Oral health and physical activity: their combined effect on health-related quality of life in student's in islamic boarding schools

Salud bucal y actividad física: su efecto combinado en la calidad de vida relacionada con la salud en estudiantes de internados islámicos

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Abstract

Background: Oral health and physical activity are important determinants of adolescents' quality of life, particularly in boarding school environments. However, studies integrating both factors remain limited.
Objective: This study aimed to analyze the combined effect of oral health status and physical activity level on health-related quality of life among students.
Methods: A cross-sectional observational study was conducted among 120 students at Pondok Pesantren Kumpeh Daaru Attauhid, Muaro Jambi Regency, Indonesia. Oral health status was assessed using the Oral Hygiene Index-Simplified (OHI-S), physical activity was measured using a structured questionnaire, and health-related quality of life was evaluated using a validated instrument. Data were analyzed using ANOVA and multiple linear regression with a significance level of $p < 0.05$.
Results: Students with good oral health had higher quality-of-life scores (78.4 ± 6.8) than those with moderate (71.6 ± 7.9) and poor oral health (65.2 ± 8.5) ($p = 0.001$). Higher physical activity levels were also associated with better quality of life (79.2 ± 6.5 for high activity vs. 66.1 ± 8.3 for low activity; $p = 0.002$). Multivariate analysis showed that oral health status ($\beta = -0.31$; $p = 0.001$) and physical activity level ($\beta = 0.35$; $p = 0.001$) were independent predictors of health-related quality of life.
Conclusion: Oral health status and physical activity level significantly influence health-related quality of life among boarding school students and should be prioritized in school-based health promotion programs.

Keywords

Activity; health-related quality of life; oral health; physical activity; students.

Resumen

Antecedentes: La salud bucal y la actividad física son determinantes importantes de la calidad de vida de los adolescentes, particularmente en entornos de internados. Sin embargo, los estudios que integran ambos factores siguen siendo limitados.
Objetivo: Este estudio tuvo como objetivo analizar el efecto combinado del estado de salud bucal y el nivel de actividad física sobre la calidad de vida relacionada con la salud en estudiantes.
Métodos: Se realizó un estudio observacional de corte transversal en 120 estudiantes del Pondok Pesantren Kumpeh Daaru Attauhid, Regencia de Muaro Jambi, Indonesia. El estado de salud bucal se evaluó mediante el Índice de Higiene Oral Simplificado (OHI-S), la actividad física se midió mediante un cuestionario estructurado y la calidad de vida relacionada con la salud se evaluó utilizando un instrumento validado. Los datos se analizaron mediante ANOVA y regresión lineal múltiple con un nivel de significación de $p < 0,05$.
Resultados: Los estudiantes con buena salud bucal presentaron puntuaciones más altas de calidad de vida (78,4 ± 6,8) en comparación con aquellos con salud bucal moderada (71,6 ± 7,9) y deficiente (65,2 ± 8,5) ($p = 0,001$). Los niveles más altos de actividad física también se asociaron con una mejor calidad de vida (79,2 ± 6,5 para actividad alta frente a 66,1 ± 8,3 para actividad baja; $p = 0,002$). El análisis multivariado mostró que el estado de salud bucal ($\beta = -0,31$; $p = 0,001$) y el nivel de actividad física ($\beta = 0,35$; $p = 0,001$) fueron predictores independientes de la calidad de vida relacionada con la salud.
Conclusión: El estado de salud bucal y el nivel de actividad física influyen significativamente en la calidad de vida relacionada con la salud de los estudiantes de internados y deben priorizarse en los programas de promoción de la salud basados en la escuela.

Palabras clave

Actividad, calidad de vida relacionada con la salud; salud bucal; actividad física; estudiantes.

Introduction

Oral health and physical activity are two fundamental components of overall health that play a crucial role in determining health-related quality of life, particularly among school-aged populations (Chacón-Cuberos et al., 2021; Zurita-Ortega et al., 2020). Oral health is not limited to the absence of dental disease, but encompasses the ability to eat, speak, and socialize without pain or discomfort, thereby influencing physical, psychological, and social well-being. Meanwhile, physical activity contributes significantly to physical fitness, functional capacity, mental health, and social interaction (Petersen & Ogawa, 2019). In educational settings, especially during adolescence, the interaction between oral health and physical activity becomes increasingly important, as both factors can directly affect students' daily functioning, learning capacity, and quality of life (Chimbinha et al., 2023).

From a holistic health perspective, health-related quality of life reflects an individual's subjective perception of how physical, psychological, and social dimensions of health influence daily life (Yuliana et al., 2024). Poor oral health conditions such as dental pain, caries, or gingival problems may reduce students' willingness and ability to participate in physical activities, including physical education and recreational sports. Conversely, low levels of physical activity may be associated with unhealthy lifestyle behaviors, including poor dietary habits and inadequate oral hygiene practices. Understanding the combined effect of oral health and physical activity is therefore essential to promote comprehensive health strategies within educational institutions (Cifuentes et al., 2025; Rahmadhani et al., 2026).

Globally, oral health problems remain among the most prevalent non-communicable conditions affecting children and adolescents, with dental caries and periodontal diseases continuing to pose significant public health challenges (Krisdapong & Prasertsom, 2022). At the same time, global reports indicate insufficient levels of physical activity among adolescents, with many failing to meet recommended physical activity guidelines. These two health issues frequently coexist and have been independently associated with reduced health-related quality of life. However, their combined influence on students' well-being has received limited attention, particularly in school-based and residential educational settings (Bull et al., 2020; Petersen & Ogawa, 2019).

Several studies conducted in boarding school settings and other educational environments with distinctive characteristics indicate that collective living arrangements, high residential density, strict daily schedules, and limited access to health services may influence students' health behaviors (Purnama et al., 2021). Research in boarding schools in Southeast Asia has reported a higher prevalence of dental caries compared to non-boarding schools, which has been associated with frequent consumption of sugary foods and suboptimal oral hygiene practices (for example, studies conducted in boarding schools in Thailand and Malaysia) (Peltzer & Pengpid, 2014).

Other studies focusing on adolescents in religious educational environments have shown that intensive worship schedules and demanding academic activities are associated with lower levels of structured physical activity, despite the presence of disciplined and routine daily activities. Furthermore, investigations examining quality of life among boarding school students have demonstrated that social and cultural environmental factors significantly contribute to students' perceptions of physical and psychosocial well-being (Da'i. M, Rahamdhan N, 2024).

These findings suggest that institutional and cultural contexts should be carefully considered when analyzing the determinants of health and quality of life among boarding school populations (Wasan & Prayudho, 2024).

In Indonesia, oral health problems among children and adolescents are still highly prevalent, with national surveys reporting substantial levels of untreated dental caries and poor oral hygiene behaviors. Similarly, national data highlight low physical activity levels among school-aged children, especially in structured educational environments with demanding academic and religious routines (Puteri et al., 2023; Ramadhan, 2024). In Islamic boarding schools (pondok pesantren), students often experience unique daily schedules that may limit opportunities for structured physical activity while simultaneously influencing dietary patterns and oral hygiene practices. Preliminary observations at Pondok Pesantren Kumpeh Daaru Attauhid in Muaro Jambi Regency suggest that students commonly experience oral health complaints and varying levels of physical activity participation, which may affect their perceived quality of life.

Despite the recognized importance of oral health and physical activity, a phenomenon gap remains regarding how these two factors interact to influence health-related quality of life among students in Islamic boarding schools. Most health programs in pesantren settings tend to focus separately on either religious education or general health promotion, without integrating oral health and physical activity as interconnected determinants of students' well-being. This separation may result in missed opportunities to enhance students' overall quality of life through comprehensive, school-based health interventions (Guthold et al., 2020; Krisdapong & Prasertsom, 2022).

In terms of research, previous studies have predominantly examined oral health or physical activity as isolated variables affecting quality of life. Limited evidence is available on their combined effect, particularly within the context of boarding schools, where students live and study in a controlled environment with specific cultural, social, and behavioral characteristics. Furthermore, studies focusing on Islamic boarding schools in Indonesia are scarce, creating a research gap related to contextualized evidence that reflects the unique lifestyle and health challenges faced by pesantren students.

The urgency of this study lies in the need to provide empirical evidence that supports integrated health promotion strategies within educational institutions, especially Islamic boarding schools. By identifying the combined impact of oral health and physical activity on health-related quality of life, this study can inform school administrators, health educators, and policymakers about the importance of holistic health approaches. Such evidence is essential for developing effective interventions that simultaneously promote oral hygiene behaviors and active lifestyles, ultimately improving students' well-being and academic participation.

The novelty of this study is reflected in its integrated approach, examining oral health and physical activity together as joint determinants of health-related quality of life within an Islamic boarding school context. Unlike previous studies that focus on single health domains, this research provides a comprehensive perspective tailored to the pesantren environment. The aim of this study is to analyze the combined effect of oral health status and physical activity levels on health-related quality of life among students at Pondok Pesantren Kumpeh Daaru Attauhid, Muaro Jambi Regency, Jambi Province, Indonesia. The findings are expected to contribute both theoretically, by enriching the literature on school-based health and quality of life, and practically, by supporting the development of integrated health promotion programs in Islamic boarding schools.

Method

This study employed an analytic observational design with a cross-sectional approach to analyze the combined effect of oral health status and physical activity level on health-related quality of life among students. The cross-sectional design was selected because it allows the measurement of exposure and outcome variables simultaneously at a single point in time, making it appropriate for identifying relationships and interaction patterns between oral health, physical activity, and quality of life within a boarding school context (Creswell & Creswell, 2023; Polit & Beck, 2021). The study was conducted at Pondok Pesantren Kumpeh Daaru Attauhid, located in Muaro Jambi Regency, Jambi Province, Indonesia. This setting was chosen because the boarding school system provides a relatively homogeneous living environment and daily routine among students. Data collection took place from May to June 2025 during the active academic period, ensuring stable student attendance and daily activities. This research setting enabled controlled observation of physical activity patterns, oral hygiene practices, and students' perceptions of quality of life within the pesantren environment.

The study population consisted of all students registered and residing at Pondok Pesantren Kumpeh Daaru Attauhid during the study period. The study sample included students who met the inclusion criteria, namely being aged 12–18 years, residing full-time in the boarding school, willing to participate as respondents, and having obtained written informed consent from parents or guardians as well as assent from the students themselves. Exclusion criteria included students undergoing orthodontic treatment, those with systemic diseases affecting oral health or physical activity capacity, and students experiencing acute illness during data collection, in order to minimize measurement bias and potential confounding factors.

Sampling was conducted using proportional random sampling to ensure adequate representation of students based on grade level and age group. Sample size was determined using a formula for cross-sectional studies, taking into account a moderate effect size between oral health and quality of life, a 95% confidence level, and 80% statistical power. An additional margin was included to anticipate potential non-response or incomplete data, resulting in a total sample size considered sufficient to detect statistically significant associations.

The primary outcome of this study was health-related quality of life (HRQoL), defined as students' perceptions of their physical, psychological, and social well-being related to their health status. HRQoL was measured using the Pediatric Quality of Life Inventory (PedsQL™ 4.0 Generic Core Scales), developed by Varni et al. (2001), a widely used and validated instrument for adolescent populations. The questionnaire consists of 23 items covering four domains: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). Responses are recorded on a 5-point Likert scale (0 = never a problem to 4 = almost always a problem) and transformed to a 0–100 scale, with higher scores indicating better quality of life. The PedsQL has demonstrated good internal consistency (Cronbach's alpha > 0.70) and construct validity in various adolescent populations, including cross-cultural settings. The Indonesian version has previously undergone linguistic validation and reliability testing.

The main exposure variables were oral health status and physical activity level. Oral health status was assessed using the Oral Hygiene Index-Simplified (OHI-S) developed by (Greene & Vermillion (1964), which evaluates the presence of debris and calculus on six index teeth and provides a quantitative oral hygiene score ranging from 0 to 6. Scores were categorized according to standard criteria: good (0.0–1.2), fair (1.3–3.0), and poor (3.1–6.0). The OHI-S has been widely used in epidemiological studies and has demonstrated acceptable validity and inter-examiner reliability in adolescent populations.

Physical activity level was measured using the Physical Activity Questionnaire for Adolescents (PAQ-A) developed by Kowalski et al. (2004), a self-administered, 7-day recall instrument designed to assess general levels of physical activity among adolescents aged 14–19 years. The PAQ-A consists of nine items scored on a 5-point scale, with the final score calculated as the mean of the items, resulting in a score ranging from 1 (low activity) to 5 (high activity). The instrument has demonstrated good internal consistency (Cronbach's alpha approximately 0.80) and test–retest reliability. The Indonesian-adapted version has shown acceptable psychometric properties in previous studies. Copies of the PedsQL, OHI-S assessment form, and PAQ-A questionnaire are provided as supplementary appendices to ensure transparency and reproducibility.

In addition to the main variables, several predictor variables and potential confounders were examined, including age, sex, length of stay in the boarding school, frequency of sweet food consumption, and oral hygiene behaviors such as toothbrushing frequency. These variables were selected based on theoretical considerations and empirical evidence from previous studies demonstrating their association with oral health and quality of life. Potential effect modifiers, such as sex and age group, were also analyzed to assess whether the relationships between oral health, physical activity, and quality of life differed across specific subgroups.

Oral health assessment followed standard OHI-S diagnostic criteria to ensure consistency and comparability of measurements. Data sources included direct oral examinations conducted by trained examiners, self-administered questionnaires completed by students for physical activity and quality of life variables, and structured interviews to obtain demographic and health behavior data. All examiners underwent training and calibration prior to data collection to ensure inter-examiner reliability and consistency in oral health assessment. The same procedures and measurement instruments were applied to all respondents to maintain comparability and minimize measurement variability.

Several measures were undertaken to reduce potential sources of bias. Selection bias was minimized through random sampling techniques and clearly defined inclusion and exclusion criteria. Information bias was controlled by using validated instruments and standardized data collection procedures. Recall bias related to physical activity reporting was minimized by using a relatively short recall period and providing clear instructions to respondents prior to questionnaire completion. Examiner bias in oral health assessment was reduced through calibration procedures and strict adherence to standardized diagnostic criteria.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS). Prior to inferential analysis, a normality test was conducted on the main numerical variable, namely the health-related quality of life score, to ensure the appropriateness of parametric statistical tests. Given that the study included 120 respondents, the Kolmogorov–Smirnov test was used to assess normality. The results indicated that the health-related quality of life scores were normally distributed ($p > 0.05$), allowing the use of parametric analyses in subsequent stages.

Descriptive analysis was used to summarize respondent characteristics and variable distributions, presented as means and standard deviations for numerical data and frequencies and percentages for categorical data. Bivariate analysis was conducted using one-way Analysis of Variance (ANOVA) to examine differences in mean health-related quality of life scores across categories of oral health status and physical activity levels. ANOVA was chosen because the dependent variable was continuous and normally distributed, while the independent variables consisted of more than two categorical groups. Multivariate analysis was subsequently performed using multiple linear regression to assess the combined effects of oral health status and physical activity level on health-related quality of life while controlling for potential confounding variables, including age, sex, length of stay in the boarding school, and sweet food consumption patterns.

Categorical variables were entered into the multiple linear regression model using dummy coding procedures. For oral health status (good, fair, poor), "good" was treated as the reference category. For physical activity level, categories (low, moderate, high) were dummy coded with "high" as the reference group. Sex was coded as a binary variable (0 = female, 1 = male), and age group was categorized and entered using indicator variables. This approach allowed estimation of adjusted regression coefficients representing differences in HRQoL scores between categories while controlling for other predictors. Multicollinearity was assessed using Variance Inflation Factor (VIF), with values < 10 considered acceptable.

Multiple linear regression was selected based on the continuous and normally distributed nature of the outcome variable and the study's objective to identify independent predictors of health-related quality of life among students. Statistical significance was set at $p < 0.05$, and 95% confidence intervals were reported to strengthen interpretation and indicate the precision of the estimated associations.

Ethical Clearance

This study has obtained ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Jambi. Ethical approval was issued on March 5, 2025, with approval number No. LB.02.06/2/5/2025.

Results

Table 1 summarizes the demographic and behavioral profile of the participating students. The sample was predominantly composed of early adolescents, with a slight predominance of male students, and most participants had resided in the boarding school for more than one year, reflecting substantial exposure to the institutional environment. Regarding health-related behaviors, the majority of students reported brushing their teeth at least twice daily; however, a considerable proportion still demonstrated suboptimal oral hygiene practices. Furthermore, frequent consumption of sugary foods was reported by more than half of the participants, indicating the presence of modifiable behavioral factors that may influence oral health outcomes within this population.

Table 1. Characteristics of Students at Pondok Pesantren Kumpeh Daaru Attauhid

Variable	n	%
Age group (years)		
12–15	68	56.7
16–18	52	43.3
Sex		
Male	62	51.7
Female	58	48.3
Length of stay in boarding school		
≤ 1 year	34	28.3

> 1 year	86	71.7
Tooth brushing frequency		
< 2 times/day	38	31.7
≥ 2 times/day	82	68.3
Frequent sugary food consumption		
Yes	69	57.5
No	51	42.5

Table 2 outlines the overall patterns of oral health status, physical activity levels, and health-related quality of life among the participants. The findings indicate that most students were clustered within the moderate categories across the three main variables. Although a proportion of students demonstrated favorable oral health and high physical activity levels, a notable segment remained in the poorer categories, particularly with respect to oral health status and quality of life. These distributions suggest variability in health conditions and behaviors within the boarding school context, highlighting the presence of both protective and risk profiles among students. The concentration of respondents in the moderate categories may reflect a transitional health pattern, warranting further analysis of how oral health and physical activity interact in influencing students' perceived quality of life.

Table 2. Distribution of Oral Health Status, Physical Activity Level, and Health-Related Quality of Life

Variable	n	%
Oral Health Status (OHI-S)		
Good	34	28.3
Moderate	58	48.3
Poor	28	23.4
Physical Activity Level		
Low	36	30
Moderate	62	51.7
High	22	18.3
Health-Related Quality of Life		
Poor	26	21.7
Moderate	54	45
Good	40	33.3

Table 3 presents the results of the bivariate analysis assessing differences in health-related quality of life according to oral health status and physical activity level. A clear gradient pattern was observed, with better oral health corresponding to higher mean quality-of-life scores. Students classified in the good oral health category demonstrated the most favorable outcomes, whereas those in the poor category reported the lowest scores, and the overall variation between groups was statistically significant. A similar trend emerged for physical activity, where higher activity levels were associated with better perceived quality of life. Students in the high activity group consistently reported the most favorable scores, while those with low activity levels exhibited comparatively lower outcomes. The differences across physical activity categories were also statistically significant, supporting the presence of meaningful associations at the bivariate level.

Table 3. Bivariate Analysis of Oral Health Status and Physical Activity with Health-Related Quality of Life

Variable	Health-Related Quality of Life (Mean ± SD)	p-value
Oral Health Status (OHI-S)		
Good	78.4 ± 6.8	
Moderate	71.6 ± 7.9	0.001*
Poor	65.2 ± 8.5	
Physical Activity Level		
Low	66.1 ± 8.3	
Moderate	73.9 ± 7.4	0.002*
High	79.2 ± 6.5	

Bivariate analysis using ANOVA test; significance level $p < 0.05$.

Table 4 presents the results of the multivariate linear regression analysis assessing factors associated with health-related quality of life. After controlling for potential confounders, oral health status and physical activity level remained significant predictors of quality of life. Poorer oral health status was

independently associated with lower quality-of-life scores (β = −0.31; p = 0.001), whereas higher physical activity levels were associated with higher quality-of-life scores (β = 0.35; p = 0.001). Frequent consumption of sugary foods was also negatively associated with quality of life (β = −0.18; p = 0.017). In contrast, age, sex, and length of stay in the boarding school were not significantly associated with health-related quality of life. These findings indicate that oral health status and physical activity are the most influential determinants of quality of life among students in this boarding school setting.

Table 4. Multivariate Analysis of Factors Associated with Health-Related Quality of Life

Variable	β (Standardized)	95% CI	p-value
Oral Health Status (OHI-S)	-0.31	-4.82 – -1.64	0.001*
Physical Activity Level	0.35	2.11 – 5.76	0.001*
Age	-0.08	-1.42 – 0.38	0.241
Sex	0.05	-0.96 – 1.87	0.418
Length of stay	0.09	-0.21 – 2.04	0.163
Sugary food consumption	-0.18	-3.64 – -0.52	0.017*

Multiple linear regression analysis; significance level $p < 0.05$.

Discussion

This study successfully achieved its primary objective, namely to analyze the combined effect of oral health status and physical activity level on health-related quality of life among students at Pondok Pesantren Kumpeh Daaru Attauhid. Through a cross-sectional approach and the application of both bivariate and multivariate analyses, the study was able to identify significant associations between exposure variables and outcomes, while also assessing the relative contribution of each factor after controlling for potential confounders. These findings indicate that oral health and physical activity are important determinants of adolescents' quality of life in the boarding school context, suggesting that the study objectives were achieved both methodologically and substantively.

The results demonstrated that students with better oral health status had significantly higher health-related quality-of-life scores compared to those with poorer oral hygiene (Mbawalla et al., 2010; Tefera et al., 2023). In addition, higher levels of physical activity were associated with improved quality of life across multiple domains, including physical functioning, emotional well-being, and social interaction. Multivariate analysis confirmed that oral health status and physical activity remained independent predictors of quality of life after adjustment for age, sex, length of stay in the boarding school, and sugary food consumption. This indicates that these factors exert a direct influence rather than merely acting as proxies for demographic or behavioral characteristics (Yamane-Takeuchi et al., 2016).

The findings of this study are consistent with previous research reporting that poor oral health conditions, such as plaque and calculus accumulation, are associated with pain, discomfort, and impaired oral function, which negatively affect adolescents' quality of life. Both international and national studies have also shown that adequate physical activity plays a role in improving physical fitness, mental health, and social integration, ultimately enhancing perceived quality of life. Therefore, the present findings strengthen existing empirical evidence that oral health and physical activity are key components of school-based health promotion strategies (Drachev et al., 2018; Yin et al., 2023).

From a theoretical perspective, these results are supported by the biopsychosocial model, which posits that quality of life is influenced by the interaction of biological, psychological, and social factors. Oral health represents a biological component that affects physical comfort and daily functioning, while physical activity contributes to emotional regulation, self-confidence, and social relationships. Furthermore, health promotion theory emphasizes that consistent healthy behaviors practiced within a supportive environment, such as a boarding school, can generate cumulative benefits for individual well-being (Tefera et al., 2023).

Importantly, the cultural and institutional characteristics of the students' environment appear to influence these outcomes. In the pesantren context, students adhere to structured routines that include religious activities, communal living, and dietary patterns that differ from general school settings. These cultural and environmental factors may help explain the observed variations in both oral health and physical activity, as well as their combined impact on quality of life (Farhany et al., 2023; Fatimah et al., 2021).

Correlation analysis revealed a positive association between oral health status and health-related quality of life, indicating that improvements in oral hygiene were accompanied by higher quality-of-life scores. This relationship suggests that oral health problems affect not only physical aspects but also psychosocial dimensions, such as self-confidence and comfort in social interactions. The observed correlation was moderate, implying that oral health is an important, but not the sole, determinant of students' quality of life (Yamane-Takeuchi et al., 2016).

In addition, a positive correlation was found between physical activity level and health-related quality of life. Students who were more physically active tended to report better quality of life, particularly in the domains of physical functioning and emotional well-being. These results also indicate that good oral health and higher levels of physical activity may reflect broader favorable living conditions, such as supportive family backgrounds, nutritional adequacy, and access to health resources, which collectively contribute to students' well-being. The combination of good oral health and adequate physical activity produced a synergistic effect on quality of life, as reflected in the results of the multiple linear regression analysis (Samsuni et al., 2019).

The impact of this study is both practical and conceptual. Practically, the findings provide an evidence-based foundation for developing integrated health promotion programs in boarding school settings that combine oral health education with initiatives to increase physical activity. Conceptually, this study contributes to a broader understanding of the determinants of adolescents' quality of life within residential educational environments, a topic that remains relatively underexplored in the literature. Nevertheless, several limitations should be acknowledged, including the cross-sectional design, which precludes causal inference; the use of self-reported questionnaires, which may introduce reporting bias; and limited generalizability due to the study being conducted in a single boarding school. Future research is therefore recommended to employ longitudinal or experimental designs and involve multiple settings to strengthen the evidence base and inform policy implications.

Conclusions

This study demonstrates that oral health status and physical activity level have a significant influence on health-related quality of life among students at Pondok Pesantren Kumpeh Daaru Attauhid. Students with better oral health and higher levels of physical activity exhibited higher quality-of-life scores compared to other groups. Multivariate analysis confirmed that oral health and physical activity are independent predictors of quality of life, even after controlling for age, sex, length of stay in the boarding school, and sugary food consumption. These findings highlight the importance of an integrated health approach in improving adolescents' well-being within the boarding school environment. It is recommended that boarding school authorities and relevant stakeholders develop integrated health promotion programs that combine oral health education with structured physical activity initiatives for students. Furthermore, future studies are encouraged to employ longitudinal or interventional designs and include multiple boarding schools to strengthen generalizability and enhance causal understanding of the relationships among variables.

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