face therapy for depression and anxiety (Balcombe & Leo, 2022; Ferrari et al., 2022).

The data reported that only a quarter of individuals with mental illness receive psychological support, with far fewer accessing care in low- and middle-income countries (Marciano et al., 2023). This disparity highlights the importance of scalable, evidence-based digital interventions capable of bridging socioeconomic and geographical barriers (Stiles-Shields et al., 2023). Moreover, participatory design that incorporates adolescents' voices is essential to ensure relevance, cultural sensitivity, and adherence, particularly for marginalized populations (Litke et al., 2023).

Although digital interventions have demonstrated effectiveness in reducing depression and anxiety among youth (Chen et al., 2024; Ferrari et al., 2022), several limitations persist. First, most studies have been conducted in high-income contexts, leaving little evidence on their impact in low- and middle-income countries where the need is greatest (Marciano et al., 2023). Second, many interventions fail to integrate suicide-prevention features, despite suicide being a leading cause of adolescent mortality (Kennedy et al., 2025). Third, cultural sensitivity and youth participation in app design remain limited, reducing engagement and adherence (Litke et al., 2023). These gaps underscore the urgent need for scalable, youth-centered, and contextually relevant digital solutions that address both depression and suicide risk among adolescents.

The *Nyala* app was developed in response to this need. It integrates preventive strategies, therapeutic tools, and an SOS feature for crisis situations, tailored to adolescents' unique challenges and digital behaviors. This study therefore aims to evaluate the impact of the *Nyala* app on adolescents' depression and suicide risk.

LITERATURE REVIEW

Adolescent Mental Health

Adolescence is a transitional phase marked by rapid physical, emotional, and social changes, increasing vulnerability to mental health problems such as depression and suicidal ideation (Blakemore, 2019; Kapadia, 2024; Paruk & Karim, 2016). According to Erikson's psychosocial theory, adolescents face the crisis of identity versus role confusion; unresolved conflicts may lead to emotional instability (Zhang, 2015). The WHO reports that one in seven adolescents experiences mental disorders, with depression being the leading cause of illness and suicide a major cause of death. Addressing these issues requires accessible, youth-friendly interventions emphasizing early detection, emotional education, and crisis support (Patel et al., 2018).

Depression and Suicidal Risk Among Adolescents

Depression among adolescents manifests as persistent sadness, irritability, and loss of interest (Ghazal et al., 2025). Its causes are multifactorial—biological, cognitive, and environmental (Qian, 2023; Yin et al., 2025). Prolonged depression elevates suicidal risk, often triggered by perceived burdensomeness and social disconnection (Grossberg & Rice, 2022; Phan et al., 2022). Limited access to care and stigma further worsen these risks, especially in low-

and middle-income countries (Herrman et al., 2022; Lovero et al., 2023).

Digital Interventions for Adolescent Mental Health

Digital interventions have emerged as effective, accessible, and stigma-free solutions for addressing adolescent mental health issues. Mobile health (mHealth) applications that incorporate psychoeducation, self-monitoring, and mood-tracking features have been shown to reduce depressive symptoms and improve emotional regulation among adolescents (Badesha et al., 2022; Bantjes, 2022; Marciano et al., 2023; Mens et al., 2022; O'Dea et al., 2024; Willems et al., 2024). Studies indicate that such digital platforms offer flexibility, anonymity, and affordability, making them especially suitable for young people who may hesitate to seek traditional therapy (Fernández-Batanero et al., 2025; Jones, Hussain, et al., 2022; Jones, Merry, et al., 2022; Marinova et al., 2021; Opie et al., 2024; Wright et al., 2023).

RESAERCH METHOD

This study employed a posttest-only control group design. The research was conducted over a two-week period (October 1–14, 2025) at a private junior high school in Surakarta. A total of 40 adolescents aged 10–19 years were selected based on inclusion criteria: access to a smartphone and informed consent (with parental consent for minors). Participants were divided into two groups, with 20 in the intervention group and 20 in the control group.

The intervention group received access to the *Nyala* app, which features psychoeducation, mood tracking, depression symptoms and risk of suicide screening, a thought diary, and an SOS function. Participants were encouraged to use the app daily for two weeks. The control group received no digital intervention during the study period.

Depressive symptoms and suicide risk were assessed at baseline and at a two-week follow-up using the Patient Health Questionnaire-9 (PHQ-9) and Suicidal Behaviors Questionnaire-Revised (SBQ-R). The Mann–Whitney U test was performed to evaluate differences both within and between groups.

Ethical approval for this study was obtained from the Research Ethics Committee of Universitas Muhammadiyah PKU Surakarta. Written informed consent and parental consent were obtained before participation.

RESEARCH RESULTS

Table 1. Demographic Characteristics Of Adolescents By Age (N=40)

Characteristic	Groups	n	Mean	SD	Min-Max
Age	Intervention	20	12.95	0.83	12-15
	Control	20	13.65	0.93	12-15

Table 1 presented the demographic characteristics of adolescents based on age. The intervention group consisted of 20 participants with a mean age of 12.95 years (SD = 0.83), ranging from 12 to 15 years. Similarly, the control group included 20 participants with

a mean age of 13.65 years (SD = 0.93), also ranging from 12 to 15 years. Overall, both groups were comparable in terms of age distribution.

Table 2. Demographic characteristics of adolescents by gender and family income (N=40)

Characteristics	Categories	Intervention Group		Control Group	
		n	%	n	%
Gender	Male	10	50	12	60
	Female	10	50	8	40
Family Income	<City Minimum Wage	7	35	11	55
	=City Minimum Wage	12	60	6	30
	>City Minimum Wage	1	5	3	15

Table 2 showed the distribution of participants by gender and family income. In the intervention group, there were equal proportions of males (50%) and females (50%), while in the control group, males accounted for 60% and females 40%. Regarding family income, most participants in the intervention group had a family income equal to the city minimum wage (60%), followed by below the minimum wage (35%) and above the minimum wage (5%). In contrast, in the control group, 55% of participants had a family income below the city minimum wage, 30% equal to it, and 15% above it.

Table 3. Differences Of Depressive Symptoms And Suicidal Risk Between The Intervention And Control Groups (N=40)

Variables	Groups	n	Mean	SD	p-value
Depressive symptoms	Intervention	20	2.35	2.64	0.000
	Control	20	8.50	7.02	
Suicidal Risk	Intervention	20	4.00	0.00	0.000
	Control	20	4.55	2.84	

Table 3 summarized the differences in depressive symptoms and suicidal risk between the intervention and control groups. The mean depressive symptom score in the intervention group was 2.35 (SD = 2.64), significantly lower than the control group's mean score of 8.50 (SD = 7.02) (p = 0.000). Similarly, the mean suicidal risk score was 4.00 (SD = 0.00) in the intervention group and 4.55 (SD = 2.84) in the control group, with a statistically significant difference (p = 0.000). These findings indicate that the intervention had a positive effect in reducing depressive symptoms and suicidal risk among adolescents.

DISCUSSION

The participants in this study were early to mid-adolescents aged 12 to 15 years, with an average age of approximately 13 years. This developmental phase represents a critical period of heightened emotional sensitivity, identity exploration, and vulnerability to mental health issues (Ruan et al., 2023). According to Erikson's

psychosocial theory, adolescents experience the stage of identity versus role confusion, during which emotional instability, self-doubt, and the search for self-definition are common (Nebhinani & Jain, 2019; Zhang, 2015). The relatively homogeneous age distribution between groups ensures that developmental differences did not act as confounding variables, allowing the intervention effects to be more confidently attributed to the *Nyala* app. Adolescents at this age also possess sufficient cognitive maturity to engage in reflective, self-directed learning and expressive activities, which are central to the *Nyala* app's digital mental health framework (Wright et al., 2023).

In terms of gender composition, both groups displayed a nearly balanced distribution between male and female participants. Such balance is important, as gender differences may influence the way adolescents express and cope with psychological distress. Research indicates that girls tend to internalize emotional struggles, often resulting in depressive symptoms, while boys are more likely to exhibit externalizing behaviors (Kökönyei et al., 2023; Olivier et al., 2022). Maintaining a balanced gender ratio strengthens the study's validity and reduces the risk that results were disproportionately influenced by gender-related emotional or behavioral patterns (Singh et al., 2021).

Socioeconomic diversity was also represented in this study, with participants coming from families earning below, equal to, or above the city's minimum wage. Socioeconomic status (SES) is a key contextual factor affecting adolescent mental health, as those from lower-income families are often exposed to higher psychosocial stressors—such as economic strain, parental tension, and reduced access to mental health care (Robins et al., 2024). Despite these challenges, adolescents in the intervention group achieved better psychological outcomes, suggesting that digital tools like the *Nyala* app can bridge the SES gap by providing low-cost, accessible, and stigma-free support (Osborn et al., 2020; Wright et al., 2023). This finding highlights the potential for equitable implementation of digital mental health interventions in resource-limited settings.

Following the intervention, adolescents who used the *Nyala* app reported substantially lower depressive symptoms and suicidal risk than those in the control group. The decline in depressive symptom scores among *Nyala* users underscores the therapeutic benefits of digital expressive and reflective practices. Through psychoeducational materials—such as videos and articles—the app promotes emotional literacy, helping adolescents identify, understand, and regulate their feelings. This aligns with growing evidence that digital interventions can effectively alleviate depressive and anxiety symptoms in youth through engaging, self-paced, and accessible platforms (Osborn et al., 2020). Such tools also help reduce barriers to conventional care, including stigma, cost, and limited availability of trained mental health professionals (Allen & Boyle, 2018; Stiles-Shields et al., 2024).

One distinctive feature of the *Nyala* app is its SOS function, which connects users to designated contacts or mental health professionals during crises. This immediate access to support can be life-saving, particularly since delays in crisis response often worsen outcomes for adolescents in distress.

The privacy and accessibility of digital interventions further enhance early help-seeking behaviors, reducing the stigma associated with traditional mental health services (Osborn et al., 2020). Adolescents may also find such anonymous and user-driven support systems more approachable, especially when privacy concerns or geographical barriers limit access to in-person care (Jones, Hussain, et al., 2022; Jones, Merry, et al., 2022).

Additionally, *Nyala*'s mood-tracking and thought-diary features enable adolescents to engage in continuous self-monitoring—an essential skill for emotional regulation. Regularly identifying and reflecting on emotions fosters greater self-awareness and supports adaptive coping strategies (Au-Yeung et al., 2023; Badesha et al., 2022). Based on Gross's emotion regulation model, developing emotional awareness is a prerequisite for effective regulation. Thus, these features may empower adolescents to detect negative thought patterns early and implement constructive responses (Reynard et al., 2022).

In contrast, adolescents in the control group—who did not receive any intervention—displayed higher average levels of depressive symptoms and suicidal risk. This aligns with prior studies showing that adolescents without structured psychological support are more prone to prolonged emotional distress and maladaptive coping (Kruzan et al., 2024; Välimäki et al., 2017). The observed difference between groups indicates that *Nyala* not only reduces depressive tendencies but may also function as a preventive tool against the escalation of suicidal ideation.

Overall, these findings reaffirm the biopsychosocial understanding of adolescent mental health, which emphasizes the interaction between biological, psychological, and social domains. The *Nyala* app embodies this integrative model by combining mental health screening, psychoeducation, emotional expression, digital self-monitoring, and crisis response. Its effectiveness among adolescents from diverse socioeconomic backgrounds illustrates its scalability and cultural adaptability in the Indonesian context. By addressing multiple determinants of well-being, *Nyala* presents a holistic, affordable, and accessible approach to adolescent mental health promotion (Allen & Boyle, 2018).

These results have important implications for mental health service delivery. Digital-based interventions like *Nyala* can complement conventional counseling, particularly in schools and communities where mental health professionals are limited. The app's private, user-friendly, and culturally attuned design allows adolescents to manage emotional challenges independently yet safely. Future research should expand the sample size, incorporate longitudinal assessments, and explore qualitative feedback to better understand user engagement, sustainability, and the long-term impact of digital emotional-support platforms.

CONCLUSION

The results of this study indicate that the *Nyala* app is an effective digital intervention for reducing depressive symptoms and suicidal risk among adolescents. By integrating psychoeducation, self-monitoring, expressive writing, and crisis support, the app promotes emotional regulation and psychological resilience. Its

effectiveness across gender and socioeconomic groups highlights its inclusivity and scalability. These findings support the use of digital mental health tools as complementary resources in adolescent mental health services, particularly in low-resource or stigma-sensitive contexts.

Conflict Of Interest

The authors declare that there is no conflict of interest regarding the publication of this article. The funding agency had no role in the design of the study, data collection, analysis, interpretation, or decision to publish the results.

Acknowledgment

This research was funded by the Directorate General of Higher Education, Science, and Technology (Kemendiktisaintek) throughthe DPP M Research Grant Program, Fiscal Year 2025. The authors would like to express their sincere gratitude to all participating adolescents, school authorities, and research assistants for their valuable contribution. Appreciation is also extended to the institutional ethics committee for their constructive feedback and support throughout the study.

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