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Effectiveness of Mint Candy Use in Reducing Smoking Behavior Among Adolescents: A Quasi-Experimental Study

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Abstract

Smoking behavior among adolescents remains a significant public health concern and contributes to an increased risk of various chronic diseases later in life. Several interventions have been developed to help adolescents reduce their smoking habits; however, the use of mint candy as a non-pharmacological alternative has received limited attention in research, particularly among school-aged adolescent populations. This study aimed to determine the effectiveness of mint candy in reducing smoking behavior among adolescents in Aceh Besar, Indonesia. This study employed a quasi-experimental design with an intervention group and a control group. A total of 70 adolescent smokers were selected using purposive sampling and assigned to either the intervention group ($n = 35$) or the control group ($n = 35$). The intervention group received 6-8 mint candies per day for two weeks, while the control group received no intervention. Smoking behavior was assessed using a smoking behavior questionnaire consisting of three items.

Data were analyzed using the Wilcoxon Signed-Rank Test and the Mann-Whitney U Test. The mean smoking behavior score in the intervention group decreased significantly from 7.97 ± 0.785 before the intervention to 2.97 ± 0.785 after the intervention ($z = -5.916$; $p < 0.001$). In the control group, the smoking behavior score decreased from 8.00 ± 0.767 to 7.06 ± 0.725 ($z = -4.281$; $p < 0.001$); however, the reduction was relatively small. Between-group analysis showed no significant difference at baseline (pre-test) ($p = 1.000$), whereas a significant difference was observed between the intervention and control groups at post-test ($z = -7.317$; $p < 0.001$). The use of mint candy was effective in reducing smoking behavior among adolescents. Mint candy may be considered a simple, low-cost, and easily implemented promotive and preventive intervention within school health programs to help reduce smoking behavior among adolescents.

Keywords: Adolescents, Smoking Behavior, Mint Candy, Non-Pharmacological Intervention, Health Promotion

Introduction

Smoking remains a major public health issue and continues to pose a global challenge, particularly among adolescents. Adolescence is a developmental period characterized by various biological, psychological, and social changes that may increase an individual's susceptibility to engaging in risky behaviors, including smoking. According to the World Health Organization [1], most adult smokers begin smoking before the age of 18 years, making prevention efforts among adolescents a critical strategy in tobacco control. Smoking initiation at a young age has been associated with an increased risk of nicotine dependence, cardiovascular disease, chronic respiratory disorders, cancer, and various other health problems later in adulthood [2].

Indonesia is one of the countries with the highest number of smokers in the world. The high prevalence of smoking among school-aged adolescents has become a serious concern due to its potential impact on the health and well-being of future generations. Numerous studies have shown that adolescent smoking behavior is influenced by multiple factors, including peer influence, family environment, exposure to tobacco-related media and advertising, and limited ability to resist social pressure to smoke [3, 4]. Furthermore, social and environmental factors play a substantial role in shaping smoking habits among adolescents, highlighting the importance of interventions that target both behavioral change and environmental influences [5, 6]. Nicotine dependence is one of the main factors that makes it difficult for individuals to quit smoking. Nicotine acts by

stimulating dopamine release in the central nervous system, producing feelings of pleasure and reward. When nicotine levels decrease, individuals experience a strong urge to smoke again, known as craving. This condition leads to a repetitive cycle of dependence that becomes increasingly difficult to break. Among adolescents, this process may develop more rapidly than in adults due to ongoing brain development that continues into early adulthood^[7].

Various strategies have been developed to help individuals reduce or quit smoking, including both pharmacological and non-pharmacological approaches. Nicotine replacement therapy has been proven effective in supporting smoking cessation among adults; however, its use among adolescents is still limited by several factors, including cost, accessibility, and user acceptability. Therefore, there is a need for alternative interventions that are simple, safe, low-cost, and easily applicable to adolescent populations^[8].

One alternative that has begun to receive attention is the use of mint candy as a form of behavioral substitution for smoking. Mint candy contains menthol, which produces a cooling and refreshing sensation in the oral cavity through activation of the Transient Receptor Potential Melastatin 8 (TRPM8) receptors. This receptor activation may provide a refreshing effect and reduce the discomfort often experienced when individuals attempt to reduce cigarette consumption^[9]. In addition, mint sensation has been shown to help divert attention from smoking cravings, thereby assisting individuals in controlling the urge to smoke^[10].

From a behavioral perspective, the use of mint candy may serve as a substitute for the oral activity typically associated with smoking behavior. This strategy allows individuals to maintain oral stimulation without the need to consume cigarettes. Previous research has indicated that the use of mint-flavored products may help reduce smoking frequency and decrease levels of nicotine dependence, particularly among younger populations^[11]. In addition, Bold reported that mint and menthol flavors can enhance positive sensory experiences during smoking cessation attempts, thereby supporting individuals in maintaining their efforts to quit smoking^[12].

Theoretically, the effectiveness of mint candy use can be explained through the Health Promotion Model developed by Pender. This model posits that health behavior change is influenced by perceived benefits, perceived barriers, self-efficacy, as well as interpersonal and situational influences. In the context of this study, the use of mint candy has the potential to enhance perceived benefits by providing a refreshing sensation and helping to reduce smoking cravings. In addition, its easy accessibility and relatively low cost may reduce barriers to adopting healthy behavior, while peer support and the school environment may strengthen adolescents' commitment to reducing smoking behavior^[13].

Although various studies have indicated that mint-based products have potential in supporting smoking cessation, most of this evidence has been conducted among adult populations and active smokers undergoing nicotine replacement therapy. Research examining the effectiveness of mint candy as a non-pharmacological intervention among adolescents remains relatively limited, both globally and nationally. In particular, in Aceh Besar, no study has specifically evaluated the effectiveness of mint candy use in reducing smoking behavior among school adolescents. This research gap highlights the need for further studies to

generate scientific evidence that can serve as a basis for developing health promotion programs tailored to the characteristics of local adolescents.

Based on the aforementioned background, this study aimed to analyze the effectiveness of mint candy use in reducing smoking behavior among adolescents in Aceh Besar, Indonesia. The findings are expected to provide empirical evidence regarding the use of mint candy as a simple, low-cost, and easily applicable non-pharmacological intervention within school health programs to support the prevention and control of smoking behavior among adolescents.

Methods

This study employed a quasi-experimental design using a pretest-posttest control group design approach. The population in this study consisted of all junior high school students in Aceh Besar who were active smokers, aged 13-14 years, and registered as active students in the 2025-2026 academic year. The population was selected based on the high prevalence of smoking behavior among early adolescents, as well as recommendations from local health services regarding schools with a relatively high number of student smokers.

The study sample consisted of 70 respondents who met the inclusion criteria. The sample size was determined using power analysis based on Cohen's table, with a significance level (α) of 0.05, statistical power of 0.80, and an effect size of 0.50 (medium effect size). Based on these calculations, the minimum required sample size was 64 respondents. To account for a potential 10% dropout rate, the sample size was increased to 70 respondents.

The sampling technique used in this study was purposive sampling, a method of selecting participants based on specific criteria established by the researcher. The inclusion criteria were students with active smoking behavior, willingness to participate in the study, and completion of the entire research procedure. The respondents were then divided into two groups, namely an intervention group consisting of 35 students and a control group consisting of 35 students.

The intervention group consisted of students from SMPN 1 Darussalam who received treatment in the form of 6-8 mint candies per day for two weeks, while the control group consisted of students from SMPN 2 Kuta Baro who did not receive any intervention during the study period. The group allocation was conducted to compare changes in smoking behavior before and after the intervention and to evaluate the effectiveness of mint candy in reducing smoking behavior among adolescents. This study was conducted from Desember 2025 to January 2026 at SMPN 1 Darussalam and SMPN 2 Kutabaro, Aceh Besar, Indonesia.

Data Collection Process

Data collection was conducted from 2 to 30 Januari 2026 after the researcher obtained research permission from the relevant institution and the participating schools. Prior to the study implementation, the researcher coordinated with the school principals and responsible teachers to explain the objectives, procedures, benefits, and timeline of the study. Subsequently, the researcher selected respondents based on the predetermined inclusion and exclusion criteria.

At the initial stage, all respondents who met the study criteria were informed about the purpose and procedures of the research. After the respondents agreed to participate, the

researcher obtained informed consent from both the respondents and their parents. Subsequently, both study groups, namely the intervention group and the control group, were given a smoking behavior questionnaire to assess the baseline condition (pre-test) prior to the intervention.

After the initial assessment was conducted, the intervention group received education on the dangers of smoking and the benefits of smoking cessation, as well as mint candies to be used as a substitute for smoking. The mint candies were administered at a dose of 6-8 pieces per day for 14 days. The researcher explained the method of use, whereby the candies were consumed when the urge to smoke arose or during times that were typically associated with smoking behavior. Throughout the intervention period, the researcher conducted regular monitoring to ensure participants' adherence to the prescribed mint candy consumption protocol.

During the first and second weeks, the researcher conducted follow-up visits to evaluate the implementation of the intervention, identify any difficulties experienced by participants, and ensure that respondents continued participating in the study until completion. Meanwhile, the control group did not receive any specific intervention and continued their usual daily activities throughout the study period.

After the two-week intervention period was completed, both groups were again administered the same smoking behavior questionnaire to assess changes in smoking behavior following the intervention (post-test). All collected data were then checked for completeness (editing), coded (coding), entered into statistical software (data entry), and analyzed in accordance with the study objectives.

Data Analysis

Data analysis was performed using statistical software to address the research objectives. Prior to analysis, the data underwent editing, coding, data entry, and data cleaning processes to ensure completeness and accuracy of the data obtained from respondents.

Univariate analysis was conducted to describe the characteristics of respondents and the distribution of study variables. Respondent characteristics such as age, gender, and grade level were presented in the form of frequency distributions and percentages. Meanwhile, smoking behavior data were presented using mean, standard deviation, median, minimum, and maximum values.

Prior to bivariate analysis, data normality was tested using the Shapiro-Wilk test because the sample size in each group was less than 50 respondents. The results of the normality test indicated that smoking behavior data in both the intervention and control groups were not normally distributed ($p < 0.05$); therefore, non-parametric statistical tests were used for further analysis.

Bivariate analysis was conducted to examine differences in smoking behavior before and after the intervention as well as to compare smoking behavior between the intervention and control groups. The Wilcoxon Signed-Rank Test was used to analyze differences in smoking behavior scores before (pre-test) and after (post-test) the intervention within each group. This test was selected because the data were not normally distributed and measurements were taken within

the same group (paired data). The decision criterion was that a p -value < 0.05 indicated a statistically significant difference between pre-test and post-test scores. The Mann-Whitney U Test was used to compare smoking behavior scores between the intervention and control groups. The analysis was performed on both pre-test data to assess baseline equivalence and post-test data to evaluate the effectiveness of the mint candy intervention. The decision criterion was that a p -value < 0.05 indicated a statistically significant difference between the two groups.

Ethical Consideration

This study obtained research permission from the Faculty of Nursing, Universitas Syiah Kuala, and received ethical approval from the same institution with Ethical Registration Number **112010241125**.

Results

Data on respondent characteristics are presented in Table 1.

Table 1: Respondent Characteristics Data in the Intervention and Control Groups

Characteristics	Intervention (n=35)		Control (n=35)	
	f	%	f	%
Age (Years)				
Mean $\pm$ SD	13,54 $\pm$ 0,505		13,57 $\pm$ 0,502	
Min-Max	13-14		13-14	
Gender				
Male	35	100	35	100
Female	0	0	0	0
Religion				
Islam	35	100	35	100
Grade				
Grade 7	16	45,7	17	48,6
Grade 8	19	54,3	18	51,4
Ethnicity				
Acehnese	35	100	35	100

Based on Table 1, the characteristics of the respondents show that the mean age in the intervention group was 13.54 $\pm$ 0.505 years, while in the control group it was 13.57 $\pm$ 0.502 years, with an age range of 13-14 years, indicating a relatively homogeneous distribution between groups. All respondents in both groups were male, of Acehnese ethnicity, and Muslim, indicating no variation in these characteristics within the study.

Overall, the characteristics of respondents in both the intervention and control groups demonstrated a high level of homogeneity. Both groups had nearly identical mean ages with the same age range, all respondents were male, Muslim, and of Acehnese ethnicity. In addition, the distribution of grade levels (Grade VII and VIII) was relatively balanced between the two groups. These similarities in demographic and academic characteristics indicate that the intervention and control groups were comparable at baseline, suggesting that any differences in outcomes observed after the intervention were more likely attributable to the effect of the intervention rather than differences in respondent characteristics.

The study results on differences in smoking behavior scores among students at SMPN 1 Darussalam and SMPN 2 Kuta Baro in the intervention and control groups are presented in Tables 2 and 3.

Table 2: Differences in Smoking Behavior Before and After the Intervention in the Intervention Group

Variabel	Kelompok Intervensi (n=35)			
	Wilcoxon			
	Pre test (Mean $\pm$ SD)	Post test (Mean $\pm$ SD)	z	p
Smoking Behavior	7,97 $\pm$ 0,785	2,97 $\pm$ 0,785	-5,916	0,000

Table 3: Differences in Smoking Behavior Before and After the Intervention in the Control Group

Variabel	Kelompok Kontrol (n=35)			
	Wilcoxon			
	Pre test (Mean $\pm$ SD)	Post test (Mean $\pm$ SD)	z	p
Smoking Behavior	8,00 $\pm$ 0,767	7,06 $\pm$ 0,725	-4,281	0,000

The analysis results showed that both the intervention and control groups experienced a statistically significant difference between pre-test and post-test scores ($p < 0.05$). However, the reduction in smoking behavior scores in the intervention group was much greater, decreasing from 7.97 to 2.97, compared to the control group, which only decreased from 8.00 to 7.06. These findings indicate that the intervention was more effective in reducing smoking behavior. In contrast, although the change in the control group was statistically significant, it did not demonstrate strong clinical relevance due to its relatively small reduction.

Table 4: Differences in Smoking Behavior Between the Intervention and Control Groups

Variabel		Intervention Group n=35	Control Group n=35	Z	P
		Mean Rank	Mean Rank		
Smoking Behavior	Pretest	35,50	35,50	0,000	1,000
	Posttest	18,00	53,00	-7,317	0,000

The results of the Mann-Whitney U Test indicated that prior to the intervention, there was no significant difference in smoking behavior between the intervention and control groups ($p = 1.000$), suggesting that both groups were comparable at baseline. After the intervention, a significant difference was observed between the two groups ($p < 0.001$), with the intervention group showing a lower mean rank compared to the control group. These findings indicate that the intervention was effective in reducing smoking behavior among participants, as the improvement observed in the intervention group was greater than that in the control group.

Discussion

The results of the study showed that there was a statistically significant difference between pre-test and post-test scores in both the intervention and control groups ($p < 0.05$). However, the reduction in smoking behavior was substantially greater in the intervention group, decreasing from 7.97 to 2.97, compared to the control group, which only decreased from 8.00 to 7.06. These findings indicate that the provision of mint candy as an intervention has a stronger effectiveness in reducing smoking behavior among adolescents compared to no specific intervention. These results are consistent with previous studies reporting that

behavior substitution-based interventions can help reduce smoking frequency by redirecting oral habits and providing sensory stimulation similar to smoking activity [14, 15].

The effectiveness of mint candy in this study can be explained using the Health Promotion Model (HPM) proposed by Nola Pender. This model emphasizes that health behavior is influenced by perceived benefits, perceived barriers, self-efficacy, and interpersonal influences [13]. In the context of this study, mint candy provides a cooling and refreshing sensation in the mouth that helps divert smoking urges (cravings), thereby increasing perceived benefits of the substitute behavior. In addition, the easy accessibility and use of mint candy may also reduce barriers to smoking reduction efforts among adolescents [16, 17].

From the perspective of self-efficacy, adolescents who received the mint candy intervention had a greater likelihood of feeling capable of controlling smoking urges and replacing them with healthier alternative behaviors. Within the HPM framework, increased self-efficacy is a key determinant of successful health behavior change [13]. In addition, environmental support such as peers, teachers, and family also plays an important role in strengthening adolescents' commitment to behavior change, as described in the interpersonal influence component of the HPM [18].

This study is also supported by previous findings indicating that the use of mint or peppermint in the form of candy or behavioral substitution therapy may help reduce smoking urges and decrease cigarette consumption frequency. The menthol sensation produced by mint provides a relaxing effect and sensory distraction that can reduce nicotine cravings. Moreover, the use of mint candy as a non-pharmacological alternative is considered safer, more accessible, and more suitable for adolescent populations compared to conventional nicotine replacement therapy [14, 19].

Although a reduction in smoking behavior scores was also observed in the control group, the change was relatively small and did not demonstrate strong clinical significance. This may have been influenced by a testing effect or increased awareness among respondents after completing the pre-test, which could affect post-test responses even in the absence of a specific intervention [20]. Therefore, changes in the control group cannot be interpreted as the result of an effective intervention.

Overall, the findings of this study indicate that mint candy intervention is effective in reducing smoking behavior among adolescents. This intervention may serve as an alternative non-pharmacological health promotion strategy that is simple, low-cost, and easily implemented in school settings, particularly for preventing smoking behavior among adolescents [21, 22].

Conclusions

This study demonstrated that the use of mint candy was effective in reducing smoking behavior among adolescents. The results showed a significant reduction in smoking behavior scores in the intervention group after two weeks of mint candy administration, with a greater decrease compared to the control group. In addition, a statistically significant difference was found between the intervention and control groups after the treatment, indicating that mint candy may serve as a simple, safe, and easily applicable

non-pharmacological alternative intervention to help reduce smoking behavior among adolescents.

Recommendations

The findings of this study may serve as a simple, low-cost, and easily applicable non-pharmacological alternative intervention to help adolescents reduce smoking behavior. For future researchers, it is recommended to conduct studies with stronger research designs, involve larger and more diverse samples, and use longer intervention periods.

References

1. WHO. Ministry of Health and WHO release Global Adult Tobacco Survey Indonesia Report 2021 [Internet], 2024. Available from: https://www.who.int/indonesia/news/detail/22-08-2024-ministry-of-health-and-who-release-global-adult-tobacco-survey-indonesia-report-2021?utm_source=chatgpt.com
2. Sari SP, Swatitits M, Saputri K, Budi S. Social Media Exposure towards Asian Youth Smoking Behaviour: A Scoping Review. 2024; 12(2):214-221.
3. East K, McNeill A, Thrasher JF, Hitchman SC. Social norms as a predictor of smoking uptake among youth: A systematic review, meta-analysis and meta-regression of prospective cohort studies, 2021, 2953-2967.
4. Khouja JN, Suddell SF, Peters SE, Taylor AE, Munafò MR. Is e- - cigarette use in non- - smoking young adults associated with later smoking? A systematic review and meta- - analysis, 2021, 8-15.
5. Barrington-Trimis JL, Pang RD, Jao NC. Effects of Mint, Menthol, and Tobacco-Flavored E-Cigarettes on Tobacco Withdrawal Symptoms in Adults who Smoke Menthol Cigarettes: A Laboratory Pilot Study, 2025, 1-14.
6. Artanti KD, Arista RD, Fazmi TIK. The influence of social environment and facility support on smoking in adolescent males in Indonesia. J Public Health Res. 2024; 13(1).
7. Wooten S, Catley D, Miller MK, Wilson K, Richter KP, Masonbrink A. Treatment of e- - cigarette use among hospitalised adolescents and young adults: A protocol for intervention development and evaluation of preliminary efficacy and implementation outcomes in a randomised controlled trial, 2025, 1-8.
8. Vance L, Glanville B, Ramkumar K, Chambers J, Tzelepis F. The effectiveness of smoking cessation interventions in rural and remote populations: Systematic review and meta-analyses. Int J Drug Policy [Internet]. 2022; 106:103775. Available from: <https://doi.org/10.1016/j.drugpo.2022.103775>
9. Arshad MK, Fatima I, Ahmad W, Ellahi S, Mumtaz M, Usman M, *et al.* Mint (Mentha): A Herb and Used as a Functional Ingredient. 2023; 8634:38-52.
10. Li S, Qu Z, Li Y, Ma X. Efficacy of e-health interventions for smoking cessation management in smokers: A systematic review and meta-analysis. eClinicalMedicine [Internet]. 2024; 68:102412. Available from: <https://doi.org/10.1016/j.eclinm.2023.102412>
11. Mavroeidis A, Stavropoulos P, Papadopoulos G, Tsela A, Roussis I, Kakabouki I. Alternative Crops for the European Tobacco Industry: A Systematic Review. Plants. 2024; 13(2).
12. Bold KW, Sharma A, Haeny A, Gueorguieva R, Buta E, Baldassarri S. A randomized controlled trial of potential tobacco policies prohibiting menthol flavor in cigarettes and e-cigarettes: A study protocol, 2024, 1-11.
13. Pender NJ, Murdaugh CL, Parsons MA. Health Promotion in Nursing Practice. Seventh Edition, 2015.
14. McDowell EH, Kennedy JN, Feehan M, Bell SA, Marking SE, Zdinak JP, *et al.* Effect of fruit and mint flavored Rogue® oral nicotine product use on smoking reduction and quitting in a 6-Month prospective cohort of adults who smoke cigarettes. BMC Public Health. 2024; 24(1).
15. Rodríguez-Bolaños R, Ramírez-Palacios P, Gallegos-Carrillo K, Chávez-Iñiguez A, Lara D, Ossip DJ, *et al.* Use of flavor capsule cigarettes and their preliminary impact on smoking cessation in Mexico: An exploratory study. J Health Popul Nutr. 2025; 44(1):22.
16. Fithria F, Adlim M, Jannah SR, Tahlil T. A randomized controlled trial on the islamic-based program using family approaches in preventing adolescents' smoking behavior in indonesia: A study protocol. Belitung Nurs J. 2020; 6(4):136-140.
17. Fauziyah NS, Yulistiani M. The Effectiveness of Gum and Mint Candy in Quitting Smoking in Adolescents. Proc Ser Heal Med Sci. 2022; 3:80-87.
18. Khaira W, Mulia M. Pendekatan Gestalt Terhadap Perilaku Merokok. Intelektualita. 2023; 12(1):89-98.
19. Tahlil T, Maulina M, Hadi N. Program Peningkatan Keterampilan Menolak Rokok Secara Sopan untuk Remaja di Aceh Besar. J Kreat Pengabd Kpd Masy [Internet], Dec 1, 2024; 7(12):5257-5266. Available from: <https://ejournalmalahayati.ac.id/index.php/kreativitas/article/view/18129>
20. Beck Cheryl Polit Denise. Polit & Beck's Nursing Research: Generating and Assessing Evidence for Nursing Practice Polit & Beck's Nursing Research: Generating and Assessing Evidence for Nursing Practice [Internet]. 12th ed. north american: LWW, 2024.
21. Fithria F, Adlim M, Jannah SR, Tahlil T. Indonesian adolescents' perspectives on smoking habits: A qualitative study. BMC Public Health. 2021; 21(1):1-8.
22. Tahlil T, Woodman RJ, Coveney J, Ward PR. The impact of education programs on smoking prevention: A randomized controlled trial among 11 to 14 year olds in Aceh, Indonesia. BMC Public Health. 2013; 13(1).