

Effectiveness of health communication on improving puberty readiness knowledge among Indonesian elementary student: a pre-post study

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Abstract. Puberty readiness is a crucial aspect of child development, yet often overlooked in primary education curricula. This study aimed to evaluate the effectiveness of a health communication intervention in improving elementary students' knowledge about puberty readiness at Muhammadiyah Mantaran Elementary School, Sleman, Yogyakarta, Indonesia. Using a one-group pretest-posttest design, 47 fourth-grade students aged 9–10 years participated in three interactive sessions involving guided discussions, visual media, and real-life simulations addressing physical, emotional, and social changes during puberty. Data were collected using questionnaires administered before and after the intervention and analyzed using paired sample t-tests. The pre-test mean score was 8.11 (N = 47, SD = 1.184, SE = 0.173), which increased to 8.91 (N = 47, SD = 0.929, SE = 0.135) in the post-test assessment. The sample was evenly distributed by gender, with most students having normal nutritional status and being in the early to mid-pubertal stage. The health communication intervention proved highly effective in enhancing puberty readiness in a meaningful and inclusive manner. These findings support the integration of proactive, gender-sensitive, and contextually relevant educational strategies into school-based health programs for early reproductive health promotion.

1 Introduction

Puberty is a critical phase in child development, marked by rapid physical, emotional, and social changes. In Indonesia, the average age of menarche (first menstruation) ranges from 12 to 14 years [1]. According to the 2013 Basic Health Research approximately 20.9% of Indonesian girls experience menarche before the age of 12 with some regions such as West Nusa Tenggara reporting rates as high as 35.2% [2]. A study in Surabaya found that 56.4% of female elementary school students in grades IV–V were emotionally and cognitively unprepared for menarche, while in Yogyakarta, lack of knowledge was linked to anxiety and misconceptions about menstruation [3]. Without adequate preparation, children are at risk of psychological distress, poor genital hygiene, and vulnerability to sexual exploitation and

sexually transmitted infections. Elementary school curricula in Indonesia generally lack comprehensive reproductive health education, leading children to rely on inaccurate or stigmatizing sources of information [4]. Low levels of puberty-related knowledge among elementary school students, particularly in Sleman, Yogyakarta, reflect a significant gap in early health education. Furthermore, the involvement of teachers and parents in communicating puberty-related issues remains limited in both content and delivery methods. Without structured intervention, children may navigate the transition into puberty unprepared, which can have long-term consequences for reproductive health and psychosocial well-being. This study proposes a school-based health communication intervention to improve elementary students' readiness for puberty. Through interactive educational sessions using visual media, guided discussions, and simulations, this research aims to increase students' knowledge of physical, emotional, and social changes during puberty. Prior studies show that good knowledge levels are significantly correlated with menarche preparedness [5]. However, existing educational interventions have primarily targeted older adolescents or have been implemented sporadically. A study at SDIT Baitul Jannah in Lampung demonstrated that empowering teachers and parents improves their engagement in puberty education [6]. Still, these efforts lack a systematic and measurable health communication approach tailored to children aged 10–12. The key research gaps addressed in this study are. Earlier target age group (grades IV elementary), as children begin entering early puberty stages. A holistic health communication approach that fosters emotional engagement and active participation, beyond mere information transfer. An evidence-based intervention using a pre-post design to clearly measure improvements in knowledge. Puberty readiness is not only a health issue but also a matter of child protection and personal empowerment. This intervention model is urgently needed, especially given the trend of earlier puberty onset and the lack of systemic support in elementary schools.

2 Methods

2.1 Research design and location

This study employed a **pre-post test without control group design** (one-group pretest-posttest design) conducted at Muhammadiyah Mantaran Elementary School, Sleman, Yogyakarta, Indonesia. This design was selected to evaluate changes in students' knowledge before and after the health education intervention on puberty readiness.

2.2 Participants

The participants consisted of grade IV elementary school students. A total sampling technique was used, initially identifying 49 respondents. During the study implementation, two students were absent due to illness, resulting in a final sample of 47 students who completed all research activities.

2.3 Research instrument

The research instrument utilized a knowledge questionnaire consisting of 10 items covering three key aspects: definition of puberty, signs and symptoms of puberty and physical changes during puberty. The questionnaire was designed to assess students' understanding of puberty readiness before and after the intervention.

2.4 Research activities

The research activities were conducted in the following sequence **Pre-test** Initial measurement of students' knowledge using the questionnaire before intervention. **Health Education Intervention:** The intervention consisted of interactive educational materials including: visual media presentations, focus group discussions and role-playing simulations about health communication. **Post-test:** Re-measurement of students' knowledge following the intervention. **Anthropometric Measurements:** Body weight measurement (in kilograms), Height measurement (in centimeters) and Calculation of Body Mass Index (BMI). Puberty Status Identification assessment of participants' puberty development stage.

2.5 Data analysis

The data analysis comprised descriptive statistics frequency, percentage, mean, and standard deviation. Inferential statistics: Paired t-test to compare pre-test and post-test scores (with $\alpha = 0.05$). Analysis procedures data was analyzed using computerized statistical software, normality testing was conducted using the Shapiro-Wilk test, differences were considered significant if p-value ≤ 0.05 .

3 Results and discussion

3.1 Respondent characteristics

The study sample consisted of 47 participants with diverse demographic characteristics. Gender distribution was relatively balanced, with males comprising 42.6% and females 57.4% of the sample. The age distribution showed that the majority of participants (68.1%) were 9 years old, while 31.9% were 10 years old. Nutritional status assessment revealed that most participants (74.5%) were classified as underweight, 17.0% had normal nutritional status, and 4.3% were overweight. Regarding pubertal status, the vast majority of participants (97.9%) had not yet entered puberty, with only 2.1% showing signs of pubertal development

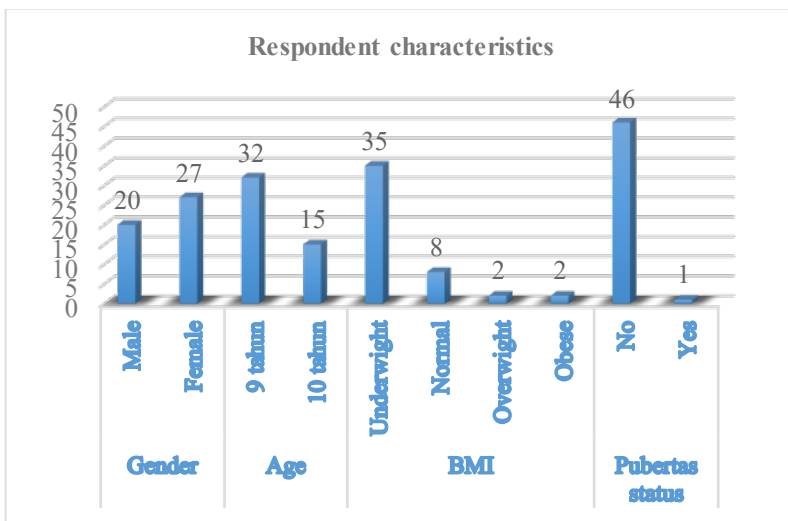


Chart 1. Respondent characteristics (n=47)

Based on the collected data, the gender composition of the research sample consisted of 27 male respondents (42.6%) and 20 female respondents (57.4%). This distribution demonstrates a relatively balanced gender representation in the study sample, which is crucial for ensuring the generalizability of findings across both genders [7]. The age range of respondents spanned from 9 to 10 years, with the majority of participants being 9 years old ($n = 32$, 68.1%) and the remaining 15 respondents (31.9%) being 10 years old. This age-specific focus is particularly relevant as it targets children who are approaching or entering puberty, making the educational intervention timely and age-appropriate. The BMI data was categorized according to World Health Organization (WHO) standards for school-aged children (6–18 years). The nutritional status distribution revealed concerning patterns: underweight 35 students (74.5%); normal weight 8 students (17.0%), overweight 2 students (4.3%), obese 2 students (4.3%). This distribution indicates a significant prevalence of undernutrition in the study population, with nearly three-quarters of students classified as underweight. This finding has important implications for comprehensive health education programs that should address both pubertal development and nutritional status [8]. Among the 47 respondents assessed for pubertal status, only 1 male student (2.1%) had entered puberty. This low prevalence of pubertal development is consistent with the age group studied and supports the timing of the intervention as a preventive educational measure before the onset of significant pubertal changes.

3.2 Respondents' knowledge level

Table 1 shows that there is a significant effect of health education on students' knowledge of puberty (p -value = 0.000). The analysis of paired samples statistics revealed significant improvements in knowledge scores following the educational intervention. The pre-test mean score was 8.11 ($N = 47$, $SD = 1.184$, $SE = 0.173$), which increased to 8.91 ($N = 47$, $SD = 0.929$, $SE = 0.135$) in the post-test assessment.

Table 1. Results of the analysis of the influence of health education on students' knowledge about puberty.

Variable	Mean	SD	SE	P value
Pretest	8,11	1,184	0,173	0,000
Post-test	8,91	0,929	0,135	

3.3 Effectiveness of educational intervention

The statistically significant improvement in knowledge scores from pre-test to post-test demonstrates the effectiveness of the educational intervention implemented in this study. This finding aligns with previous research on the effectiveness of school-based educational interventions targeting pubertal health knowledge. Effect of a health education program on puberty knowledge reported similar positive outcomes following structured health education programs, noting that well-designed interventions can significantly improve adolescents' understanding of pubertal changes and menstrual health [9].

3.4 Relationship between nutritional status and pubertal development

The high prevalence of underweight participants (74.5%) and the very low percentage of participants who had entered puberty (2.1%) suggest a potential relationship between nutritional status and the timing of pubertal onset. Connections between obesity and puberty provides comprehensive evidence supporting the relationship between nutritional status and pubertal timing [10]. The literature suggests that both undernutrition and overnutrition can

affect the timing of puberty, with different mechanisms operating at each extreme of the nutritional spectrum. Our findings, showing a high proportion of underweight participants with delayed pubertal onset, are consistent with research indicating that inadequate nutritional status may delay the onset of puberty. Association between precocious puberty and obesity risk further supports the complex relationship between nutritional status and pubertal development, noting that both extremes of nutritional status can disrupt normal pubertal timing. The low prevalence of overweight participants (4.3%) in our sample may reflect the broader nutritional context of the study population, which appears to be characterized more by undernutrition than overnutrition [11].

3.5 Implications for educational interventions

The effectiveness of the intervention among young participants (9-10 years old) suggests that pubertal health education can be successfully delivered to children before they enter puberty, potentially preparing them better for the changes they will experience. Our study extends these findings by demonstrating that such interventions can be effective even with younger children who have not yet entered puberty[12].

3.6 Methodological considerations and limitations

The use of paired t-test analysis in this study provided a robust method for evaluating the effectiveness of the educational intervention. demonstrates the widespread application of this statistical approach in educational intervention research, supporting its appropriateness for our study design. However, several limitations should be considered when interpreting our findings. The high proportion of underweight participants in our sample may limit the generalizability of our results to populations with different nutritional profiles.

3.7 Future research directions

Longitudinal studies are needed to evaluate the long-term impact of early pubertal health education on both knowledge retention and health behaviors. Gamification for pubertal and menstrual health education in suggests that innovative educational approaches, such as gamification, may enhance engagement and effectiveness, particularly for younger audiences[13].

4 Conclusion

This study demonstrates the effectiveness of a school-based educational intervention in improving knowledge about pubertal changes among children aged 9-10 years. The statistically significant improvement in knowledge scores, coupled with the moderate correlation between pre-test and post-test performance, provides strong evidence for the intervention's effectiveness.

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