ORIGINAL ARTICLE

Increasing knowledge and attitudes about dental caries and prevention after educational intervention using a modified lecture method in adolescents

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ABSTRACT

Introduction: The prevalence of caries in adolescents is still high, and the average visit to the dentist is when the disease is advanced. Educational interventions about dental caries and prevention need to be carried out to improve oral health status. Providing oral health education with appropriate methods will increase knowledge and encourage changes in attitudes and behaviors to prevent adolescent dental caries. This study aimed to analyze the differences in knowledge and attitudes before and after the intervention of education on dental caries and prevention among adolescents using a modified lecture method. **Method:** The study design is Quasi-Experimental with one group pretest posttest research design. Sample selection used probability sampling techniques, with simple random sampling techniques. The population in this study was students of SMPN 1 Jatinangor, with the total sample of 186 respondents. Respondents were given educational intervention using a modified lecture method, namely giving a lecture, with the help of a powerpoint presentation with interesting pictures, providing a toothbrush demonstration and ending with a discussion group. Pretest and posttest assessment was using questionnaires. Pretest and posttest assessments used a questionnaire, which contained 20 knowledge questions and 15 attitude questions. Questionnaires and educational materials had been tested for validity and reliability, with Cronbach's alpha results for knowledge at 0,878 and attitude at 0,841. The data were analyzed with the Wilcoxon test. **Results:** There was a significant difference between knowledge before and after the intervention of education on dental caries and prevention with a p-value of 0.001 (<0.05), and there was an increase in knowledge score, there was an average increase in knowledge score of 52%. Likewise, there were differences in attitudes before and after the intervention, with a p-value of 0.001 (<0.05) and an increase in attitude scores of 7.95%. **Conclusion:** The modified lecture method using power points, videos, demonstrations, group discussions and roll play on brushing teeth, which are carried out on adolescents, can increase knowledge and attitudes towards dental caries and prevention

KEYWORDS

Intervention, education, knowledge and attitude, dental caries, prevention

INTRODUCTION

Global data shows that as many as 3.5 billion people worldwide suffer from dental caries, especially in most low-income and middle-income countries, and the prevalence of the disease is increasing.[1] The prevalence of dental caries in adolescents aged 12-19 years based on Oral Health Surveillance in 2019 was 57%.[2]

The results of Basic Health Research (Riskesdas) in 2018 showed that the prevalence of dental caries in Indonesia was 88.8%, and the prevalence rate of dental caries in adolescents (10-14 years) was 73.4%.[3] Dental caries is a multifactorial disease caused by an imbalance of oral flora (biofilm) and fermentable carbohydrates on the teeth (host) surface over time.[4]

Oral health in adolescents is important because adolescence is a transition period to adulthood, where there is rapid growth and development related to physical and mental aspects.[5,6] One of them is the growth of permanent teeth that replace deciduous teeth, which puts adolescents in periods with a high risk of dental caries.[7,8] According to the World Health Organization (WHO), early adolescence ranges from 10-14 years.[9] The high prevalence of dental caries in adolescents can affect the quality of life of adolescents, judging from the frequent cases of toothache in adolescents, causing absenteeism at school.[10]

Data from the Jatinangor Community Health Center showed that the ratio of fillings to extractions was 0.01.[11] Initial survey data showed that knowledge about dental caries and prevention habits among teenagers at SMPN 1 Jatinangor, Sumedang Regency was still low. One of the reasons was that they often came for treatment in poor condition, severe toothache, or tooth infection. In addition, of the 306 students, 110 people experienced dental caries down to the pulp, and 20 people experienced dental caries in the occlusal area. According to the dentist, the Jatinangor Community Health Center, as the dental health supervisor for Jatinangor junior high school students, stated that the school students had never received oral health education about dental caries and prevention, because the human resources at the community health center were very minimal.

According to research results, toothache affects a person's level of work, while awareness of dental examination and maintenance is still low. On average they come to the hospital with dental problems, such as cavities and swollen gums.[12] Lack of health education leads to a high prevalence of dental caries in adolescents.[13] Adolescents who receive information about dental health has more frequent visits to the dentist.[14] An individual's knowledge, attitudes, values, motives, and needs play a significant role in a person's efforts to engage in preventive behavior.[15] Health education significantly increases adolescents' oral health knowledge.[16] Effective health education encourages adolescents to be aware of the health conditions of their oral cavity and causes attitude changes that will improve the quality of life of adolescents.[17] The World Health Organization explains that period of adolescence/school age is the right time for health promotion through education about preventive measures.[18] At this age, children have a high level of curiosity, and there is a meaningful transition in responsibility for themselves.[5] Oral health education will change adolescents' behavior regarding the prevention of dental diseases and determine the lifestyle habits of adolescents in the future.[16,19]

The high rate of dental caries in adolescents is due to low knowledge and prevention of dental caries.[6] In the adolescence phase, adolescents have a high risk of dental caries due to poor biofilm control and decreased oral hygiene, so most caries develop more severely.[16] This is a problem that must be solved. Previous studies explained that adolescents who were given education related to oral health were led to positive changes in dental caries prevention behavior.[16] Subedi's research in 2021, stated that dental health education effectively improves knowledge, attitudes, and behaviors of oral health.[20] Other studies have also shown that oral health education positively impacts oral health status in schoolchildren.[21]

Due to the low status of oral health knowledge, especially about dental caries and its prevention in adolescents in the Jatinangor Region, researchers were moved to conduct research by providing education to increase adolescents' knowledge and attitudes about dental caries and prevention. This study aimed to determine the differences in knowledge and attitudes before and after the intervention of education on dental caries and prevention in adolescents. This study aimed to analyze the differences in knowledge and attitudes before and after the

intervention of education on dental caries and prevention among adolescents using a modified lecture method.

METHODS

The type of research used was Quasi-Experimental with One Group Pretest-Posttest. The population in this study was students of SMPN 1 Jatinangor in 2023, which reached 1,019 students and consisted of grades 7, 8, and 9. The results of sample calculations using paired analytical formulas found that the minimum number of samples was 84 students.[22] The total sample obtained in the field was 186 students, namely 93 from class 7 and 93 from class 8. This research took groups from class 7 and class 8, and class 9 was not included because they did not receive permission; in which at the time of learning students were facing exams, and there was no longer any lesson schedule.

Sample selection used was probability sampling techniques, with simple random sampling techniques. Samples from 10 classes were shuffled and 3 classes were taken (per class around 35 students) for the intervention group and 3 classes were taken again for the control group. The sample inclusion criteria were students at SMPN 1 Jatinangor aged 12-14 years, having good general health, willing to be respondents and having obtained parental approval through informed consent and student approval through assent. The exclusion criteria were that students had to be more cooperative in following the research stages and filling out incomplete questionnaires.

The research was conducted at SMPN 1 Jatinangor from February – March 2023. Preliminary research was conducted, in the form of a survey to determine the extent of dental health knowledge of SMPN 1 Jatinangor students, and research licensing was managed. After analyzing the survey results, material was made for educational interventions and questionnaires according to the needs of the survey analysis results. The face validity test of the questionnaire was to be carried out in April 2023, followed by validity and reliability tests on April 6 – 13, 2023. This study assessed the level of knowledge and attitudes about caries and prevention before and after education. The assessment was carried out through questionnaires (before and directly after the provision of education), implementing 6 randomly selected classes on June 15-17, 2023. The provision of education in these 6 classes was carried out by one person, so that the delivery of material was maintained.

The questionnaire had gone through content validity test stage to test the relevance of the content through expert analysis and judgment using the content validity index (CVI), which can be used to check the relevance, clarity, and importance of the clarity of each question item according to experts.[23] This content validity index was assessed by three experts (NS, FMP, AAS) in the field of Dental Public Health and Prevention, as well as to test the content validity of PowerPoint learning media using the content validity index (CVI). The CVI results for knowledge items were the mean value of I-CVI = 0.917, and attitude items were mean I-CVI = 0.934. The results of the I-CVI value of each item were considered relevant by three experts who showed the average proportion value for knowledge items = 0.917 and the average proportion of attitude items = 0.93. Based on these values, the questionnaire had good validity (I-CVI > 0.79).

The face validity test was carried out on five students to determine the respondents' acceptance of each questionnaire item, namely readability, understanding and ease of answering the questionnaire, so that the perceptions of respondents and researchers were the same. The students were outside the sample and selected using the same criteria as the sample.[24] The validity of the question items and their reliability were tested on 20 respondents using the same criteria as the research sample and using Bivariate Pearson correlation (Pearson Product Moment) with the results of all question items being declared valid with a calculated r value > r table. The reliability test results for the knowledge questionnaire obtained Alpha Cronbach value = 0.878 and the attitude questionnaire with Alpha

Cronbach = 0.841. All knowledge and attitude question items were considered reliable, and all tests consistently had high reliability.

The knowledge items in this questionnaire consisted of 20 items and used the Guttman Scale, with a total score of 20. Where the value per item of the knowledge questionnaire was if the respondent answered 1 correctly and 0 incorrectly.[25] Then the total knowledge score was classified into 3 categories, namely insufficient knowledge (0 – 6, 7), moderate knowledge (6.8 – 13.5), and good knowledge (13.6 – 20). The attitude statement item consisted of 15 items and used the Likert Scale.[26] The Likert Scale consists of 5 scales, with a value of 0 – 5, namely from strongly disagree, disagree, between agree and disagree, agree, strongly agree, with a total score of 75. Then the total attitude score is c into 3 categories, namely poor (15 – 35), moderate (36 – 56), and good (57 – 75).

Educational intervention was given to students in class, and carried out for 3 days for 6 classes. Each class was given education about dental caries and its prevention for 30 minutes, followed by a tooth brushing demonstration and discussion for 15 minutes. The intervention involved education in a single visit using the modified providing lecture method. A modification of the lecture method in this research was a lecture method assisted by power points, videos, and toothbrushing demonstrations as well as group discussions. The activities carried out included direct lectures to students about dental caries and its prevention, using powerpoint (PPT) presentations with interesting pictures and videos, so that students remained enthusiastic and did not get bored. Apart from that, education was provided through a demonstration method of tooth brushing techniques and continued with group discussions in class. Finally students did a direct role play which was evaluated by the instructor, together with the students. Students were expected to be able to assess whether the tooth brushing techniques used by their friends were right or wrong and some of the techniques were used. All mistakes could be immediately discovered and corrected by the instructor.

The tools used were a set of computers with educational materials, dental phantoms and toothbrushes and questionnaires. The knowledge provided included dental caries and prevention, including anatomy of the oral cavity and teeth, dental period, plaque and calculus, the process of caries, types of cavities (dental caries), brushing, dental cleaning aids, snacking frequency, self-detection of plaque and caries, routine control every six months to the dentist. The education provided regarding the attitude to prevent dental caries included attitudes when teeth experience caries and, attitudes towards the effects of caries on teeth, attitudes towards prevention and maintenance of oral health.

Students were given a pretest on dental caries education and prevention material before the educational intervention was carried out and a posttest was given directly after the intervention. The questionnaires were filled out together in class and online using Google Form.

Research data were collected and analyzed using statistical tests. The characteristics of the study sample were poured into the frequency distribution table. Data to distinguish pretest and posttest results were analyzed using the Wilcoxon Test to see differences in knowledge and attitudes towards dental caries and prevention in students before and after the intervention of education on dental caries and prevention using a modified lecture method. Media to process research results such as Microsoft Excel or google spreadsheet, data analysis media Statistical Program for Social Science (SPSS) 27 was used.

RESULTS

Table 1 shows the results of the demographic characteristics of 189 respondents from SMP 1 Jatinangor grade 7 and 8 students. It 1 shows the study sample was mostly aged 12 - 14 years, and the respondents were more female at 108 people (58.06%) from grades 7 and 8.

Table 1. Demographic characteristics of respondents(n=186)

Characteristics of Respondents	n	%
Age		
12 years	11	5,91
13 years	86	46,24
14 years	89	47,85
Gender		
Male	78	41,94
Female	108	58,06
Class		
7	93	50
8	93	50

Table 2. Distribution of frequency of respondents' knowledge answers to dental caries and prevention before and after intervention (n = 186)

Items	*Pretest*		*Posttest*	
	True	False	True	False
	n (%)	n (%)	n (%)	n (%)
Healthy teeth are what they look like	143 (76,9)	43(23,1)	162 (87,1)	24 (12,9)
The sequence / layer of the teeth from the outermost to the innermost	116 (62,4)	70 (37,6)	151 (81,2)	35 (18,8)
The part of the tooth that contains a lot of blood vessels and nerves	130 (69,9)	56 (30,1)	135 (72,6)	51 (27,4)
Permanent teeth are almost complete at what age	56 (30,1)	130 (69,9)	125 (67,2)	61 (32,8)
Period of teeth	136 (73,1)	50 (26,9)	159 (85,5)	27 (14,5)
Plaque definition	53 (28,5)	133 (71,5)	102 (54,8)	84 (45,2)
Calculus definition	74 (39,8)	112 (60,2)	108 (58,1)	78 (41,9)
The process of occurrence of caries	62 (33,3)	124 (66,7)	61 (32,8)	125 (67,2)
Causes of dental caries	67 (36,0)	119 (64,0)	100 (53,8)	86 (46,2)
Signs of dental caries	82 (44,1)	104 (55,9)	138 (74,2)	48 (25,8)
Overview of carious teeth (accompanied by pictures)	104 (55,9)	82 (44,1)	131 (70,4)	55 (29,6)
White spot as a sign of caries (accompanied by pictures)	38 (20,4)	148 (79,6)	92 (49,5)	94 (50,5)
Prevention of dental caries	37 (19,9)	149 (80,1)	116 (62,4)	70 (37,6)
Toothbrush methods for teenagers	82 (44,1)	104 (55,9)	115 (61,8)	71 (38,2)
Terms for brushing teeth properly and correctly	94 (50,5)	92 (49,5)	110 (59,1)	76 (40,9)
Plaque cleaning	83 (44,6)	103 (55,4)	138 (74,2)	48 (25,8)
Prevention of cavities	41 (22,0)	145 (78,0)	62 (33,3)	124 (66,7)
Good measures for the prevention of cavities	83 (44,6)	103 (55,4)	144 (77,4)	42 (22,6)
Habits that can make cavities easier	80 (43,0)	106 (57,0)	119 (64,0)	67 (36,0)
Poor behavior in preventing cavities	58 (31,2)	128 (68,8)	104 (55,9)	82 (44,1)

Table 2 shows the percentage of pretest results, each question item being mostly answered incorrectly and fewer answering the question item correctly (items no 1,2,3,5 and 11). The results of the respondent posttest showed improved

knowledge, with increased respondents' correct answers to each question item. Only a few question items were still answered incorrectly (items no 8, 12, and 17).

Table 3. Respondents' level of knowledge of dental caries and its prevention before and after intervention (n = 186)

Knowledge	Before Intervention		After Intervention	
	n	%	n	%
Good	9	4,84	87	46.77
Moderate	121	65,05	93	50.00
Less	56	30,11	6	3.23

Table 3 shows respondents' knowledge of dental caries and its prevention before and after educational interventions. The respondents' knowledge level before the educational intervention was, on moderate, in the good category, 121 (65.05%), and only slightly in the good category, 9 (4.84%). After the educational intervention, moderate knowledge remained in the good category of 93 (50%), but the good category increased to 87 (46.77%). Respondents whose knowledge in the category was less, as many as 56 (30.11%), reduced to 6 (3.23%) respondents.

Table 4. Differences in average pretest and posttest results of dental caries knowledge and prevention with Wilcoxon test (n = 186)

	Range	Minimum	Maximum	Mean	$\rho - value$
Pretest	70	10	80	41,56	0,001
Posttest	75	25	100	63,20	

Table 4 shows an increase in the average value of knowledge from a pretest score of 41.56 to a posttest result of 63.20. The ρ-value of the Wilcoxon pretest and posttest test was 0.001 (<0.05), which means there was a difference in the level of knowledge before and after the educational intervention.

Table 5. Frequency distribution of answers to respondents' attitudes towards dental caries and prevention before and after the intervention (n = 186)

Items		1	2	3	4	5
		n (%)	n (%)	n (%)	n (%)	n (%)
When toothache and taking medication, should still see the dentist	Pretest	17 (9,1)	16 (8,6)	35 (18,8)	98 (52,7)	20 (10,8)
	Posttest	3 (1,6)	8 (4,3)	21 (11,3)	122 (65,6)	32 (17,2)
Brushing your teeth at least 2X a day	Pretest	9 (4,8)	15 (8,1)	30 (16,1)	78 (41,9)	54 (29,0)
	Posttest	2 (1,1)	3(1,6)	21 (11,3)	94 (50,5)	66 (35,5)
The importance of brushing your teeth so that your teeth are clean from plaque	Pretest	9 (4,8)	69 (37,1)	43 (23,1)	52 (28,0)	13 (7,0)
	Posttest	12 (6,5)	48 (25,8)	40 (21,5)	65 (34,9)	21 (11,3)
The importance of brushing your teeth with toothpaste containing *fluoride*	Pretest	8 (4,3)	13 (7,0)	80 (43,0)	64 (34,4)	21 (11,3)
	Posttest	2 (1,1)	7(3,8)	39 (21,0)	101 (54,3)	37 (19,9)
The more you brush your teeth, the better	Pretest	8 (4,3)	20 (10,8)	31 (16,7)	71 (38,2)	56 (30,1)
	Posttest	0 (0,0)	10 (5,4)	28 (15,1)	99 (53,2)	49 (26,3)
The need to control the presence or absence of dental caries with the help of mirrors	Pretest	10 (5,4)	11 (5,9)	33 (17,7)	101 (54,3	31 (16,7)
	Posttest	2 (1,1)	3(1,6)	22 (11,8)	114 (61,3)	45 (24,2)
Even though you brush your teeth regularly, you still have to control whether or not your teeth are clean from plaque	Pretest	12 (6,5)	48 (25,8)	40 (21,5)	66 (35,5)	20 (10,8)
	Posttest	11 (5,9)	49 (26,3)	31 (16,7)	79 (42,5)	16 (8,6)
Need to see a dentist immediately even if the caries is small	Pretest	8 (4,3)	58 (31,2)	64 (34,4)	40 (21,5)	16 (8,6)
	Posttest	8 (4,3)	51 (27,4)	58 (31,2)	50 (26,9)	19 (10,2)

Items		1	2	3	4	5
		n (%)	n (%)	n (%)	n (%)	n (%)
The importance of routine dental control to the dentist every 6 months, even though the teeth do not hurt	Pretest	13 (7,0)	21 (11,3)	42 (22,6)	84 (45,2)	26 (14,0)
	Posttest	7 (3,8)	4 (2,2)	16 (8,6)	114 (61,3)	45 (24,2)
The importance of routinely cleaning the tongue every day	Pretest	14 (7,5)	69 (37,1)	61 (32,8)	32 (17,2)	10 (5,4)
	Posttest	16 (8,6)	57 (30,6)	63 (33,9)	40 (21,5)	63 (33,9)
The high frequency of snacking facilitates, the occurrence of caries	Pretest	9 (4,8)	11 (5,9)	49 (26,3)	97 (52,2)	20 (10,8)
	Posttest	1 (0,5)	4 (2,2)	22 (11,8)	120 (64,5)	39 (21,0)
The importance of treating cavities rather than being extracted	Pretest	29 (15,6)	78 (41,9)	52 (28,0)	13 (7,0)	14 (7,5)
	Posttest	25 (13,4)	68 (36,6)	47 (25,3)	26 (14,0)	20 (10,8)
The importance of immediately seeing a dentist if there is a tooth that hurts	Pretest	10 (5,4)	10 (5,4)	51 (27,4)	73 (39,2)	42 (22,6)
	Posttest	0 (0,0)	5 (2,7)	26 (14,0)	92 (49,5)	63 (33,9)
Brushing your teeth needs to wait thirty minutes after eating or drinking acid	Pretest	9 (4,8)	21 (11,3)	78 (41,9)	67 (36,0)	11 (5,9)
	Posttest	2 (1,1)	15 (8,1)	71 (38,2)	81 (43,5)	17 (9,1)
Sugar as a causative factor of caries	Pretest	12 (6,5)	51 (27,4)	86 (46,2)	27 (14,5)	10 (5,4)
	Posttest	11 (5,9)	51 (27,4)	74 (39,8)	45 (24,2)	5 (2,7)

Note: 1 = strongly disagree; 2 = disagree; 3 = between agreeing and disagreeing; 4 = agree; 5 = very agreeable

Table 5 shows pretest and posttest results for all attitude question items, most of whom preferred affirmative and strongly agreed statements. The results on the pretest contained several items that preferred disapproval and strongly disapproval (nos. 3, 8, 10, 12, and 15). But after intervening for all posttest results, there was an increase in the number of respondents who expressed a positive attitude (agree and strongly agree), but a slight increase in items no 7, 8, 12, and 15.

The pretest results with the most scores of 4 and 5 (positive attitude) are question items number 2, 5, and 6 while the most scores 1 and 2 (negative attitude) are item numbers (3, 10, 12,15). Posttest results showed that scores 4 and 5 (positive attitude) increased the most, including question items number (1, 2, 4, 5, 6, 9, 11, 13) and scores 1 and 2 (negative attitude) the most were question items number 10, 12 and 15.

Table 6. Respondents' attitudes towards dental caries and prevention before and after intervention (n = 186)

Attitude	Before Intervention		After Intervention	
	n	%	n	%
Good	14	7,53	54	29,03
Moderate	172	92,47	132	70,97
Less	0	0	0	0

Table 6 shows the level of students' attitudes towards dental caries and its prevention before and after educational interventions. Before the intervention, the average attitude of respondents was in the moderate category of 172 (92.47%), and the level of student attitudes after being given the average educational intervention was still in the moderate category of 132 (70.97%). However, there was an increase in attitudes in the good category from 7.53% to 29.03%. None of the respondents had attitudes in the category of less either before or after the educational intervention.

Table 7. Differences in mean pretest and posttest results attitude towards dental caries and its prevention with Wilcoxon test (n = 186)

	Range	Minimum	Maximum	Mean	$\rho - value$
Pretest	27	37	64	49,59	0,001
Posttest	29	38	67	53,53	

Table 7 shows the average pretest score of 49.59 and posttest score of 53.53, showing increased respondents' attitudes. The ρ-value of the Wilcoxon pretest and posttest test was 0.000, meaning there were differences in attitude levels before and after an educational intervention.

DISCUSSION

Table 1 shows the characteristics of research respondents at the age range of 12-14 years, with an average age of 13 years. Data from the Population and Civil Registration Service of West Java Province states that junior high school students generally have an age range of 13-15 years.[27] The gender is dominated by women. The results of the initial survey assessing knowledge about dental caries and prevention showed that respondents were in the low category. Initial survey results assessing knowledge about dental caries and prevention showed that respondents were in the low category. This is different from the results of research from Hidayati (2022), namely that knowledge of dental caries and prevention in adolescents is in the moderate category.[28] Adolescents are a group that needs promotion of oral health because, at this age, all their teeth have almost erupted, but if oral hygiene behavior is not maintained, it will affect their quality of life and increase their absence from school.[6,13] Therefore in this research, this intervention was provided in the form of providing education about dental caries and prevention so that knowledge and attitudes towards dental caries and prevention can be improved. The aim of education at the school level was to prevent the emergence of oral disease and develop healthy behavior and attitudes.[21]

The research results in table 2, regarding knowledge of dental caries and prevention in adolescents, before and after being given the intervention. The measurements used a questionnaire containing oral health, dental anatomy, primary and permanent teeth, plaque and calculus, dental caries and signs, caries process and caries prevention. The results of the knowledge pretest consisted of 20 question items, 15 of which were answered incorrectly and only 4 items were answered correctly, about dental anatomy (item no. 1, 2, 3, 5) and dental caries with pictures (item no 11). Knowledge questions that were answered incorrectly were about plaque and calculus, dental caries and signs, the caries process, brushing teeth and caries prevention. Other research revealed that adolescents' knowledge was still low, namely about bacteria as a cause of tooth decay, sweet foods such as chocolate, and not knowing the causes of tooth decay.[28] In both research results there were similarities regarding the low level of knowledge about the causes of dental caries. This should be a concern, because low knowledge about the causes of caries is a high risk factor for dental caries.

After the intervention was carried out to increase knowledge about dental caries and prevention, using the modified lecture method, the average value of knowledge after the intervention (posttest) showed that all question items which at the pretest were mostly answered incorrectly and at the posttest could be answered correctly, an increase in correct answers for each question item around 30-50% (Table 2). In table 3, both before and after the intervention, the average level of knowledge about dental caries and prevention in adolescents was in the medium category, but there was a shift after the intervention, namely a relatively high increase in the good category, and a decrease in the moderate and poor categories. After the intervention, other research showed the same thing, namely that knowledge scores related to dental health increased greatly in students who received dental health education interventions compared to peers who did not

receive it. Schools act as an effective place to promote oral health, as students spend most of their time at school.[29]

The results of the difference test between the average knowledge before and after the intervention showed that there was a significant difference, this showed an increase in the average knowledge value before the intervention (41.56) and after the intervention, it increased to (63.20) (Tabel 4). This showed that there had been an increase in knowledge about dental caries and prevention among adolescents at SMPN 1 Jatinangor, in which from the results of the initial survey even before the intervention, knowledge about dental caries and prevention was lacking.

The results of the research are in line with research from Haque (2016) from Bangladesh, namely that the level of knowledge of students before being given oral health education was mostly in the poor category, and after education, it was in the good category.[13] Research by Rui Jiang (2023) from China showed that the majority of changes were accurate knowledge and attitudes, moderate practice towards preventing dental caries.[28 30] This difference in students' knowledge could be caused by many factors, including culture, parental education level, and socio-economic status.[29 31] The results of this study showed that the respondent's level of knowledge was still in the medium category. This is partly because students at this school had only been given one educational intervention and had never previously received educational intervention related to dental caries and prevention.

Table 5 shows the results of the pretest and posttest regarding attitudes towards dental caries and prevention, in which respondents chose more positive (affirmative) statements and expressed more agreeable attitudes (scale 4). Table 6 shows that on average, most of the adolescents had a moderate attitude towards dental caries and prevention, both in the pretest and posttest results, a small percentage had a good attitude and none had a poor attitude. However, in the posttest there was an increase in good attitudes, respondents who had moderate attitudes shifted to having good attitudes. This can be seen in table 7, the test results of the difference in the average attitude values before the intervention (pretest) and after the intervention (posttest) are significant, this shows that there was a change in attitude after being given the intervention, although it was not large. Research from Sanadhya (2014) found that knowledge increases after receiving education, thus influencing adolescents' attitudes.[30 32] According to Gardner (1985), attitude is a conclusion made on the basis of complex beliefs about the object of attitude. It is a combination of a person's instincts and feelings, prejudices or biases, perceptions, fears, threats and beliefs regarding a particular topic.[31 33]

The overall research results carried out an educational intervention using a modified lecture method, which was proven to be able to increase adolescents' knowledge and attitudes towards dental caries and its prevention. In table 3, after the intervention (posttest), there was an increase in knowledge, in which most of the question items were answered incorrectly, and the respondents were able to answer correctly. Only 3 knowledge question items were still answered incorrectly (items no. 8, 12, and 17), namely about the process of caries occurrence, the initial appearance of caries (white spots), and caries prevention, although the average level of knowledge and attitudes of respondents was still in the medium category. This is because the intervention was only given once and the respondents had never received educational information about dental caries and its prevention. The results of this study were in line with research results which stated that oral health education is effective in reducing plaque in short-term studies but is not effective in studies with long follow-up periods.[34] According to Nakre PD. (2013), all research is effective in increasing knowledge outcomes, and changes in attitudes over a longer period of time are only possible through continuous oral health education programs.[35]

Even though only one intervention was carried out and respondents had never previously received educational information about dental caries and its

prevention, there was an increase in all knowledge items except for these 3 items (Tabel 5). Intervention with this lecture modification method has been proven to quickly increase knowledge, this is possible because this method provides repetition of several important materials, so it is hoped that the material will be easy to remember and understand. Interventions given by various aids such as lectures, albums, models, flipcharts, leaflets, E-programs, games, drawings, and presentations proved effective in improving oral hygiene status and dental caries, but no reduction in plaque levels and gingival inflammation as compared to oral health talk/counseling by dentists.[36] In applying this modified lecture method, educational information was given via PowerPoint which was equipped with real pictures that were interesting and clear, and selected according to teenagers, and reinforced with video shows, and students could immediately do a role play about how to brush their teeth, good and correct teeth. Demonstration and experiment method is a very effective teaching method, because it helps students to find their own answers based on correct facts.[32 37] Then in the discussion there is a question and answer method which allows for direct communication which is two-way traffic, because at that time there is also direct communication, two-way. at the same time a dialogue occurs between the instructor and students. Then they fill out the pretest-posttest online.

This lecture modification method was created so that adolescents who are now the millennial generation can continue to pay attention to the material provided so that they are willing to listen to all the material as new information and hopefully can open their minds so that they are ultimately interested and want to actively participate in activities. All of this is adapted to the characteristics of the millennial generation, which is generally characterized by increased use and familiarity with communication, media and digital technology. They want information that is easy to access, and open their minds about the importance of something that is renewable, unique, interesting and competitive.[33 38] This generation always appreciates creative and innovative ideas. Apart from that, according to Hunt, they really likes trial and error which allows for constant learning and self-evaluation.[34 39] This method is also in accordance with the statistical results showing that 90% of information processed by the brain is visual. The human brain only needs 13 milliseconds to process an image, thus the human brain processes images 60,000 times faster than tex.[35 40] The response from respondents during the provision of educational intervention was quite enthusiastic, as seen from the fact that they were able to pay attention and follow it until the end, as well as with real pictures. According to them, the pictures were interesting and easy to understand. In this research, even though it was only given in one educational intervention, with a modified lecture method, the material was given repeatedly with several methods of delivering information, so that it would be able to increase and strengthen knowledge and attitudes. Repeated sessions can have a better impact in improving respondents' knowledge and attitudes.[36 41]

Increasing knowledge about dental caries and prevention in this study had an impact on improving attitudes as well. The average value of attitudes towards dental caries and prevention from this study was in the moderate category (Table 5). This was in line with research conducted by Artika (2022) which showed that the 12-15 year old group could understand the material provided, thereby encouraging changes in behavior and attitudes towards oral health.[42] The change in attitude in this study appeared to be not entirely positive, because maybe there were still things that were still in doubt. This is the first time students were being given oral health educational information about dental caries and prevention, so students might not be sure about the information they received, because the educational information they received was something new. According to Allport (1935), attitude is a mental state of will that is organized by experience when facing certain situations, it does not appear immediately or is innate, but is structured and formed through experience which has a direct influence on a person's response.[43] This means that in taking action based on their experiences, students will consider the positive and

negative sides, and tend to take action based on what they feel is right.[44] Therefore, it is not enough for information intervention to be given just once, but must be repeated in a structured manner and changes monitored. This is in line with the results of the level of knowledge which is still in the medium category. If knowledge about dental caries and prevention is good, then attitudes are expected to improve.

The modified lecture method used in this study was proven to increase knowledge and attitudes towards dental caries and prevention (Tables 2 & 5). This modified lecture method provided advantages compared to the lecture method in general, where in this method the material provided had been specifically adapted to the oral health needs of adolescents, coupled with clear and interesting real images through PowerPoint presentations, also adapted to the habits of adolescents, and there was also a live demonstration about brushing teeth. There was interaction between students and educators, where students were also given discussion time so that material that was not yet understood could be asked and discussed, in the end students did a role play of brushing teeth. Another thing that might have contributed to increasing knowledge and attitudes in this research was that the intervention strategy chosen was carried out in schools, where adolescent communities gather. School-based educational interventions have shown improvements in oral health and changes in attitudes and behavior in adolescents.[40 45] Other studies have shown that oral hygiene knowledge increased more in groups given longer educational interventions.[20]

In this study, intervention by providing educational information about caries and prevention might only be able to increase knowledge and attitudes, which would have an impact in the short term. The results of a number of systematic reviews of the evidence suggest that oral health education can be effective in increasing knowledge in the short term and at some levels.[35, 46,47] Because knowledge alone is not enough to change health behavior in adolescents. [13,17] It takes several months for individuals to adapt to new behaviors learned through educational interventions [20,41 48] Individuals with good knowledge do not necessarily have good attitudes and behavior. Therefore, it is necessary to strengthen health education in adolescents to change negative attitudes into positive ones.[29 31] Most of the knowledge and behavior related to oral health increased after 6 months of intervention but will return to the beginning if behavioral reinforcement is not carried out.[42 49]

The overall research results regarding knowledge and attitudes towards dental caries and prevention were in line with Ghaffari's (2018) meta-analysis research which stated that educational interventions and promotion of oral health can improve individual knowledge, attitudes and behavior. Adolescents' curiosity increases motivation which will shape attitudes and behavior in adolescents.[41 48] Knowledge will have a negative or positive impact on attitudes, adolescents who have knowledge and positive attitudes regarding oral health will lead to good oral health maintenance behavior.[29 31]

This research showed that the average change in increasing knowledge scores was more significant than increasing attitudes. This research showed that the average change in increasing knowledge scores was more significant than increasing attitudes. In contrast to research from Haque SE, et al. (2016), it stated that significant improvement was observed regarding school aged adolescents' self-reported higher knowledge, attitudes and practices at follow-up compared with baseline. The increase in respondents' knowledge and attitudes through this intervention could be caused by many factors; Adequate preparation during the 4 days of providing oral health education, reinforcement and, moreover, repeated sessions having a better impact in improving knowledge and attitudes among students.[13] This is because education was only carried out once due to limited research time. Individuals need more time to adapt their attitudes and behavior because the attitude or behavior must emerge from within the adolescent himself.[17] The formation of this behavior must be accompanied by reinforcing the knowledge that has been given.[42 49] Repetition in repetition according to the research results of Sarayuthpitak (2022) who underwent repeated intervention for six weeks showed a

higher increase in knowledge than the group that was not given repeated intervention.[43 50]

One of the limitations of research that uses quasi-experimental methods is that this research was carried out by taking class groups, so it was not possible to have several students carry out the experiments. Apart from that, the difficulties faced were in the field of conditioning and attracting students' attention to pay attention to the material, so that the education provided was not optimal. When given advice or input, increasing independence in adolescents often leads to rejection.[16] The reason it is difficult to manage students during research is also one of the reasons students are often disturbed by their peers, this is due to inappropriate attitudes of adolescents who are often very easily influenced by the environment.[44,51]

Finding appropriate strategies or other intervention methods that are more effective in the adolescent age group is needed to improve knowledge, attitudes and behavior (skills). Further research is recommended to analyze ways or methods of learning intervention that are appropriate and of interest to adolescents. The right intervention will arouse interest in learning, increase knowledge, change attitudes to be positive, and ultimately improve oral health behavior. One method that can be used is to provide education with peers as material providers, accompanied by appropriate delivery media for adolescents. However, Xiang's (2022) research found that peer intervention is an effective method for improving oral health in adolescents.[45 53]

Another limitation of this research was the short research time so it could not assess behavior changes. This research only assessed attitudes through questionnaires, and it is recommended for further research to carry out clinical dental examinations, to assess changes in attitudes towards more effective adolescent behavior. Further research using this lecture modification method can be developed into longitudinal research to find out more concrete changes in knowledge, attitudes and behaviour.

This is an important recommendation based on research results, that the delivery of information is expected to be accompanied by real and clear pictures and also the importance of repeating the material provided in one activity with various methods or various appropriate learning/intervention modifications that are adapted to the characteristics of adolescents. Apart from the material that is repeated during the intervention, it is also necessary to provide reinforcement for the repetition over a certain period of time so that it acts as a reminder and reinforcer in the behavior change process. Apart from that, it is more effective for adolescents to do it together in their community, such as at school.

CONCLUSION

The modified lecture method using power points, videos, demonstrations, group discussions and role play on brushing teeth, which was carried out on adolescents, can increase knowledge and attitudes towards dental caries and prevention. Delivery of educational material with real and clear pictures, repetition of material in various methods/modifications of learning methods and according to the characteristics of adolescents, play an important role in increasing knowledge and attitudes about oral health

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