Tobacco Consumption Among School Age in Bojonegoro Indonesia: Prevalence and Associated Factors

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Abstract. Smoking remains one of the top causes of death globally. Indonesia ranks among the countries with the highest smoking rates, particularly among elementary school children. Children living near people who smoke have a well-documented higher risk of smoking initiation. Healthcare professionals should incorporate tobacco-use counseling into pediatric health evaluations to foster a smoke-free environment. This study employed a cross-sectional design utilizing secondary questionnaire data approved by the Bojonegoro District Health Office and analyzed all eligible records of elementary school students in grades 4–6 using a descriptive quantitative approach. An total sampling method with specific inclusion and exclusion criteria was applied to ensure that the data met the study objectives. The findings indicate that smoking behavior among these children is strongly associated with gender (92 out of 546 vs. 0 out of 525; $p < 0.01$), with smoking risk factors including the presence of smokers at school (15.4%), smoking family members (11.9%), and peer influence (53.8%). In response, a school-based anti-smoking campaign targeting teachers and the educational environment is recommended.

Keywords: Smoking, Child, School, Behavior, Risk Factor.

1 Introduction

Tobacco is one of the leading risk factors for global disease burden and mortality[1]. This burden is associated with both direct tobacco consumption and secondhand exposure, particularly among children. In 2019, secondhand smoke was estimated to be responsible for approximately 50,000 deaths and 4.5 million disabilities among children under the age of 14 [2]. Indonesia ranks among the countries with the highest number of active smokers globally, with over 70.2 million tobacco users in 2021, following China and India. There was an increase of 8.8 million adult smokers in 2021 compared to a decade earlier, after accounting for population growth. Tobacco use is significantly more prevalent among men, with 65.5% of men smoking in 2021, compared to only 3.3% of women [3] .

According to Government Regulation No. 19 of 2003, cigarettes are processed tobacco products that are wrapped and contain nicotine and tar, with or without additional substances. Cigarettes are typically cylindrical in shape, made from paper measuring

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70–120 mm in length (depending on the region) with a diameter of approximately 10 mm, and filled with tobacco leaves and other mixtures [4].

Exposure to cigarette smoke is harmful to children and adolescents. They inhale dust at twice the rate of adults, thereby absorbing more smoke particles. This is due to their higher respiratory rates and narrower airways, which result in greater exposure [5]. Furthermore, exposure to cigarette smoke increases the incidence of respiratory tract infections, coughing, phlegm production, wheezing, and asthma, and it has also been associated with significant reductions in lung function. Such exposure exacerbates preexisting chronic respiratory conditions. In the long term, it may negatively impact children's nutritional status [6].

Nicotine can reduce oxygen delivery by 30–40% and inhibit the absorption of calcium, minerals, and vitamin C, all of which are vital for growth [7]. Smoking at a young age may contribute to the adoption of other harmful lifestyle behaviors, including alcohol and drug use later in life. Cigarette use is also linked to early onset of stroke and various dental and oral health problems (Nuha, Demartoto, and Prasetya, 2023). Despite the dual burden of malnutrition and high smoking prevalence in Indonesia, there is a lack of research exploring children's understanding of smoking behaviors.

A study conducted by the Global Youth Tobacco Survey (GYTS) from 2006 to 2012 found that 81.4% of Indonesian adolescents were exposed to secondhand smoke. Among adolescents aged 13–15 years, 24.5% of boys and 2.3% of girls were smokers, with 3.2% already showing signs of addiction. Previous research has also shown that in the past decade, cigarette consumption among adolescents in Bojonegoro increased by up to 55.1%, and smokers accounted for 60% of the total population [8].

One characteristic of school-aged children is a high level of curiosity. This curiosity is often directed toward objects and their surrounding environment [9]. The development of curiosity and its influence on memory during childhood highlight the need for educational approaches tailored to various stages of child development. For effective and targeted prevention, it is essential to first understand the risk factors that lead children to engage in specific behaviors, including smoking. It is expected that this exploratory study will produce specific and applicable insights tailored to the real socio-cultural conditions of the target area.

Bojonegoro is one of the tobacco-producing regions in Indonesia and has historically served as a supplier to cigarette manufacturers from Kudus, Malang, and Surabaya. In addition to locally cultivated tobacco, Bojonegoro also produces Virginia tobacco, which is in high demand among manufacturers [10]. The region hosts more than one cigarette factory, including PT. Gudang Garam, Tbk., and PT. Putera Jaya Sakti Perkasa. These factories are strategically located near residential areas and even schools. Such proximity raises concerns about the behavior of elementary school children, who tend to imitate adults and possess natural curiosity, coupled with easy access to cigarettes.

2 Materials and Method

This study employed a cross-sectional design using secondary data, which had received prior approval from the Bojonegoro District Health Office under letter number 440/2337/412.202/2024. The study utilized secondary data obtained from a standardized smoking screening questionnaire developed by the Ministry of Health of the Republic of Indonesia, which had undergone prior validation and was used nationally. Ethical approval, including consent procedures and data confidentiality, had been addressed during the original data collection by the Bojonegoro District Health Office.

The study was conducted using a descriptive quantitative approach. The target population comprised elementary school students in grades 4 through 6. The sampling method employed was a total sampling technique, in which all available data were included and analyzed. Inclusion and exclusion criteria were applied to ensure that the selected sample from the secondary data met the study objectives and provided sufficient information. The inclusion criterion was that the data pertained to children enrolled in grades 4 to 6 in elementary schools in Bojonegoro District.

Descriptive statistics were used to summarize respondent characteristics, and categorical comparative analysis using the Pearson Chi-square test was performed to examine associations between smoking status (ever smoked vs. never smoked) and potential associated factors, including grade level, gender, knowledge of the harmful effects of smoking, exposure to smoking at school, family members who smoke, and peers who smoke. Statistical significance was determined at $p < 0.05$.

3 Result

This study was successfully conducted in 20 elementary schools located in the Gunungsari area of Bojonegoro. The research utilized secondary data derived from a standardized smoking screening questionnaire developed by the Ministry of Health of the Republic of Indonesia. After applying the inclusion and exclusion criteria, a total of 1,071 respondents were included in the analysis.

The schools involved in this study were: MI Al Falah Kadungrejo, MI Faradisal Jannah, MI Mansyaul Huda, MI Miftahul Ulum, MI Muhammadiyah 19, MI Tanwiriyah, MI Tanwirul Hija, MI Tanwirul Qulub, SD-NU Al Falah, SD Negeri Gajah I, SD Negeri Gajah II, SD Negeri Gunungsari I, SD Negeri Kadungrejo, SD Negeri Kalisari, SD Negeri Lebaksari, SD Negeri Sumuragung, SD Negeri Tanggungan, SD Negeri Tlogoagung I, and SD Negeri Tulungagung I.The characteristics of the respondents are presented in Table 1.

Data analysis was performed using categorical comparative analysis with the Chi-square test to examine the associations between risk factors—such as demographic variables (grade level, gender) and exposure to smoking (knowledge of the negative effects of smoking, witnessing someone smoke at school, having a family member who smokes, having close friends who smoke) and the outcome variable of smoking status (never smoked vs. ever smoked).

Table 1. Respondent Characteristics

Demographic characteristic	Total (n)	Precentage (%)
Total responden	1071	100,0
Grade		
4th	371	34,6
5th	373	34,8
6th	327	30,5
Gender		
Male	546	51,0
Female	525	49,0
Never/ever smoked		
Ever smoked	93	8,7
Never smoked	978	91,3
Knowing the bad effect of smoking		
Yes	806	75,3
No	265	24,7
Have seen people smoke at school		
Yes	403	37,6
No	668	62,4
People who smoke at school		
Teacher	169	43,6
School residents	36	9,3
Security	7	1,8
Firends	2	0,5
Other	174	44,8
Having family member who smoke		
Yes	704	65,7
No	367	34,3
Having close friend who smoke		
Yes	117	10,9
No	954	89,1

3.1 Grade Level

This study revealed a significant increase in the proportion of students who reported smoking as grade level advanced among 4th- to 6th-grade elementary school students. The percentage of smokers was 4.9% (18 out of 371) in grade 4, 8.3% (31 out of 373) in grade 5, and 13.1% (43 out of 327) in grade 6, with statistical analysis indicating a significant difference ($p < 0.01$). This pattern shows a consistent upward trend in smoking prevalence across higher grade levels, with the highest proportion observed among sixth-grade students.

3.2 Gender

All of the children who reported smoking in this study were boys, while no girls reported smoking (92 out of 546 vs. 0 out of 525; $p < 0.01$). This result demonstrates a clear gender disparity in smoking behavior among elementary school children. The finding indicates that smoking behavior in this population was exclusively observed among male students.

3.3 Knowledge about the Dangers of Smoking

In this study, children who stated that they were aware of the harmful effects of smoking had a significantly higher proportion of smokers compared to those who reported not knowing about these harmful effects (85 out of 806 [10.5%] vs. 7 out of 265 [2.6%]; $p < 0.01$). This result shows a clear difference in smoking prevalence between the two groups, indicating that reported awareness of smoking-related harms does not necessarily correspond to lower smoking behavior among elementary school children. The observed pattern highlights a notable disparity between knowledge and behavior within this population.

3.4 Ever seen people smoking at school

The prevalence of smoking among students who had witnessed someone smoking at school was significantly higher than among those who had not (62 out of 403 [15.4%] vs. 30 out of 668 [4.5%], $p < 0.01$). Demographic data revealed that the individuals most frequently observed smoking in the school environment were categorized as "others," including street vendors and nearby residents (n = 174 [44.8%]), followed closely by teachers (n = 169 [43.6%]). School staff (n = 36 [9.3%]), security personnel (n = 7 [1.8%]), and peers (n = 2 [0.5%]) accounted for smaller proportions.

3.5 Family Members Smoking

This study demonstrated a significant association between having family members who smoke and the prevalence of smoking among children. The proportion of smokers was significantly higher among children with at least one smoking family member compared to those without (84 out of 704 [11.9%] vs. 8 out of 367 [2.2%], $p < 0.01$). This finding indicates that smoking behavior among children tends to occur more frequently in households where smoking is present, highlighting the influence of the family environment on children's smoking behavior. The observed difference underscores the role of familial exposure in shaping early smoking initiation among elementary school children.

3.6 Peers Who Smoke

In this study, children who reported having peers who smoked showed a significantly higher smoking prevalence compared to those who did not have smoking peers (63 out

of 117 [53.8%] vs. 29 out of 954 [3.0%], $p < 0.01$). This result indicates a clear difference in smoking prevalence between the two groups, with a substantially higher proportion observed among children who had peers who smoked.

Table 2. Results of categorical comparative analysis of factors associated with never/never smoking

Dependent Variable	Ever Smoked		*p-Value**
	Yes n (x%)	**No** n (x%)	
Grade			
4th grade elementary school (n=371)	18 (4,9%)	353 (95,1%)	<0,01
5th grade elementary school (n=373)	31 (8,3%)	342 (91,7%)	
6th grade elementary school (n=327)	43 (13,1%)	284 (86,9%)	
Gender			
Male (n=546)	92 (16,8%)	454 (83,2%)	<0,01
Female (n=525)	0 (0%)	525 (100%)	
Knowing the bad effects of smoking			
Yes (n=806)	85 (10,5%)	721 (89,5%)	<0,01
No (n=265)	7 (2,6%)	258 (97,4%)	
Have seen people smoke at school			
Yes (n=403)	62 (15,4%)	341 (84,6%)	<0,01
No (n=668)	30 (4,5%)	638 (95,5%)	
Having a family member who smokes			
Yes (n=704)	84 (11,9%)	620 (88,1%)	<0,01
No (n=367)	8 (2,2%)	359 (97,8%)	
Having close friends who smoke			
Yes (n=117)	63 (53,8%)	54 (46,2%)	<0,01
No (n=954)	29 (3,0%)	925 (97,0%)	

**Pearson Chi-square*

4 Discussion

According to the 2014 Global Youth Tobacco Survey, Indonesia had the highest prevalence of adolescent smokers in the world. Specifically, 8.9% began smoking under the age of 7, 10.9% at ages 8–9, increasing to 25.6% at ages 10–11, and 43.2% at ages 12–13, with 11.4% starting at ages 14–15 [11]. Considering relative age effects, it has been observed that, on one hand, relatively older students within a grade level tend to have lower motivation than their younger peers. On the other hand, relatively younger students often exhibit lower levels of social-emotional adjustment and self-esteem. Moreover, maladaptive behaviors—considered risk factors for repeated delinquency—occur more frequently among relatively younger students, leading to higher rates of deviant

behavior recurrence within this group. In terms of interpersonal relationships, it is noteworthy that while relatively younger students tend to have fewer friends and less face-to-face interaction, they engage in electronic communication more frequently than their relatively older peers [12].

This gender disparity persists into adulthood, with male smoking prevalence reaching 47.5% compared to only 1.1% among females, according to the 2013 Indonesian Basic Health Research (Riskesdas). There is a prevailing perception that smoking enhances a male's image, portraying him as cool or tough. Additionally, cigarette advertisements often promote positive imagery that appeals specifically to boys and young men [15]. A study in Surabaya revealed that smoking behavior is socially constructed as an element of masculinity among adolescent males, despite existing regulations aimed at restricting tobacco product access to minors. The study emphasized the urgent need to reconsider the distribution of tobacco products to ensure they are not accessible to youth [16].

Curiosity is defined as a desire within an individual to learn about a particular object or event, obtained through observation, listening, or measurement. Research has shown gender-based differences in the distribution of curiosity levels among students. A higher percentage of male students were categorized as having very high and high curiosity compared to female students. However, a higher percentage of female students were categorized as having very high and high levels of comprehension difficulties. This may suggest that curiosity does not always translate directly into understanding, and that gender differences can influence cognitive styles and thought processes in children [17].

In case of Knowledge about the Dangers of Smoking, a study involving 52 students from SD Negeri Grogol 05 in West Jakarta revealed that most students held negative perceptions of smoking behavior, indicating that they viewed smoking as harmful. However, the majority lacked specific knowledge about smoking, including information on harmful substances in cigarettes and the associated health risks [19]. Conversely, research by Ariani et al. (2019) involving 356 students from grades IV and V across 33 elementary schools in Karawang showed a more positive perception of smoking behavior. This may reflect a lack of understanding among elementary students regarding the direct and indirect dangers of smoking [20].

Young children are typically highly motivated to explore and understand their world. It has been suggested that children's understanding emerges when they actively seek connections between their experiences and conceptual frameworks that help them make sense of their environment [21]. A study by Nurmansyah et al. (2019) found that the majority of students both smokers and non-smokers were aware that smoking could cause health problems. This finding underscores the importance of shifting the youth's perspectives on smoking, rather than solely focusing on delivering information about its health risks once awareness is already present [22]. A similar dynamic is observed in studies examining the relationship between knowledge, attitudes, and behavior in health protocol compliance. One such study found a weak but positive correlation between knowledge and attitudes with adherence to health protocols, suggesting that greater knowledge and positive attitudes may lead to improved behavior, albeit modestly [23].

Teachers represent a major contributing factor to students' exposure to smoking behavior within school premises. Given their role as role models and their prolonged interaction time with students, teachers should refrain from exhibiting behaviors that set a negative example [24]. Much of children's knowledge is derived not from direct experience but through information received from others. The use of visual materials is particularly effective in the learning process. Visual imagery can stimulate thought, capture students' attention, and facilitate conceptual understanding [25]. Visual perception involves the processing of sensory and cognitive information through vision, relying on both visual stimuli and cognitive factors such as visual attention and memory. It entails the differentiation of concepts through visual analysis, including form constancy, background discrimination, and the application of existing knowledge [26].

The presence of smokers on school grounds increases the likelihood of secondhand smoke exposure among students. It is not uncommon for teachers to smoke openly in the school environment, consequently exposing nearby students to passive smoking. From a public health perspective, secondhand smoke is often considered more harmful than direct smoking. Therefore, it is advisable for schools to enforce strict no-smoking policies for their teaching staff [22].

A meta-analysis by Wang et al. (2018) revealed that smoking by family members and peers is a strong predictor of tobacco use among adolescents and children [27].

This finding aligns with a study by Rezeki and Utari (2021), which investigated 120 sixth-grade students across four elementary schools in Banda Aceh. They found that students from families with smoking members were significantly more likely to smoke themselves—61.8% reported smoking—placing them at 5.3 times greater risk compared to those without such family exposure. Common reasons for initiating smoking included being frequently asked by parents to purchase cigarettes and often witnessing family members smoke, which led to curiosity and, eventually, addiction [28].

Additional factors influencing adolescent smoking include parental smoking, peer pressure, and the desire to gain social acceptance. Initiation may also be shaped by parenting style, the smoking behavior of siblings, and the belief that smoking alleviates stress and boredom8. Logistic regression analysis in another study found that parental permission to smoke at home was the strongest predictor of child smoking, followed by low levels of parental supervision. Parents and siblings who smoke, lenient household smoking rules, and weak parental oversight are significant predictors of smoking behavior in children aged 8–12. In the Indonesian cultural context, children tend to hold their parents and siblings in high regard due to cultural, religious, and customary norms, making family members important role models. Consequently, children are likely to imitate behaviors exhibited by their family [29].

Child development is influenced by individual characteristics, family environment, and broader social contexts. Physical health, cognition, language skills, and socio-emotional development all contribute to school readiness. Parental behavior and values are frequently passed down to children through daily routines at home [21] . In South Korea, the proportion of adolescents exposed to secondhand smoke at home decreased from 40.3% in 2006 to 23.0% in 2018, driven by increasing parental awareness and behavioral change—parents have become more conscious about not smoking in the presence of children30. Setting clear expectations for smoke-free environments appears

to be more effective in preventing smoking initiation among youth than merely advising them against tobacco use [31].

This finding of peer who smoke consistent with the study by Smit et al. (2023), which demonstrated that adolescent smokers typically have more friends who also smoke, whereas non-smokers tend to associate more with non-smoking peers. This phenomenon can be explained through the concept of peer influence, a social process whereby an individual's behaviors or attitudes are shaped by the behaviors and expectations of their peers within a social network [32].

A study by Ajsal et al. (2023) involving 32 students from grades 4 to 6 at SD 210 Kajaolaliddong, Barebbo Subdistrict, Bone Regency, found a statistically significant relationship between having smoking peers and students' smoking behavior ($p = 0.002$). This relationship is likely due to the frequent social interactions that students have with their peers both in school and in their neighborhoods, making them highly susceptible to negative influences such as smoking and peer group formation. Students often feel social pressure to imitate their friends' behaviors to avoid being labeled as unpopular [33].

Smoking behavior generally begins and develops during adolescence. Current research highlights that attitudes associated with smoking behavior differ significantly between smokers and non-smokers. Beliefs such as smoking increases confidence, enhances social appeal, helps with stress relief, and symbolizes maturity and masculinity are statistically associated with adolescent smoking behavior [22].

Peer influence is a powerful determinant of behavior in elementary school children and can shape the peer environment. This environment is characterized by attitudes of cooperation, empathy, mutual understanding, and helpfulness, which can significantly affect student learning outcomes [34]. A separate study emphasized the importance of cultivating wisdom in forming friendships. It advocates avoiding harmful and destructive relationships while promoting supportive peer relationships that foster personal growth, positive behavioral change, and collective well-being, including spiritual development [35].

5 Conclusion

This study identified that smoking behavior among elementary school children in the Gunungsari area of Bojonegoro remains a notable public health concern. Among 1,071 students in grades 4–6, 8.7% reported having ever smoked. The prevalence of smoking increased progressively with grade level, with higher proportions observed among older students. Smoking behavior was reported exclusively among boys, while no cases were identified among girls, indicating a clear gender disparity in smoking prevalence at the elementary school level.

Several factors were found to be significantly associated with smoking behavior among children. These included gender, grade level, exposure to smoking within the school environment, having family members who smoke, and having peers who smoke. Children who had smoking peers and those exposed to smoking at school showed notably higher smoking prevalence. In addition, children from households with smoking

family members were more likely to report smoking, highlighting the influence of social and environmental exposure on early smoking behavior.

Based on these findings, preventive efforts should prioritize the roles of families and schools in reducing children's exposure to smoking. Strengthening school-based smoke-free policies, promoting non-smoking role models within the educational environment, and increasing parental awareness of the impact of household smoking are essential. Early preventive interventions targeting elementary school students are crucial to reducing smoking initiation and protecting children's long-term health.

Ethical Considerations. We have gone through ethical clearance and obtained ethical approval Number: 3249-KEPK from the Health Research Ethics Committee, Faculty of Nursing, Airlangga University.

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Conflict Of Interest. There is no conflict of interest.

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