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# LIST OF CONTENTS

<b>LIST OF CONTENTS.....</b>	<b>iii</b>
<b>COMPARISON OF ORAL HYGIENE STATUS FOLLOWING XYLITOL AND NON-XYLITOL CHEWING GUM USE AMONG STUDENTS OF SMP NEGERI 1 PADANG PARIAMAN .....</b>	<b>1</b>
<b>Abstract.....</b>	<b>1</b>
<b>1. INTRODUCTION.....</b>	<b>1</b>
<b>2. METHODS .....</b>	<b>2</b>
<b>3. RESULTS .....</b>	<b>3</b>
<b>4. CONCLUSION .....</b>	<b>5</b>
<b>REFERENCES.....</b>	<b>5</b>
<b>PROMOTING DIABETES PREVENTION IN THE WORKPLACE: THE EFFECTIVENESS OF DIABETES HEALTH COACHING AMONG OFFICE WORKERS.....</b>	<b>7</b>
<b>Abstract.....</b>	<b>7</b>
<b>1. INTRODUCTION.....</b>	<b>7</b>
<b>2. METHODOLOGY .....</b>	<b>8</b>
<b>3. RESULTS .....</b>	<b>9</b>
<b>4. CONCLUSIONS.....</b>	<b>11</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>11</b>
<b>REFERENCES.....</b>	<b>11</b>
<b>DENTAL PLAQUE INDEX AMONG FOURTH TO SIXTH-GRADE STUDENTS AT SDN 01 NAN SABARIS, PADANG PARIAMAN .....</b>	<b>13</b>
<b>Abstract.....</b>	<b>13</b>
<b>1. INTRODUCTION.....</b>	<b>13</b>
<b>2. METHODOLOGY .....</b>	<b>13</b>
<b>3. RESULTS.....</b>	<b>14</b>
<b>4. CONCLUSIONS.....</b>	<b>15</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>15</b>
<b>REFERENCES.....</b>	<b>15</b>
<b>PERSON-CENTERED COUNSELING IMPROVES DIETARY BEHAVIOR AMONG PATIENTS WITH GOUT AT RASANAE TIMUR PUBLIC HEALTH CENTER IN BIMA CITY .....</b>	<b>17</b>
<b>Abstract.....</b>	<b>17</b>
<b>1. INTRODUCTION .....</b>	<b>17</b>
<b>2. METHODOLOGY .....</b>	<b>18</b>
<b>3. RESULTS.....</b>	<b>18</b>
<b>4. DISCUSSION .....</b>	<b>19</b>
<b>5. CONCLUSIONS.....</b>	<b>20</b>

ACKNOWLEDGEMENTS .....	20
REFERENCES.....	20
<b>RELATIONSHIP BETWEEN PERSONAL HYGIENE KNOWLEDGE AND ATTITUDES AND DERMATITIS SEVERITY AMONG STUDENTS OF MODERN ROBITHOH ISLAMIC BOARDING SCHOOL, BANDUNG REGENCY .....</b>	<b>22</b>
1. INTRODUCTION.....	22
2. METHODOLOGY.....	24
3. RESULTS .....	24
4. CONCLUSION .....	26
5. CONCLUSIONS.....	27
ACKNOWLEDGEMENTS .....	27
REFERENCES.....	27
<b>FORMULATION AND EVALUATION OF LIQUID HAND WASHING SOAP PREPARATION FROM ETHANOL EXTRACT FROM BINAHONG LEAVES.....</b>	<b>29</b>
Abstract.....	29
1. INTRODUCTION.....	29
2. METHODOLOGY .....	30
3. RESULTS .....	32
4. CONCLUSIONS.....	33
REFERENCES.....	34
<b>THE RELATIONSHIP BETWEEN KNOWLEDGE OF CARIOGENIC FOODS AND DENTAL CARIES EXPERIENCES AMONG STUDENTS AGED 12–15 YEARS IN PASAMAN REGENCY .....</b>	<b>36</b>
Abstract.....	36
1. INTRODUCTION.....	36
2. METHODOLOGY.....	37
3. RESULTS AND DISCUSSION.....	37
4. CONCLUSION .....	40
REFERENCES.....	40
<b>PHYSICAL ACTIVITY AND DIETARY KNOWLEDGE AMONG ELDERLY WITH HYPERTENSION: A STUDY IN RANGKASBITUNG PHC.....</b>	<b>42</b>
Abstract.....	42
1. INTRODUCTION.....	42
2. METHODOLOGY.....	43
3. RESULTS .....	44
4. CONCLUSION .....	49
ACKNOWLEDGEMENTS .....	49
REFERENCES.....	49

<b>THE RELATIONSHIP BETWEEN THE ROLE OF POSYANDU CADRES AND THE COMPLETENESS OF BASIC IMMUNIZATION IN INFANTS AGED 12-24 MONTHS IN SAMARINDA CITY .....</b>	<b>53</b>
Abstract.....	53
1. INTRODUCTION.....	53
2. METHODOLOGY .....	55
3. RESULTS .....	55
CONCLUSIONS.....	60
REFERENCES.....	60
<b>EFFECTS OF ORAL HEALTH EDUCATION AND MASS TOOTHBRUSHING ON ELEMENTARY SCHOOL STUDENTS .....</b>	<b>62</b>
Abstract.....	62
1. INTRODUCTION .....	62
2. METHODS .....	63
3. RESULTS.....	64
4. DISCUSSION .....	65
5. CONCLUSIONS.....	66
ACKNOWLEDGEMENTS .....	67
REFERENCES.....	67
<b>EFFECT OF CMC-NA CONCENTRATION VARIATION AS A THICKENING AGENT IN SHAMPOO FORMULATION CONTAINING GRAPESEED OIL (<i>VITIS VINIFERA</i> L.).....</b>	<b>69</b>
Abstract.....	69
1. INTRODUCTION.....	69
2. METHODOLOGY .....	70
3. RESULTS .....	72
4. CONCLUSIONS.....	75
ACKNOWLEDGEMENT.....	75
REFERENCES.....	75
<b>NURSING INTERVENTIONS FOR PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION: A NARRATIVE REVIEW OF CURRENT EVIDENCE.....</b>	<b>77</b>
Abstract.....	77
1. INTRODUCTION.....	77
2. METHODOLOGY .....	79
3. RESULTS .....	79
4. CONCLUSIONS.....	85
ACKNOWLEDGEMENTS .....	85
REFERENCES.....	86

<b>COMPARATIVE EFFECTIVENESS OF VERTICAL-HORIZONTAL VERSUS FONES-HORIZONTAL COMBINED TOOTHBRUSHING TECHNIQUES ON PLAQUE INDEX AMONG ELEMENTARY SCHOOL CHILDREN .....</b>	<b>89</b>
<b>Abstract.....</b>	<b>89</b>
<b>1. INTRODUCTION.....</b>	<b>89</b>
<b>2. METHODOLOGY .....</b>	<b>90</b>
<b>3. RESULTS AND DISCUSSION.....</b>	<b>90</b>
<b>4. CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>92</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>92</b>
<b>REFERENCES.....</b>	<b>92</b>
<b>THE RELATIONSHIP BETWEEN ENERGY INTAKE, MACRONUTRIENT INTAKE AND PHYSICAL ACTIVITY AND OVERNUTRITION IN ADOLESCENTS.....</b>	<b>94</b>
<b>Abstract.....</b>	<b>94</b>
<b>1. INTRODUCTION.....</b>	<b>94</b>
<b>2. METHODS .....</b>	<b>95</b>
<b>3. RESULTS .....</b>	<b>95</b>
<b>4. DISCUSSION .....</b>	<b>97</b>
<b>5. CONCLUSION .....</b>	<b>99</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>99</b>
<b>REFERENCES.....</b>	<b>99</b>
<b>VALIDITY AND PRACTICALITY OF A DASH DIET E-BOOKLET FOR PATIENTS WITH HYPERTENSION IN PRIMARY HEALTH CARE SETTINGS .....</b>	<b>101</b>
<b>Abstract.....</b>	<b>101</b>
<b>1. INTRODUCTION.....</b>	<b>101</b>
<b>2. METHODOLOGY .....</b>	<b>102</b>
<b>3. RESULTS .....</b>	<b>103</b>
<b>4. CONCLUSIONS .....</b>	<b>106</b>
<b>REFERENCES .....</b>	<b>106</b>

## COMPARISON OF ORAL HYGIENE STATUS FOLLOWING XYLITOL AND NON-XYLITOL CHEWING GUM USE AMONG STUDENTS OF SMP NEGERI 1 PADANG PARIAMAN

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### Abstract

Dental and oral health problems are among the most common health issues experienced by the community, with dental caries being the most prevalent. One of the main causes of dental caries is the accumulation of dental plaque. One effort to control plaque formation is chewing gum. This study aimed to determine the differences in oral hygiene status (Plaque Index) between chewing xylitol gum and non-xylitol gum among seventh-grade students of SMP Negeri 1 V Koto Kampung Dalam, Padang Pariaman Regency. This study employed a quasi-experimental design with a pre-test and post-test approach. The study population consisted of all seventh-grade students at SMP Negeri 1 V Koto Kampung Dalam, Padang Pariaman Regency, totaling 91 students. A total sampling technique was applied, and 80 students who met the inclusion criteria were selected as participants. Data were collected through plaque index examinations. Data analysis included univariate and bivariate analyses. Prior to hypothesis testing, a normality test was conducted and revealed that the data were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was used for statistical analysis. The results showed that the mean oral hygiene score in the xylitol gum group decreased from 1.665 before intervention to 0.652 after intervention, with a mean difference of 1.013. In the non-xylitol gum group, the mean oral hygiene score decreased from 1.702 to 1.152, with a mean difference of 0.55. The findings indicated a significant difference in oral hygiene status between respondents who chewed xylitol gum and those who chewed non-xylitol gum, with an Asymp. Sig. value of less than 0.05. Xylitol gum was more effective in reducing the Plaque Index than non-xylitol gum, as evidenced by a greater mean reduction (1.013 compared to 0.55).

Keywords: Oral Hygiene, Chewing Gum, Plaque, Xylitol.

### 1. INTRODUCTION

Health is fundamentally one of the most essential aspects of human life, encompassing both physical and mental well-being.[1] Health can be achieved through health development efforts aimed at increasing awareness, willingness, and the ability of individuals to lead healthy lives, thereby attaining an optimal level of health.[2] In addition to general physical health, oral and dental health also requires significant attention.[1] Oral and dental health refers to a healthy condition of the hard and soft tissues of the teeth, as well as related structures within the oral cavity.[3] Poor oral and dental health can negatively affect daily life, including a decline in general health, reduced self-confidence, and disruptions in school and workplace activities.[4]

According to data from the World Health Organization (WHO), nearly 3.5 billion people worldwide suffer from oral and dental diseases.[5] Meanwhile, data from the Indonesian Basic Health Research (Riskesdas) 2013 indicated that 25.9% of the Indonesian population reported oral and dental health problems.[6] This figure increased substantially to 57.6% in 2018.[7] In West Sumatra Province, the

prevalence of oral and dental health problems rose from 22.2% in 2013 to 58.5% in 2018.[8] In Padang Pariaman Regency, the prevalence reached 27.6%.[6]

Adolescence is a transitional developmental stage between childhood and adulthood, characterized by biological, cognitive, and socio-emotional changes.[8] During this period, adolescents often experience various health problems, including oral and dental health issues.[9] Data from Riskesdas 2018 showed that the prevalence of oral and dental health problems among children aged 10-14 years reached 55.6%.[7] This represented an increase compared to Riskesdas 2013, which reported a prevalence of 25.2% in the same age group.[6] Among the various oral health problems, dental caries remains the most prevalent.[10] One of the primary causes of dental caries is dental plaque.[1]

Dental plaque is a soft deposit that accumulates on tooth surfaces and consists of various microorganisms that live and proliferate within the oral cavity. Plaque formation commonly occurs when individuals neglect proper oral hygiene practices.[11] Plaque can be removed through both mechanical and chemical methods.[12] Mechanical methods include toothbrushing with toothpaste, whereas chemical methods involve the use of anti-plaque agents.[14]

One anti-plaque agent that has gained considerable attention is xylitol-containing chewing gum. Chewing gum serves as a delivery medium, while xylitol functions to reduce harmful bacteria that accumulate and contribute to plaque formation.[14] Xylitol is a naturally occurring five-carbon sugar alcohol derived from birch trees. It interferes with the metabolism of *Streptococcus mutans* by preventing the fermentation process, thereby reducing bacterial growth and activity.[14] As an alternative sweetener, xylitol possesses a sweetness level comparable to sucrose and exhibits anticariogenic properties.[15] In addition, xylitol inhibits plaque-forming bacteria, promotes remineralization, and stimulates salivary flow.[16]

Chewing xylitol gum increases salivary secretion within the oral cavity. Enhanced salivary flow helps reduce bacterial populations, thereby maintaining oral cleanliness and protecting teeth from decay. Previous studies have shown that consuming xylitol gum at a dosage of 3.9-30 g/day for 1-3 years can reduce the incidence of dental caries by 30-82%.[15] Furthermore, chewing xylitol gum three to four times daily for at least five minutes after meals has been reported to inhibit plaque accumulation.[17]

Previous studies investigating the effectiveness of xylitol gum in plaque reduction demonstrated that chewing xylitol gum at a dosage of 3.4-10 g/day is effective in decreasing plaque formation. These findings suggest that consuming approximately three to seven pieces of xylitol gum per day is beneficial for oral health.[18] Another study reported a reduction in the mean plaque index from 15.00 before intervention to 8.36 after chewing xylitol gum, indicating a decrease of 6.64 points in plaque index scores.[19]

SMP Negeri 1 V Koto Kampung Dalam is located on Bagindo Enong Street, Campago, V Koto Kampung Dalam District, Padang Pariaman Regency, West Sumatra Province, Indonesia. The school has a total enrollment of 309 students, consisting of 175 male and 134 female students. Students aged 11-14 years are primarily enrolled in Grade VII, with a total of 91 students in this grade level.

The school is located approximately 900 meters from the Kampung Dalam Community Health Center (Puskesmas), with an estimated travel time of about two minutes. Although the school receives annual visits from the health center for health education and examinations, including dental caries screening, eye examinations, ear examinations, and measurements of height and weight, students have never undergone an assessment of oral hygiene status. Therefore, research evaluating oral hygiene status and the effectiveness of xylitol chewing gum among Grade VII students at SMP Negeri 1 V Koto Kampung Dalam is considered necessary.

## 2. METHODS

This study employed a quasi-experimental research design with a pre-test and post-test approach. One day prior to data collection, participants were instructed not to eat or brush their teeth for two hours before the study commenced, although drinking plain water was permitted.

Data collection was assisted by three trained enumerators. Before the study began, the researcher conducted a calibration session with the enumerators to standardize the assessment of oral hygiene status using the Plaque Index. The study was initiated with the group assigned to chew xylitol gum.

In the first stage, participants were divided into four groups, with each group supervised by one enumerator. In the second stage, baseline plaque index measurements were obtained. In the third stage, participants were instructed to chew two pieces of xylitol gum for five minutes. The chewing process was performed sequentially using the right posterior teeth, anterior teeth, and left posterior teeth. After five minutes, participants were instructed to discard the gum and continue their regular classroom learning activities. During the following hour, participants were instructed not to eat, drink, or rinse their mouths.

In the fourth stage, a post-intervention plaque index assessment was conducted one hour after gum consumption using the same examination procedures as the baseline assessment. On the second day, the same procedures were repeated with the non-xylitol gum group. Participants chewed two pieces of non-xylitol gum, and both pre-test and post-test plaque index assessments were performed following the identical protocol used in the xylitol gum intervention.

### 3. RESULTS

The study participants were divided into two groups. The first group consisted of 40 respondents who chewed xylitol gum, while the second group consisted of 40 respondents who chewed non-xylitol gum. The allocation of the 80 respondents into the two groups was performed using block randomization (simple computer-generated randomization) to ensure equal group sizes.

The xylitol gum used in this study was Lotte Xylitol. The sweetener composition in every two pieces of gum consisted of xylitol (39%), maltitol (34%), aspartame (0.15%), and maltitol syrup (0.07%), along with gum base, flavoring agents, thickeners, and food colorings.

The non-xylitol gum used was Big Babol, which contains approximately 3 grams of sugar per serving (serving weight approximately 44 grams), equivalent to about 35-45 grams of sugar per 100 grams. Other ingredients include gum base, glucose syrup, sorbitol, glycerin, citric acid, flavoring agents, fruit extracts, and food colorings.

The results of the study are presented as follows.

#### 3.1 Mean Oral Hygiene Status Before and After Chewing Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

**Table 1.** Mean Oral Hygiene Status Before and After Chewing Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

Group	Plaque Index (PI)		Difference
	Before	After	
<i>Xylitol</i>	1,665	0,652	1,013

The mean oral hygiene status before chewing xylitol gum was 1.665, while the mean oral hygiene status after chewing xylitol gum was 0.652, resulting in a mean difference of 1.013.

The reduction in the mean oral hygiene score after chewing xylitol gum may be attributed to the ability of chewing gum to remove food debris adhering to the tooth surface during mastication. The chewing process, which was performed for five minutes, stimulates saliva production in the oral cavity, thereby enhancing the buffering capacity of saliva and reducing plaque acidity. In addition, chewing gum contributes to the mechanical cleaning of tooth surfaces through a self-cleansing effect. Xylitol-containing gum may also reduce the number of *Streptococcus mutans* by altering its metabolic activity, promoting remineralization, and inhibiting plaque formation.

Chewing gum has been shown to increase salivary flow in the oral cavity. Saliva functions as a natural cleansing agent by removing food residues that can be readily fermented by oral bacteria, thereby reducing bacterial populations and helping to maintain oral cleanliness.[15] Furthermore, saliva possesses buffering properties that help maintain a neutral oral environment, thereby reducing plaque acidity caused by dietary sugars.[20] Xylitol can interfere with the utilization of sucrose by *Streptococcus mutans*, preventing its fermentation by these bacteria. As a result, xylitol reduces the growth and activity of *Streptococcus mutans*, promotes remineralization, and inhibits plaque formation.[11]

The findings of the present study are consistent with those of previous research, which reported a reduction in the mean plaque index from 15.00 before chewing xylitol gum to 8.36 after the intervention.[19]

### 3.2 Mean Oral Hygiene Status Before and After Chewing Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

**Table 2.** Mean Oral Hygiene Status Before and After Chewing Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

Group	Plaque Index (PI)		Difference
	Before	After	
Non <i>Xylitol</i>	1,702	1,152	0,55

The mean oral hygiene status before chewing non-xylitol gum was 1.702, while the mean oral hygiene status after chewing non-xylitol gum was 1.152, resulting in a mean difference of 0.550.

The reduction in the mean oral hygiene score after chewing non-xylitol gum may also be attributed to the stimulation of salivary flow during chewing, which helps remove food debris adhering to tooth surfaces. However, the decrease in oral hygiene scores observed after chewing non-xylitol gum was relatively small compared to that of xylitol gum. This may be due to the sugar content of non-xylitol gum, which is sweet and sticky, allowing bacteria to adhere more easily to tooth surfaces after consumption. The sugar contained in non-xylitol gum can serve as a nutrient source for oral bacteria and accelerate plaque formation. Oral bacteria metabolize sugars into acids that can damage tooth enamel.[21]

Sucrose is a readily fermentable sugar that can be converted into sticky macromolecules, enabling plaque to adhere firmly to tooth surfaces and reducing the ability of saliva to neutralize and wash away acids.[15] The findings of this study are consistent with previous research, which reported a smaller reduction in the mean plaque index among individuals who chewed sucrose-containing gum compared to those who chewed xylitol gum.[18]

### 3.3 Differences in Oral Hygiene Status Following Xylitol and Non-Xylitol Gum Consumption Among Students of SMP Negeri 1 Padang Pariaman

**Table 3.** Results of the Mann-Whitney U Test on Differences in Oral Hygiene Status Following the Consumption of Xylitol and Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

	Treatment	N	Mean	Asymp. Sig
Plaque Index	<i>Xylitol</i>	40	30,46	0,00
	Non <i>Xylitol</i>	40	50,54	

The results of the Mann-Whitney U test showed an Asymp. Sig. value of less than 0.05, indicating that the null hypothesis ( $H_0$ ) was rejected and the alternative hypothesis ( $H_a$ ) was accepted. This finding demonstrates a statistically significant difference in oral hygiene status following the consumption of xylitol and non-xylitol gum among seventh-grade students of SMP Negeri 1 Padang Pariaman.

Both xylitol and non-xylitol gum were associated with improvements in oral hygiene status and reductions in plaque index scores. This effect may be attributed to the chewing process, which stimulates salivary secretion and promotes a self-cleansing effect on tooth surfaces. However, the reduction in plaque index was greater among participants who chewed xylitol gum than among those who chewed non-xylitol gum. This difference may be explained by the sugar content of non-xylitol gum, which can adhere to tooth surfaces and accelerate plaque formation. Plaque can begin to reform as early as one hour after tooth cleaning.[22] Therefore, even after plaque removal, its reaccumulation may occur rapidly.

One effective strategy for preventing or controlling plaque formation is limiting the consumption of carbohydrate-rich foods, particularly those containing sucrose.[11] Foods and products that do not contain sucrose, such as xylitol gum, are considered more beneficial for oral health. Xylitol gum has been shown to possess antibacterial properties that inhibit plaque formation. Furthermore, chewing xylitol gum stimulates salivary flow, facilitating the removal of food debris and reducing plaque accumulation.[1] Chewing sugar-free gum after meals has also been reported to increase salivary secretion, which helps eliminate bacteria from the oral cavity.[23]

The findings of the present study are consistent with previous research demonstrating that chewing xylitol gum reduced plaque accumulation by 46%, whereas only a 9% reduction was observed among individuals who chewed conventional gum. These results indicate that xylitol gum is more effective in reducing plaque accumulation than regular chewing gum.[24] Other quasi-experimental studies have similarly reported a significant reduction in plaque index following the consumption of xylitol gum ( $p < 0.05$ ).[25]

In addition, chewing xylitol gum has been shown to significantly increase salivary pH. An elevated salivary pH contributes to the inhibition of plaque formation and supports the maintenance of oral health.[26] Although all types of chewing gum, including non-xylitol gum, may contribute to plaque reduction through increased salivary flow and mechanical cleansing, their effect on plaque index reduction is generally smaller than that observed with xylitol-containing gum.[27]

#### 4. CONCLUSION

Based on the findings of this study, it can be concluded that there was a statistically significant difference in oral hygiene status following the consumption of xylitol and non-xylitol gum among the respondents, as indicated by an Asymp. Sig. value of less than 0.05. Xylitol gum was found to be more effective in reducing the Plaque Index than non-xylitol gum. The mean reduction in plaque index observed in the xylitol gum group was 1.013, whereas the mean reduction in the non-xylitol gum group was only 0.550.

#### REFERENCES

- [1] Marlindayanti, Nur Adiba, H., Ismalayani, & Yonan. *Manajemen pencegahan karies*. Kediri: Lembaga Chakra Brahmada Lentera. (2022).
- [2] Nugraheni, H., Wiyatini, T., & Wiradona, I. *Buku ajar kesehatan masyarakat dalam determinan sosial budaya*. Yogyakarta: Deepublish. 2018.
- [3] Kementerian Kesehatan RI. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 89 Tahun 2015 tentang Upaya Kesehatan Gigi dan Mulut*. Jakarta: Kementerian Kesehatan RI. 2015.
- [4] Kementerian Kesehatan RI. *Situasi kesehatan gigi dan mulut*. Jakarta Selatan: Pusat Data dan Informasi Kementerian Kesehatan RI. 2019.
- [5] World Health Organization. *Global oral health status report: Towards universal health coverage for oral health by 2030*. Geneva: World Health Organization. 2022.
- [6] Badan Penelitian dan Pengembangan Kesehatan. *Riset Kesehatan Dasar (Riskesdas) 2013*. Jakarta: Kementerian Kesehatan RI. 2013.

- [7] Kementerian Kesehatan RI. *Hasil Riset Kesehatan Dasar (Riskesdas) 2018*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan. 2018.
- [8] Ekasari, M. F. *Latihan keterampilan hidup bagi remaja*. Malang: Wineka Media. 2022.
- [9] Wiarto, G. *Memahami pribadi remaja*. Bogor: Guepedia. 2022.
- [10] Nismal, H. *Islam dan kesehatan gigi*. Jakarta: Pustaka Al-Kautsar. 2018.
- [11] Putri, M. H., Herijulianti, E., & Nurjannah, N. *Ilmu pencegahan penyakit jaringan keras dan jaringan pendukung gigi*. Jakarta: EGC. 2018.
- [12] Riolina, A., & Oktaviani, A. *Kesehatan gigi masyarakat*. Yogyakarta: Muhammadiyah University Press. 2022.
- [13] Elina, L., & Wahyuni, S. Pengaruh pengunyahan permen karet yang mengandung sukrosa dan permen karet yang mengandung xylitol terhadap indeks plak gigi. *Jurnal Keperawatan*, 12, 5. 2017.
- [14] Praja, D. I. *Zat aditif makanan: Manfaat dan bahayanya*. Yogyakarta: Garudhawaca. 2015.
- [15] Yulianto, W. A. *Pangan fungsional untuk kesehatan*. Yogyakarta: Deepublish. 2019.
- [16] Sutanti, V., *Kariologi dan manajemen karies*. Malang: UB Press. 2021.
- [17] Ruslan, E. *Kerusakan gigi pasca perawatan endodontik (2016 ed.)*. Surabaya: Airlangga University Press. 2016.
- [18] Saputra, B., Wicaksono, D.A. dan Khoman, J.A. Efektifitas permen karet xylitol dalam menurunkan plak. *Jurnal e-Gigi*, 9(2), 139–145. 2021
- [19] Zulkaidah, U., Arsad, A., Putri, N. M., Dirman, R., & Yulistina, Y. Efektivitas mengunyah permen xylitol dapat mengurangi indeks plak siswa kelas IV. *Journal of Pharmaceutical and Health Research*, 4(2), 265–271. 2023.
- [20] Pertiwiningsih, B. I. *Kesehatan masyarakat kesehatan gigi dan mulut*. Surabaya: PT. Borobudur Inspira Nusantara. 2016.
- [21] Eka, R. *Rahasia mengetahui makanan berbahaya*. Jakarta: Titik Media Publisher. 2013.
- [22] Kasuma, N. *Plak gigi*. Padang: Andalas University Press. 2016.
- [23] Naviri, T. *1001 makanan sehat*. Jakarta: PT Elex Media Komputindo. 2015.
- [24] Söderling, E., & Pienihäkkinen, K. Effects of xylitol chewing gum and candies on the accumulation of dental plaque: A systematic review. *Clinical Oral Investigations*, 26(1), 119–129. <https://doi.org/10.1007/s00784-021-04225-8>. 2022.
- [25] Naurah SNH, Keumala CR. Pengaruh mengunyah permen karet xylitol terhadap penurunan indeks plak pada siswa di SD Negeri Gue Gajah Kabupaten aceh Besar J. *Kesehatan Gigi dan mulut*, 7(2), 2025
- [26] Asmalinda W, Sapada E, Agustin Y. Peningkatan pH saliva perokok aktif menggunakan permen karet xylitol, *j.kesehatan*, 2025
- [27] Keukenmeester, Effects of sugar-free polyol chewing gums on gingival inflammation: a systemic review

## PROMOTING DIABETES PREVENTION IN THE WORKPLACE: THE EFFECTIVENESS OF DIABETES HEALTH COACHING AMONG OFFICE WORKERS

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### Abstract

Diabetes mellitus (DM) is a growing public health concern worldwide, with office workers being particularly vulnerable due to sedentary lifestyles and unhealthy behavioral patterns. This study aimed to evaluate the effect of a Diabetes Health Coaching intervention on reducing the risk of type 2 diabetes mellitus among office workers. A pre-experimental one-group pretest–posttest design was conducted from March to December 2025 involving 39 office workers from Health Polytechnic of Surakarta. Participants were selected using purposive sampling and received a structured Diabetes Health Coaching program focused on healthy eating, physical activity, weight management, and behavior change strategies. Diabetes risk was assessed before and after the intervention using the Finnish Diabetes Risk Score (FINDRISC) questionnaire. Most participants were aged 36–45 years (41.1%), male (71.7%), had completed senior high school education (46.2%), and reported a monthly income of more than IDR 2.5 million to IDR 4 million (61.6%). The mean FINDRISC score decreased from  $5.67 \pm 1.99$  at baseline to  $4.26 \pm 2.04$  after the intervention. Statistical analysis using the Wilcoxon Signed-Rank Test revealed a significant difference between pretest and posttest scores ( $Z = -5.631, p < 0.001$ ). These findings indicate that the Diabetes Health Coaching intervention effectively reduced type 2 diabetes risk among office workers. Health coaching may serve as a practical and effective workplace-based strategy for promoting healthy lifestyle behaviors and preventing diabetes. Further studies with larger samples, control groups, and longer follow-up periods are recommended to confirm the long-term effectiveness of this intervention.

Keywords: diabetes mellitus, health coaching, FINDRISC, diabetes risk, office workers, workplace health promotion.

### 1. INTRODUCTION

Diabetes mellitus (DM) is one of the most prevalent non-communicable diseases worldwide, with a continuously increasing number of cases each year. According to the International Diabetes Federation (IDF), approximately 537 million adults (10.5% of the global adult population) were living with diabetes in 2021, of whom nearly 90% had type 2 diabetes mellitus (T2DM). In the same year, diabetes was responsible for approximately 6.7 million deaths globally. Indonesia ranked sixth among countries with the highest number of diabetes cases, with an estimated 19.5 million adults affected by the disease in 2021. These figures highlight the growing burden of diabetes on public health systems and national economies, particularly in developing countries [1].

Recent national data further demonstrate the increasing prevalence of diabetes in Indonesia. The Indonesian Health Survey (Survei Kesehatan Indonesia) 2023 reported that the prevalence of diabetes among individuals aged over 15 years, based on blood glucose measurements, increased from 10.9% in 2018 to 11.7% in 2023 [2]. This upward trend is concerning because diabetes is a chronic metabolic

disorder characterized by impaired insulin secretion, insulin action, or both, resulting in persistent hyperglycemia. Prolonged hyperglycemia can lead to serious acute complications, including hypoglycemia, diabetic ketoacidosis, and hyperosmolar hyperglycemic syndrome, as well as chronic complications affecting the cardiovascular system, kidneys, nervous system, and eyes [3, 4]. These complications significantly reduce quality of life, increase healthcare costs, and may ultimately lead to premature mortality [5, 6]

The development of T2DM is strongly associated with modifiable lifestyle factors. Unhealthy dietary habits, excessive consumption of foods high in calories, sugar, and fat, physical inactivity, prolonged sedentary behavior, inadequate sleep, smoking, psychological stress, and depression have all been identified as significant risk factors for diabetes [7, 8]. Office workers represent a population particularly vulnerable to these risk factors due to the nature of their work environment. Many employees spend long hours sitting in front of computers, engage in limited physical activity during working hours, and frequently consume fast food or other unhealthy dietary options. Such behaviors contribute to overweight, obesity, insulin resistance, and an increased risk of developing T2DM [9, 10].

Despite its serious consequences, T2DM is largely preventable through effective risk reduction strategies and lifestyle modification. Evidence suggests that improving dietary patterns, increasing physical activity, maintaining a healthy body weight, and managing stress can significantly reduce the risk of diabetes development [11, 12]. Recognizing the importance of prevention, the IDF recommends population-based interventions as a key strategy for reducing the incidence of T2DM. These interventions aim to promote sustainable behavior change and support individuals in adopting healthier lifestyles before the onset of disease [13].

One promising approach to facilitating behavior change is health coaching. Health coaching is a person-centered intervention that helps individuals achieve health-related goals through guidance, motivation, education, and continuous support provided by trained professionals. Unlike conventional health education, health coaching emphasizes collaborative goal setting, self-management, and individualized action planning, enabling participants to take an active role in improving their health behaviors [14]. Previous studies have shown that health coaching can enhance self-efficacy, improve adherence to healthy lifestyle practices, and support long-term behavior change among individuals at risk of chronic diseases [15].

Considering the increasing prevalence of diabetes, the high-risk profile of office workers, and the potential benefits of health coaching, it is important to evaluate the effectiveness of diabetes health coaching programs in reducing diabetes risk among office employees. Therefore, this study aimed to examine the effect of a diabetes health coaching intervention on reducing diabetes mellitus risk among office workers.

## 2. METHODOLOGY

This study employed a quantitative pre-experimental design using a one-group pretest–posttest design without a control group. The study was conducted from March to December 2025 at the Health Polytechnic of the Ministry of Health Surakarta, Indonesia. A total of 39 office workers were recruited using purposive sampling. Inclusion criteria were office workers aged 18 years or older who had not been previously diagnosed with diabetes mellitus by a healthcare professional. Participants were excluded if they were enrolled in other diabetes management or intensive lifestyle modification programs, had physical or mental conditions that could interfere with participation in the intervention, were unable to communicate effectively in Indonesian, or were pregnant. Participants who attended less than 80% of the health coaching sessions, failed to complete the posttest assessment, or voluntarily withdrew from the study were considered drop-outs.

The risk of developing diabetes was evaluated using the Finnish Diabetes Risk Score (FINDRISC) questionnaire both before and after the intervention. Diabetes health training interventions are systematically implemented through an integrated approach consisting of health education, goal formulation, motivational strategies, and regular training to increase participants' awareness and ability in diabetes mellitus prevention. The intervention program was carefully structured over an eight-week period, covering a total of seven sessions conducted consistently. Each session is allocated a duration of 60 to 90 minutes, tailored to the specific content and activities involved. After the completion of the intervention, participants were subjected to post-intervention evaluation using identical assessment instruments.

Descriptive statistics were used to summarize participant characteristics, while the effectiveness of the intervention was analyzed using the Wilcoxon Signed-Rank Test to compare pretest and posttest FINDRISC scores. Statistical analyses were performed using IBM SPSS Statistics, with a significance level set at  $p < 0.05$ . Ethical approval was obtained from the Health Research Ethics Committee of Health Polytechnic of Surakarta, and written informed consent was obtained from all participants prior to data collection.

### 3. RESULTS

#### 3.1 Participant Characteristics

A total of 39 office workers participated in this study. Table 1 presents the demographic characteristics of the respondents.

**Table 1.** Demographic Characteristics of Respondents (n = 39)

Characteristics	Frequency (n)	Percentage (%)
<b>Age</b>		
26–35 years (Young Adulthood)	13	33.3
36–45 years (Middle Adulthood)	16	41.1
46–55 years (Late Adulthood)	8	20.5
56–65 years (Older Adulthood)	2	5.1
<b>Total</b>	<b>39</b>	<b>100</b>
<b>Gender</b>		
Male	28	71.7
Female	11	28.3
<b>Total</b>	<b>39</b>	<b>100</b>
<b>Education</b>		
Elementary School	2	5.1
Junior High School	7	17.9
Senior High School	18	46.2
Higher Education	12	30.8
<b>Total</b>	<b>39</b>	<b>100</b>
<b>Monthly Income</b>		
< IDR 1 million	0	0
IDR 1–2.5 million	10	25.6
> IDR 2.5–4 million	24	61.6
> IDR 4 million	5	12.8
<b>Total</b>	<b>39</b>	<b>100</b>

Most participants were aged 36–45 years (41.1%), followed by those aged 26–35 years (33.3%), 46–55 years (20.5%), and 56–65 years (5.1%). The majority of respondents were male (71.7%). Regarding educational attainment, most participants had completed senior high school (46.2%), followed by higher education (30.8%), junior high school (17.9%), and elementary school (5.1%). In terms of monthly income, most respondents earned more than IDR 2.5 million to IDR 4 million (61.6%).

The demographic profile of the respondents indicates that the majority were in the productive working-age group, particularly those aged 36–45 years. Individuals in this age range often experience increased occupational responsibilities and prolonged exposure to workplace-related risk factors such

as sedentary behavior, work stress, and unhealthy dietary habits, which may contribute to an elevated risk of developing type 2 diabetes mellitus [10, 16]. The predominance of male participants reflects the workforce composition of the study setting and is noteworthy, as previous studies have shown that men are often less likely to engage in preventive health behaviors compared to women [17]. Most respondents had completed at least a senior high school education, suggesting a relatively adequate educational background that may facilitate the understanding and adoption of health-related information provided during the coaching intervention [18]. Furthermore, the majority of participants reported a moderate monthly income, which may provide sufficient access to healthcare services and healthier lifestyle choices. Overall, these characteristics suggest that the study population represents a group of working adults who are potentially vulnerable to diabetes risk factors while also possessing the capacity to benefit from preventive interventions such as health coaching.

### 3.2 Comparison of Type 2 Diabetes Risk Before and After Health Coaching

The effectiveness of the Diabetes Health Coaching intervention was evaluated by comparing participants' FINDRISC scores before and after the intervention as shown in table 2.

**Table 2.** Comparison of FINDRISC Scores Before and After Diabetes Health Coaching (n = 39)

FINDRISC Score	Mean	SD	Minimum	Maximum	Z Value*	P-value
Pretest	5.67	1.991	2	10	-5.631	<0.001
Posttest	4.26	2.035	1	9		

As shown in Table 2, the mean pretest FINDRISC score was  $5.67 \pm 1.99$ , while the mean posttest score decreased to  $4.26 \pm 2.04$ . The Wilcoxon Signed-Rank Test revealed a statistically significant difference between pretest and posttest scores ( $Z = -5.631$ ,  $p < 0.001$ ). These findings indicate that the Diabetes Health Coaching intervention significantly reduced participants' risk scores for type 2 diabetes mellitus. Therefore, the intervention was effective in lowering diabetes risk among office workers participating in this study.

The effectiveness of health coaching can be explained by its person-centered approach, which emphasizes goal setting, self-monitoring, motivation, and continuous support. Unlike conventional health education that primarily focuses on information delivery, health coaching actively engages participants in identifying personal health goals and developing practical strategies to achieve them. This approach may enhance self-efficacy and encourage sustainable behavior change, leading to improvements in lifestyle practices associated with diabetes prevention. Previous studies have similarly reported that health coaching interventions can improve physical activity levels, dietary behaviors, weight management, and other health outcomes among individuals at risk for chronic diseases, including type 2 diabetes mellitus [15, 19, 20].

The workplace setting may have further contributed to the success of the intervention. Office workers are particularly vulnerable to diabetes risk due to prolonged sitting time, limited physical activity, and unhealthy eating habits associated with busy work schedules. By providing structured coaching tailored to participants' daily routines and challenges, the intervention may have helped individuals recognize their risk factors and implement achievable lifestyle modifications [16]. These findings support the recommendation of the IDF that population-based and lifestyle-focused interventions should be promoted as effective strategies for diabetes prevention [13]. Therefore, integrating health coaching programs into workplace health promotion initiatives may represent a practical and effective approach to reducing the future burden of type 2 diabetes among working-age adults.

## 4. CONCLUSIONS

This study demonstrated that the Diabetes Health Coaching program significantly reduced the risk of type 2 diabetes mellitus among office workers, as evidenced by the decrease in mean FINDRISC scores following the intervention. These findings suggest that health coaching is a promising strategy for promoting healthy lifestyle behaviors and preventing diabetes in workplace settings. However, this study has several limitations, including the use of a one-group pretest–posttest design without a control group, the relatively small sample size, and the short-term evaluation of outcomes, which may limit the generalizability of the findings and the ability to establish causal relationships. Future studies are recommended to employ randomized controlled designs with larger and more diverse populations, longer follow-up periods, and additional outcome measures such as anthropometric and biochemical indicators to better evaluate the long-term effectiveness of diabetes health coaching interventions.

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## REFERENCES

- [1] IDF. IDF Diabetes Atlas 2021. 10th ed. Boyko EJ, Magliano DJ, Karuranga S, Piemonte L, Riley P, Saeedi P, Sun H, editors. International Diabetes Federation; 2021. [www.diabetesatlas.org](http://www.diabetesatlas.org)
- [2] Badan Kebijakan Pembangunan Kesehatan. Survei Kesehatan Indonesia Tahun 2023. 2023. <https://www.badankebijakan.kemkes.go.id/hasil-ski-2023/>
- [3] Banday MZ, Sameer AS, Nissar S. Pathophysiology of diabetes: An overview. *Avicenna Journal of Medicine*. 2020;10(4):174–188. doi:10.4103/ajm.ajm\_53\_20
- [4] Nakhleh A, Shehadeh N. Hypoglycemia in Diabetes: An Update on Pathophysiology, Treatment, and Prevention. *World Journal of Diabetes*. 2021;12(12):2036–2049. doi:10.4239/wjd.v12.i12.2036
- [5] Palamenghi L, Carlucci MM, Graffigna G. Measuring the Quality of Life in Diabetic Patients: A Scoping Review. *Journal of Diabetes Research*. 2020 [accessed 2021 Sep 15];2020. [/pmc/articles/PMC7261342/](https://pubmed.ncbi.nlm.nih.gov/3481342/). doi:10.1155/2020/5419298
- [6] Abedini MR, Bijari B, Miri Z, Shakhs Emampour F, Abbasi A. The Quality of Life of The Patients With Diabetes Type 2 Using EQ-5D-5 L in Birjand. *Health and Quality of Life Outcomes*. 2020;18(1). doi:10.1186/s12955-020-1277-8
- [7] Frier BM, Fisher M. Hypoglycemia in type 1 and type 2 diabetes: Pathophysiology, risk factors, and management. *Diabetes Care*. 2022;45(2):152–162. doi:<https://doi.org/10.2337/dc21-1561>
- [8] American Diabetes Association (ADA). 2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2025. *Diabetes Care*. 2025;48(Supplement\_1):S27–S49. doi:10.2337/dc25-S002
- [9] Ryu H, Moon J, Jung J. Influence of health behaviors and occupational stress on prediabetic state among male office workers. *International Journal of Environmental Research and Public Health*. 2018;15(6). doi:10.3390/ijerph15061264
- [10] Hutapea AM, Hutapea KMM. Sugar Crash: Analysis of Diabetes Risk in Office Workers Due to Irregular Work Patterns and Eating Patterns. *Oshada*. 2025;2(2). doi:10.62872/tnkm3k33

- 
- [11] Wang Y, Chai X, Wang Y, Yin X, Huang X, Gong Q, Zhang J, Shao R, Li G. Effectiveness of Different Intervention Modes in Lifestyle Intervention for the Prevention of Type 2 Diabetes and the Reversion to Normoglycemia in Adults With Prediabetes: Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of Medical Internet Research*. 2025;27. doi:10.2196/63975
- [12] Teixeira PP, Zucatti KP, Matzenbacher LS, Wayerbacher LF, Zhang M, Colpani V, Gerchman F. Long-Term Lifestyle Intervention Can Reduce The Development of Type 2 Diabetes Mellitus in Subjects With Prediabetes: A Systematic Review and Meta-Analysis. *Diabetes Research and Clinical Practice*. 2024;210. doi:10.1016/j.diabres.2024.111637
- [13] Ceriello A, Colagiuri S. IDF global clinical practice recommendations for managing type 2 diabetes – 2025. *Diabetes Research and Clinical Practice*. 2025;222. doi:10.1016/j.diabres.2025.112152
- [14] National Health Service England. Health Coaching: Implementation and Quality Summary Guide. NHS England and NHS Improvement; 2020. <https://www.england.nhs.uk/wp-content/uploads/2020/03/health-coaching-implementation-and-quality-summary-guide.pdf>
- [15] Almulhim AN, Hartley H, Norman P, Caton SJ, Dođru OC, Goyder E. Behavioural Change Techniques in Health Coaching-Based Interventions for Type 2 Diabetes: A Systematic Review and Meta-Analysis. *BMC Public Health*. 2023;23(1). doi:10.1186/s12889-022-14874-3
- [16] Madhu S V., Raizada N. Diabetes in the Workplace: Risks and Remedies. *Indian Journal of Endocrinology and Metabolism*. 2025;29(6). doi:10.4103/ijem.ijem\_1019\_25
- [17] Rata Mohan DS, Jawahir S, Manual A, Abdul Mutalib NE, Mohd Noh SN, Ab Rahim I, Ab Hamid J, Amer Nordin A. Gender differences in health-seeking behaviour: insights from the National Health and Morbidity Survey 2019. *BMC Health Services Research*. 2025;25(1). doi:10.1186/s12913-025-13020-0
- [18] Truong M, Fenton SH. Understanding the Current Landscape of Health Literacy Interventions within Health Systems. *Perspectives in health information management*. 2022;19(Spring).
- [19] Gittens A, Medina E, Oh J, Nelson A, Aréchiga A. Health Coaching For Individuals with Type 2 Diabetes: Assessing The Impact of Health Coaching on HbA1c, Hospitalizations, and Outpatient Services. *Frontiers in Endocrinology*. 2025;16. doi:10.3389/fendo.2025.1443490
- [20] Wong-Rieger D, Rieger FP. Health Coaching in Diabetes: Empowering Patients to Self-Manage. *Canadian Journal of Diabetes*. 2013;37(1):41–44. doi:10.1016/j.jcjd.2013.01.001

## DENTAL PLAQUE INDEX AMONG FOURTH TO SIXTH-GRADE STUDENTS AT SDN 01 NAN SABARIS, PADANG PARIAMAN

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### Abstract

Dental plaque is the primary etiology of dental caries and periodontal disease. National data indicates a significant rise in oral health issues. Objective: This study aims to evaluate the dental plaque index among fourth, fifth, and sixth-grade students at SDN 01 Nan Sabaris, Padang Pariaman Regency, in 2022. Method: A descriptive cross-sectional approach was utilized. The study sample comprised 86 students selected through a total sampling technique. Data collection involved direct clinical examination using the Patient Hygiene Performance (PHP) Index. Data were analyzed using univariate analysis. Results: The distribution of the plaque index showed that 28 students (32.55%) met the good criteria, 39 students (45.34%) fell into the moderate category, and 19 students (22.09%) exhibited poor criteria. No students achieved an excellent plaque index. Conclusion: The majority of elementary school students at SDN 01 Nan Sabaris present with a moderate dental plaque index, highlighting the need for structured dental health promotion and supervised brushing programs.

Keywords: Dental Plaque, PHP Index, Oral Hygiene, Elementary School Students

### 1. INTRODUCTION

Oral health is an integral component of systemic health and overall well-being. Maintaining optimal oral hygiene during childhood is paramount, as this period shapes lifelong health behaviors. Accumulation of dental plaque—a complex biofilm containing pathogenic bacteria—remains the major cause of dental caries and gingival inflammation if left unmanaged.

Globally, oral diseases affect billions of children, with the 10–12 age cohort being an essential monitoring group designated by the World Health Organization (WHO) for caries epidemiology. In Indonesia, the prevalence of dental and oral health issues remains high, reaching 45.3% nationally and 43.9% specifically within West Sumatra, according to Risesdas data.

While the School Dental Health Business (UKGS) program exists in collaboration with local health centers like the Pauh Kambar Health Center, empirical evidence on the precise baseline oral hygiene status of rural students in Padang Pariaman remains scarce. Previous studies in other regions show varying plaque levels in school children, but localized data is vital for tailoring public health interventions. This study addresses this research gap by providing an objective, descriptive baseline of the dental plaque index using the standard Patient Hygiene Performance (PHP) index among upper-grade students at SDN 01 Nan Sabaris. Health is a condition of physical, mental, and social well-being that allows a person to live a productive life. According to WHO, being healthy does not only mean being free from disease, but also includes overall well-being (Eliana & Sri Sumiati, 2016). Therefore, efforts to maintain health are the responsibility of all elements of society to increase awareness, willingness, and ability to live a healthy life in order to achieve optimal health (Ngongo, 2018). One of the health aspects that needs to be considered is dental and oral health because it is an integral part of the overall health of the body (Sherlyta M., et al., 2017).

### 2. METHODOLOGY

#### Study Design and Setting

This descriptive cross-sectional study was conducted in October 2024 at SDN 01 Nan Sabaris, Pauah Kamba Village, Nan Sabaris District, Padang Pariaman Regency.

### Ethical Consideration

Ethical approval was granted by the institutional review board. Prior to data collection, written informed consent was acquired from the school principal and the parents or legal guardians of the participating students.

### Participants and Sampling

The target population included all students enrolled in grades IV, V, and VI. Total sampling was employed, resulting in a final sample size of 86 students.

- **Inclusion Criteria:** Students in grades IV–VI present on the day of the examination with parental consent.
- **Exclusion Criteria:** Students undergoing active orthodontic treatment or presenting with systemic conditions that preclude oral clinical examinations.

### Measurement and Calibration

Clinical examinations were conducted using the Patient Hygiene Performance (PHP) Index method to measure plaque on six index teeth surfaces (maxillary right first molar, maxillary right central incisor, maxillary left first molar, mandibular left first molar, mandibular left central incisor, and mandibular right first molar). Prior to data collection, the researcher and two enumerators underwent a strict calibration process. Inter-examiner reliability was verified, yielding an acceptable Cohen's kappa coefficient of  $>0.80$ .

A disclosing solution was applied to the index teeth surfaces to facilitate plaque identification. Each tooth surface was conceptually divided into five areas: mesial, distal, marginal, central, and incisal/occlusal. A score of 1 was applied for the presence of plaque and 0 for its absence. The cumulative scores were averaged to calculate the final PHP Index, classified into: Excellent (0), Good (0.1–1.7), Moderate (1.8–3.4), and Poor (3.5–5). Data underwent editing, coding, entry, and cleaning before undergoing univariate frequency analysis.

## 3. RESULTS

**Table 3.1** Frequency Distribution of Plaque Index among Students (N=86)

Criteria	Frequency (f)	Percentage (%)
Excellent	0	0.00
Good	28	32.55
Moderate	39	45.34
Poor	19	22.09
<b>Total</b>	<b>86</b>	<b>100.00</b>

Based on Table 1, the largest segment of students presented with a moderate plaque index (45.34%), followed by the good category (32.55%). A notable proportion displayed poor oral hygiene (22.09%), while none of the students achieved an excellent score.

### 3.2 Discussion

The clinical findings indicate that the oral hygiene status among fourth to sixth-grade students at SDN 01 Nan Sabaris is predominantly moderate (45.34%) to poor (22.09%). This clinical pattern signifies a steady accumulation of plaque on tooth surfaces that requires systemic intervention.

These findings align closely with earlier regional studies. For instance, Princess Keloay et al. (2019) reported that the majority of school children at SD GMIM Siloam Tonselama exhibited a moderate category plaque index with a mean score of 2.6. Similarly, Karina (2020) observed predominantly moderate plaque indexes (mean score of 2.8) among students at SD Negeri 040467 Lingga. The consistency across these studies underscores a widespread public health challenge regarding pediatric oral hygiene in public elementary schools.

The presence of moderate and poor plaque indices highlights potential deficiencies in daily oral hygiene practices, such as ineffective brushing techniques or lack of regular post-meal rinsing. Proper removal of dental plaque biofilms is highly dependent on mechanical brushing efficiency. If students rely exclusively on basic horizontal or incorrect movements without thoroughly cleaning all surfaces—including lingual and palatal aspects—plaque will consistently build up, particularly around the cervical thirds of the crowns. Furthermore, a dietary pattern high in fermentable carbohydrates and sticky foods combined with irregular dental visits compounds plaque stagnation.

#### Study Limitations

This study utilized a descriptive cross-sectional design, which limits the ability to establish causal relationships between specific behavioral factors (e.g., exact brushing frequency or diet) and the clinical plaque index. Future research incorporating longitudinal tracking and analytical surveys regarding parental supervision and socioeconomic backgrounds would expand upon these findings.

### 4. CONCLUSIONS

The dental plaque index among upper-grade students at SDN 01 Nan Sabaris is primarily in the moderate category (45.34%), with a substantial proportion categorized as poor (22.09%). This baseline indicates that pediatric mechanical plaque control remains suboptimal.

#### Recommendations

1. **Practical Implications:** The school, via the UKGS program, should collaborate with local community health centers to institute supervised toothbrushing programs using fluoride toothpaste after school lunch breaks.
2. **Future Research:** Analytical studies should be conducted to evaluate the direct correlation between students' dietary habits, parental guidance, and the actual performance of oral health hygiene routines.

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### REFERENCES

- [1] Arianto, Dyah Purnomowati dan Ratnasari. (2016) Perbedaan Semangka dan Mentimun Terhadap Indeks Debris Pada Siswa Siswi SMA Tri Sukses Natar Lampung Selatan. *Jurnal Analisis Kesehatan* Volume 5, No.1 Maret 2017.
- [2] Karina Egia, Gambaran Indeks Plak dan Debris Pada Siswa/Siswi SD Negeri 040467 Lingga Kecamatan Simpang Empat Kabupaten Karo. [jurnal] *Medan Keperawatan Gigi* Volume 7, No.1. 2020
- [3] Eliana dan Sri Sumiati, *Manajemen kesehatan*, Jakarta: Kementerian Kesehatan RI. 2016
- [4] Gabriella Florecia, *Cegah Sakit Gigi*. 201.0
- [5] Hannah, Devriza. *Mencegah Pembentukan Plak gigi Dengan Menyikat Gigi Yang Benar*. 2021

- 
- [6] Lestari Pudji. Gambaran Kebersihan Gigi dan Mulut pada Siswa Kelas 4-6 di SD Ngablak I Kecamatan Ngablak Kabupaten Magelang. [Jurnal] Tasikmalaya: Keperawatan Gigi Volume 44, No.8. 2019
- [7] Machfoedz, Ircham, MENJAGA Kesehatan Gigi & Mulut Anak-anak & Ibu Hamil, Yogyakarta: Fitramaya. 2008
- [8] Ngongo, Revenolia Dheasy. (2018) Pentingnya Menjaga Kesehatan Gigi dan Mulut. [www.puskoep.dinkes-kotakupang.web.id/artikel/info-kesehatan/item/72](http://www.puskoep.dinkes-kotakupang.web.id/artikel/info-kesehatan/item/72) pentingnya-menjaga-kesehatan-gigi-dan-mulut (Diakses pada tanggal 17 Desember 2020)
- [9] Noviyanti, N.N.A. Perbandingan efektivitas mengunyah buah bengkoang. Vol 5(1):32-39. 2021
- [10] Princes Keloay, Christy N. Mintjelungan, Damajanty H. C. Pangemanan (2019) Gambaran Teknik Menyikat Gigi dan Indeks Plak Pada Siswa SD GMIM Siloam Tonselama. Jurnal e-Gigi (eG), Volume 7 Nomor 2, Juli-Desember 2019.
- [11] Sariningsih, E., Merawat Gigi Anak Sejak Usia Dini. Jakarta: PT Elex Media Komputindo. 2012
- [12] Sherlyta, M., R. Wardani, dan S. Susilawati. Tingkat Kebersihan Gigi dan Mulut Siswa Sekolah Dasar Negeri di Desa Tertinggal Kabupaten Bandung. J. ked. Gigi Unpad. 29(1): 69-76. 2017
- [13] Rusmawati, I., Ilmu Perilaku Kesehatan. Jakarta: 2010

## PERSON-CENTERED COUNSELING IMPROVES DIETARY BEHAVIOR AMONG PATIENTS WITH GOUT AT RASANA E TIMUR PUBLIC HEALTH CENTER IN BIMA CITY

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### Abstract

Gout care in primary health services often requires more than brief dietary advice because food choices are closely related to daily habits, family meals, symptoms, and patients' confidence to change. This study aimed to determine whether person-centered counseling improved dietary behavior among patients with gout at Rasanae Timur Public Health Center, Bima City. A pre-experimental one-group pretest-posttest study was conducted among 30 purposively selected respondents. Dietary behavior was assessed before and after individual counseling using a 25-item Likert questionnaire, and data were analyzed using descriptive statistics and the Wilcoxon signed-rank test. Before counseling, no respondent was in the good dietary behavior category; 20 respondents (66.7%) were moderate and 10 respondents (33.3%) were poor. After counseling, 27 respondents (90.0%) achieved good dietary behavior. The mean category score improved from 2.33 to 1.13, with a significant pre-post difference ( $Z = -4.679$ ;  $p < 0.001$ ). These findings suggest that empathetic counseling, which allows patients to discuss their usual foods, barriers, and personal plans, may help translate gout dietary recommendations into everyday practice. This local study highlights the practical value of person-centered counseling as a simple nursing strategy for strengthening dietary self-management in community-based gout care.

Keywords: dietary behavior, gout, hyperuricemia, person-centered counseling, primary health care

### 1. INTRODUCTION

Gout is a common inflammatory joint disease that occurs when persistent hyperuricemia leads to monosodium urate crystal deposition. Patients may experience recurrent pain, swelling, reduced mobility, and limitations in daily activities. Although gout has a clear biomedical basis, its management in primary care is often shaped by everyday behavior, including food choices, alcohol intake, body weight, kidney function, hypertension, and other metabolic conditions [1]. Current clinical guidance therefore emphasizes that gout treatment should combine medication, education, comorbidity control, and long-term self-management support [2].

Dietary behavior deserves particular attention because patients frequently relate gout attacks to foods they eat in daily life. Evidence has linked alcohol, red meat, seafood, and fructose-rich intake with hyperuricemia and gout risk, whereas healthier dietary patterns are generally more favorable [3], [4]. In practice, however, advice to reduce purine-rich foods is not always easy to follow. Patients may need to negotiate family menus, local food preferences, work routines, and uncertainty about which foods are safe. These realities make dietary change a personal process rather than a simple transfer of information.

Person-centered counseling offers a relevant approach for this situation. It gives patients space to talk about their own habits, barriers, fears, and readiness to change, while health workers respond with empathy, acceptance, active listening, and shared problem exploration. In chronic illness care, person-centered and empowerment-based interventions have been associated with better engagement, self-

care, and patient-reported outcomes [5], [6]. Based on this rationale, the present study aimed to analyze the effect of person-centered counseling on dietary behavior among patients with gout at Rasanae Timur Public Health Center, Bima City.

## 2. METHODOLOGY

This study used a pre-experimental one-group pretest-posttest design. It was conducted at Rasanae Timur Public Health Center, Bima City, from May to June 2025. The study population consisted of patients diagnosed with gout or patients with a history of gout who visited the public health center. Thirty respondents who met the study criteria were recruited using purposive sampling. The inclusion criteria were having a gout diagnosis or history of gout, being male or female, being in a stable general condition, being able to communicate, and being willing to participate. Patients with severe psychological problems or hearing impairment that could interfere with the counseling process were excluded.

The independent variable was person-centered counseling, while the dependent variable was dietary behavior. Dietary behavior was measured using a 25-item Likert questionnaire that covered consumption of high-purine foods, seafood, fatty foods, alcohol-containing products, vegetables, fruits, water intake, medication adherence, laboratory checking, physical activity, and efforts to avoid foods that trigger gout symptoms. The total score was categorized into good (76-100), moderate (51-75), and poor (25-50).

Counseling was delivered individually. Each session emphasized therapeutic communication, empathy, acceptance, active listening, reflection of patient experience, clarification of dietary problems, and support for patient-led behavior change. The counselor helped respondents recognize their usual eating patterns and identify realistic changes that could be practiced at home. Data were processed through editing, coding, tabulation, and computer-based analysis. Respondent characteristics and dietary behavior categories were summarized using frequencies and percentages. Because the normality test showed non-normal pretest and posttest scores, the Wilcoxon signed-rank test was used with a significance level of 0.05.

## 3. RESULTS

### 3.1 Respondent characteristics

The respondents represented adult gout patients who received services at Rasanae Timur Public Health Center. Most were older adults, men, married, and worked in informal or community-based occupations. Their characteristics are presented in Table 1.

**Table 1.** Characteristics of respondents ( $n = 30$ ).

Characteristic	Category	n	%
Age	30-35 years	4	13.3
	36-40 years	8	26.7
	> 41 years	18	60.0
Sex	Male	24	80.0
	Female	6	20.0
Marital status	Unmarried	5	16.7
	Married	23	76.7
	Widow/widower	2	6.6
Education	Elementary school	9	30.0
	Junior high school	11	36.7
	Senior high school	7	23.3
	Higher education	3	10.0
Occupation	Not working	3	10.0
	Farmer	14	46.7
	Entrepreneur	9	30.0
	Civil servant	4	13.3

Table 1 shows that respondents were predominantly aged above 41 years (60.0%), male (80.0%), married (76.7%), educated at elementary or junior high school level, and worked mostly as farmers (46.7%).

### 3.2 Dietary behavior before and after counseling

Before counseling, none of the respondents had good dietary behavior. After the counseling session, most respondents moved into the good category, suggesting that the intervention helped patients organize safer food choices and self-care practices. The pretest and posttest distribution is shown in Table 2.

**Table 2.** Dietary behavior before and after person-centered counseling.

Dietary behavior category	Pretest n	Pretest %	Posttest n	Posttest %
Good	0	0.0	27	90.0
Moderate	20	66.7	2	6.7
Poor	10	33.3	1	3.3
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>30</b>	<b>100.0</b>

Table 2 demonstrates a strong positive shift: the good dietary behavior category increased from 0.0% before counseling to 90.0% after counseling, while the poor category decreased from 33.3% to 3.3%.

### 3.3 Effect of person-centered counseling

The Wilcoxon signed-rank test was used to examine whether the observed change was statistically meaningful. In the coding system used in this study, a lower category score reflects a better dietary behavior category. The test results are shown in Table 3.

**Table 3.** Wilcoxon signed-rank test for dietary behavior change.

Indicator	Result
Mean category score before counseling	2.33
Mean category score after counseling	1.13
Negative ranks (posttest < pretest/improved)	28
Positive ranks (posttest > pretest/worsened)	1
Ties (no change)	1
Z value	-4.679
Asymp. Sig. (2-tailed)	< 0.001

Table 3 confirms a statistically significant improvement in dietary behavior after counseling. Most respondents showed better posttest categories, as indicated by 28 improved ranks and  $p < 0.001$ .

## 4. DISCUSSION

The findings indicate that person-centered counseling improved dietary behavior among patients with gout. Before counseling, respondents were concentrated in the moderate and poor categories, which suggests that many patients had not consistently avoided dietary triggers or practiced recommended self-management. After counseling, almost all respondents reached the good category. This change was not only visible descriptively but was also statistically significant based on the Wilcoxon signed-rank test.

The result is meaningful for primary health care because diet is one of the daily issues most often faced by gout patients. Recent studies have shown that alcohol, red meat, seafood, and fructose-rich foods are associated with hyperuricemia or gout risk, while healthier dietary patterns may reduce risk exposure [3], [4]. In the local service setting, counseling may have helped patients move from general

knowledge to personal decisions, such as reducing high-purine foods, limiting fatty or processed foods, increasing water intake, and asking health workers before consuming foods that could trigger symptoms.

The improvement may also be related to the nature of the counseling approach. Person-centered counseling is different from one-way health education because patients are not treated as passive recipients of advice. They are invited to reflect on their usual eating patterns, discuss barriers, and choose changes that feel realistic. This is important because dietary behavior is influenced by taste, family food preparation, occupation, social habits, and previous experiences with pain. Evidence from chronic disease care also supports the value of person-centered and empowerment-oriented interventions for strengthening self-care and patient engagement [5], [6].

Even so, the findings should be interpreted with caution. This study used a one-group pretest-posttest design, so the change cannot be attributed solely to counseling without considering other influences such as repeated measurement, symptom fluctuation, medication use, family support, or additional advice from health workers. The sample was also small and taken from one public health center using purposive sampling. Future studies should consider a controlled design, a larger sample, longer follow-up, and objective indicators such as serum uric acid level, gout flare frequency, and adherence to dietary recommendations.

## 5. CONCLUSIONS

Person-centered counseling significantly improved dietary behavior among gout patients at Rasanae Timur Public Health Center, Bima City. Before counseling, most respondents were in the moderate or poor dietary behavior category. After counseling, most respondents achieved good dietary behavior, and the Wilcoxon signed-rank test showed a significant pretest-posttest difference ( $Z = -4.679$ ;  $p < 0.001$ ).

Primary health centers can use person-centered counseling as a practical nursing strategy in gout education, especially for patients who experience recurring symptoms or difficulty controlling dietary triggers. Counseling should combine simple dietary messages with empathy, patient participation, family support, and follow-up monitoring so that dietary change becomes easier to maintain in everyday life.

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## REFERENCES

- [1] K.M. Asghari, M. Zahmatyar, F. Seyedi, A. Motamedi, M. Zolfi, S.J. Alamdary, et al., "Gout: global epidemiology, risk factors, comorbidities and complications: a narrative review," *BMC Musculoskeletal Disorders*, vol. 25, article 1047, 2024. doi: 10.1186/s12891-024-08180-9.
- [2] J.D. FitzGerald, N. Dalbeth, T. Mikuls, R. Brignardello-Petersen, G. Guyatt, A.M. Abeles, et al., "2020 American College of Rheumatology guideline for the management of gout," *Arthritis Care & Research*, vol. 72, no. 6, pp. 744-760, 2020. doi: 10.1002/acr.24180.
- [3] X. Chi, Y. Cen, B. Yang, H. Zhang, Z. Pu, J. Feng, H. Pan, and Y. Zhang, "Effects of dietary factors on hyperuricaemia and gout: a systematic review and meta-analysis of observational studies," *International Journal of Food Sciences and Nutrition*, vol. 75, no. 8, pp. 1009-1024, 2024. doi: 10.1080/09637486.2024.2400489.
- [4] Z.Y. Wen, Y.F. Wei, Y.H. Sun, and W.P. Ji, "Dietary pattern and risk of hyperuricemia: an updated systematic review and meta-analysis of observational studies," *Frontiers in Nutrition*, vol. 11, article 1218912, 2024. doi: 10.3389/fnut.2024.1218912.
- [5] F. Cano, E. Alves, A. Joao, H. Oliveira, L.G. Pinho, and C. Fonseca, "A rapid literature review on the health-related outcomes of long-term person-centered care models in adults with chronic illness," *Frontiers in Public Health*, vol. 11, article 1213816, 2023. doi: 10.3389/fpubh.2023.1213816.

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- [6] N. Stepanian, M.H. Larsen, J.B. Mendelsohn, K.L. Mariussen, and K. Heggdal, "Empowerment interventions designed for persons living with chronic disease: a systematic review and meta-analysis of the components and efficacy of format on patient-reported outcomes," *BMC Health Services Research*, vol. 23, article 911, 2023. doi: 10.1186/s12913-023-09895-6.
- [7] S. Uzun and N. Gurhan, "The effect of motivational interviewing on quality of life and self-efficacy behaviors of individuals with chronic illness: a meta-analysis study," *Public Health Nursing*, vol. 39, no. 6, pp. 1456-1468, 2022.
- [8] A.L. Deslippe, A. Soanes, C. Bouchaud, H. Beckenstein, et al., "Barriers and facilitators to diet, physical activity and lifestyle behavior intervention adherence: a qualitative systematic review," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 20, article 14, 2023.

## RELATIONSHIP BETWEEN PERSONAL HYGIENE KNOWLEDGE AND ATTITUDES AND DERMATITIS SEVERITY AMONG STUDENTS OF MODERN ROBITHOH ISLAMIC BOARDING SCHOOL, BANDUNG REGENCY

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### Abstract

**Purpose:** This study aimed to analyze the relationship between personal hygiene knowledge and attitudes and dermatitis severity among students at Modern Robithoh Islamic Boarding School, Bandung Regency. **Methodology:** This study employed a quantitative analytical design with a cross-sectional approach. The sample consisted of 40 students selected using a total sampling technique. Data were collected using a personal hygiene knowledge questionnaire, a personal hygiene attitude questionnaire, and a dermatitis observation sheet. Data were analyzed using the Spearman Rank correlation test with a significance level of  $p < 0.05$ . **Findings:** The results showed that most respondents were 14 years old (60.0%) and male (55.0%). A total of 40.0% of respondents experienced severe dermatitis. The majority of respondents had a moderate level of personal hygiene knowledge (55.0%) and a moderate level of personal hygiene attitude (77.5%). Spearman Rank correlation analysis revealed a significant relationship between personal hygiene knowledge and dermatitis severity ( $p = 0.030$ ;  $r = -0.343$ ), as well as a significant relationship between personal hygiene attitude and dermatitis severity ( $p = 0.000$ ;  $r = -0.662$ ). **Practical/Social Implications:** The findings highlight the importance of strengthening health education and fostering positive attitudes toward personal hygiene among students as a preventive strategy against dermatitis in Islamic boarding schools. Boarding school administrators may develop health promotion programs, improve personal hygiene monitoring, and provide adequate sanitation facilities to support healthy living behaviors. **Originality/Value:** This study provides empirical evidence regarding the relationship between personal hygiene knowledge and attitudes and dermatitis severity among students in an Islamic boarding school setting. The findings indicate that personal hygiene attitude has a stronger association with reducing dermatitis severity than knowledge, suggesting that attitude-based interventions should be prioritized in school health promotion programs.

Keywords: dermatitis; personal hygiene; knowledge; attitude; Islamic boarding school students.

### 1. INTRODUCTION

Dermatitis remains one of the most common skin diseases and continues to be a public health concern in many countries. This condition is characterized by inflammation of the epidermal and dermal layers, resulting in symptoms such as erythema, papules, vesicles, scales, and pruritus that may interfere with daily activities. In addition to causing physical discomfort, dermatitis can reduce quality of life, disrupt learning activities, and increase the risk of psychosocial problems when not properly

managed. Atopic dermatitis, in particular, is a chronic inflammatory skin disease that is frequently found among children and adolescents and has significant impacts on their physical, emotional, and social well-being [1], [2], [3], [4]

In Indonesia, skin diseases remain among the most frequently encountered health problems in primary healthcare services. According to the Indonesian Basic Health Research data, the prevalence of dermatitis in Indonesia reaches 6.8%, indicating that skin disorders continue to represent a considerable public health issue[5]. The tropical climate, characterized by high temperatures and humidity, promotes the growth of various microorganisms that may contribute to skin disorders. In addition to environmental factors, poor personal hygiene practices may increase the risk of developing dermatitis. Bahari and Paramita [6] reported a significant relationship between personal hygiene and the incidence of atopic dermatitis among school-aged children, highlighting the importance of personal hygiene in preventing skin diseases. Several studies have shown that inadequate personal hygiene practices, including irregular bathing habits, sharing clothes and towels, and poor bedding hygiene, are associated with an increased incidence of skin diseases among school-aged children and adolescents [5], [7], [8].

Islamic boarding schools (pondok pesantren) are residential educational institutions characterized by communal living and intensive social interactions among students. Overcrowded living conditions, shared facilities, and the practice of sharing personal belongings may increase the risk of skin diseases if not supported by proper hygiene behaviors. High residential density has been recognized as a factor that facilitates the transmission of various skin diseases among individuals living in close proximity, including students in Islamic boarding schools. Therefore, Islamic boarding school students are considered a vulnerable population for skin health problems, including dermatitis and other communicable skin diseases [9], [10], [11], [12].

Knowledge and attitudes are important factors influencing personal hygiene practices. Adequate knowledge enhances an individual's understanding of the importance of maintaining personal cleanliness, while positive attitudes encourage the consistent adoption of healthy hygiene behaviors. Health education regarding personal hygiene has been shown to improve students' knowledge and awareness of skin disease prevention in boarding school settings [13]. Individuals with better knowledge and positive attitudes are generally more likely to adopt preventive health behaviors through appropriate personal hygiene practices. Previous studies have reported associations between personal hygiene and skin diseases among boarding school students; however, most studies have focused on hygiene behaviors and environmental sanitation. Panggabean and Andayani (2024) reported a relationship between knowledge and personal hygiene practices among students with skin diseases. Other studies have demonstrated that skin cleanliness, clothing hygiene, towel hygiene, and bedding hygiene are associated with the occurrence of skin diseases in boarding school and dormitory environments [7], [10], [12]

Previous studies on skin diseases among boarding school students have primarily focused on personal hygiene practices, environmental sanitation, overcrowding, and the use of shared facilities as risk factors [7], [10], [11], [12]. Although several studies have reported associations between personal hygiene, environmental sanitation, overcrowding, and skin diseases among students, research specifically examining the simultaneous relationship between personal hygiene knowledge and attitudes and dermatitis severity remains limited. Furthermore, few studies have been conducted in Islamic boarding schools in Bandung Regency, highlighting the need for more context-specific investigations. Differences in the characteristics of boarding schools, including population size, environmental conditions, and students' daily habits, may contribute to variations in risk factors associated with dermatitis severity. Therefore, this study was conducted to provide a more specific understanding of the relationship between personal hygiene knowledge and attitudes and dermatitis severity among students in Islamic boarding schools.

A preliminary study conducted at Modern Robithoh Islamic Boarding School, Ciparay District, Bandung Regency, identified 247 students, consisting of 130 male and 117 female students. Dermatitis was found to be among the three most common health problems in the boarding school environment. Initial observations revealed that some students still shared clothing, used inadequately cleaned towels, rarely exposed bedding to sunlight, and lived in rooms with relatively high occupancy density. In addition, some students had a previous history of skin diseases and were potentially exposed to disease transmission through the shared use of personal facilities. These conditions indicate that dermatitis remains an important health issue requiring attention within the boarding school setting. Therefore, this

study aimed to analyze the relationship between personal hygiene knowledge and attitudes and dermatitis severity among students at Modern Robithoh Islamic Boarding School, Bandung Regency.

## 2. METHODOLOGY

This study employed a quantitative analytical research design with a cross-sectional approach to analyze the relationship between personal hygiene knowledge and attitudes and dermatitis severity among students at Modern Robithoh Islamic Boarding School, Ciparay District, Bandung Regency.

The study was conducted from February to March 2025 at Modern Robithoh Islamic Boarding School, Bandung Regency. The study population consisted of all students who met the inclusion criteria. A total of 40 respondents were included in the study using a total sampling technique.

Data were collected using questionnaires and an observation sheet. The knowledge questionnaire was used to assess students' level of knowledge regarding personal hygiene, while the attitude questionnaire was used to evaluate students' attitudes toward personal hygiene practices. Dermatitis severity was assessed using an observation sheet based on the signs and symptoms of dermatitis experienced by the respondents. Prior to data collection, the research instruments underwent validity and reliability testing to ensure their appropriateness for the study.

Data analysis was performed using univariate and bivariate statistical analyses. Univariate analysis was used to describe respondents' characteristics, levels of personal hygiene knowledge, personal hygiene attitudes, and dermatitis severity. Bivariate analysis was conducted using the Spearman Rank correlation test with a significance level of  $p < 0.05$  to determine the relationship between personal hygiene knowledge and attitudes and dermatitis severity.

This study adhered to research ethics principles, including informed consent, confidentiality of respondents' identities, anonymity, and respondents' voluntary participation in the study.

## 3. RESULTS

### 3.1 Respondent Characteristics

*Table 1. Respondent Characteristics Based on Age and Gender (n = 40)*

<b>Characteristics</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
<b>Age</b>		
13 years	16	40.0
14 years	24	60.0
<b>Gender</b>		
Male	22	55.0
Female	18	45.0

Based on Table 1, the majority of respondents were 14 years old, accounting for 24 respondents (60.0%). In terms of gender, most respondents were male, with 22 respondents (55.0%), while female respondents accounted for 18 respondents (45.0%).

### 3.2 Dermatitis Severity

**Table 2.** Distribution of Dermatitis Severity (n = 40)

<b>Dermatitis Category</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
No Dermatitis	0	0
Mild	13	32.5
Moderate	11	27.5
Severe	16	40.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

Based on Table 2, the majority of respondents experienced severe dermatitis, accounting for 16 respondents (40.0%). This was followed by mild dermatitis in 13 respondents (32.5%) and moderate dermatitis in 11 respondents (27.5%). No respondents were classified as having no dermatitis.

### 3.3 Levels of Personal Hygiene Knowledge and Attitudes

**Table 3.** Distribution of Personal Hygiene Knowledge and Attitude Levels

<b>Variable</b>	<b>Category</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
<b>Personal Hygiene Knowledge</b>	Good	16	40.0
	Moderate	22	55.0
	Poor	2	5.0
<b>Personal Hygiene Attitude</b>	Good	8	20.0
	Moderate	31	77.5
	Poor	1	2.5

Based on Table 3, the majority of respondents had a moderate level of personal hygiene knowledge, accounting for 22 respondents (55.0%). Regarding personal hygiene attitudes, most respondents demonstrated a moderate attitude level, accounting for 31 respondents (77.5%).

### 3.4 Relationship Between Personal Hygiene Knowledge and Attitudes and Dermatitis Severity

**Table 4.** Relationship Between Personal Hygiene Knowledge and Attitudes and Dermatitis Severity

<b>Variable</b>	<b>Correlation Coefficient (r)</b>	<b>p-value</b>	<b>Interpretation</b>
Personal Hygiene Knowledge	-0.343	0.030	Significant
Personal Hygiene Attitude	-0.662	0.001	Significant

Based on Table 4, the results of the Spearman Rank correlation test revealed a significant relationship between personal hygiene knowledge and dermatitis severity ( $p = 0.030$ ;  $r = -0.343$ ), as well as a significant relationship between personal hygiene attitude and dermatitis severity ( $p = 0.000$ ;  $r = -0.662$ ). The negative correlation coefficients indicate that higher levels of personal hygiene knowledge and more positive personal hygiene attitudes were associated with lower levels of dermatitis

severity among the students. Furthermore, the relationship between personal hygiene attitude and dermatitis severity demonstrated a stronger correlation than that between personal hygiene knowledge and dermatitis severity..

## 4. CONCLUSION

### 4.1 Relationship Between Personal Hygiene Knowledge and Dermatitis Severity

The results of this study revealed a significant relationship between personal hygiene knowledge and dermatitis severity among students at Modern Robithoh Islamic Boarding School, Bandung Regency ( $p = 0.030$ ;  $r = -0.343$ ). The negative correlation coefficient indicates that higher levels of personal hygiene knowledge were associated with lower levels of dermatitis severity. However, the strength of the correlation was categorized as weak to moderate, suggesting that factors other than knowledge may also contribute to the occurrence and severity of dermatitis.

Knowledge is considered one of the predisposing factors influencing an individual's health behavior. According to health behavior theory, individuals with adequate knowledge are more likely to understand the benefits and importance of disease prevention measures, thereby facilitating the adoption of healthy and hygienic behaviors. Students who possess good knowledge regarding personal hygiene tend to have a better understanding of the importance of maintaining body cleanliness, clothing hygiene, towel hygiene, bedding hygiene, and environmental cleanliness as preventive measures against skin diseases [10], [14].

The findings of this study are consistent with those reported by Panggabean and Andayani (2024), who found that knowledge was associated with personal hygiene practices among students in Islamic boarding schools. Other studies have also demonstrated that a good understanding of personal hygiene contributes to the adoption of preventive behaviors against skin diseases among adolescents and boarding school students. Therefore, improving knowledge through health education may serve as an effective strategy for reducing the risk of dermatitis in boarding school environments. Rahman [13] reported that personal hygiene education programs were effective in increasing students' knowledge regarding clean and healthy living behaviors as an effort to prevent dermatitis in Islamic boarding schools.

Nevertheless, the findings of this study indicate that the relationship between knowledge and dermatitis severity was not particularly strong. This suggests that adequate knowledge does not always translate into appropriate personal hygiene practices. Limited facilities, communal living habits, overcrowding, and social influences within the boarding school environment may affect students' ability to maintain proper personal hygiene. In addition to knowledge, dermatitis may also be influenced by environmental conditions, sanitation, overcrowding, and the shared use of facilities, which are commonly found in Islamic boarding school settings [7], [12].

### 4.2 Relationship Between Personal Hygiene Attitudes and Dermatitis Severity

The results of this study revealed a significant relationship between personal hygiene attitudes and dermatitis severity among students at Modern Robithoh Islamic Boarding School, Bandung Regency ( $p < 0.001$ ;  $r = -0.662$ ). The negative correlation coefficient indicates that more positive personal hygiene attitudes were associated with lower levels of dermatitis severity. The correlation coefficient of  $-0.662$  demonstrates a strong relationship, suggesting that personal hygiene attitude is an important factor in the prevention and reduction of dermatitis severity among students.

Attitude refers to an individual's tendency to respond to a particular object or condition, which is reflected in their readiness to act. Positive attitudes toward personal hygiene encourage individuals to consistently maintain personal cleanliness through regular bathing, wearing clean clothes, maintaining the cleanliness of towels and bedding, and avoiding the sharing of personal items. Conversely, negative attitudes toward personal hygiene may increase the risk of developing skin health problems, including dermatitis.

The findings of this study are consistent with those of previous studies indicating that positive attitudes toward personal hygiene are associated with a lower incidence of skin diseases among boarding school students. Panggabean and Andayani [10] reported that positive attitudes toward personal hygiene contribute to the adoption of more appropriate personal hygiene practices. Similarly,

Zaman et al. [12] demonstrated that clean and healthy living behaviors play an important role in reducing the risk of skin diseases in densely populated boarding school environments.

The stronger correlation observed between attitude and dermatitis severity, compared to knowledge, suggests that possessing knowledge about personal hygiene does not necessarily lead to the consistent implementation of healthy behaviors. A student may understand the importance of maintaining personal hygiene but may lack the motivation, awareness, or commitment required to apply such knowledge in daily life. In contrast, positive attitudes can motivate individuals to transform knowledge into actual health-promoting behaviors. In addition to increasing knowledge, health education programs play an important role in fostering positive attitudes toward personal hygiene, which may subsequently encourage sustainable behavioral changes [13].

The communal lifestyle commonly practiced in Islamic boarding schools may also influence students' attitudes toward personal hygiene. Support from school administrators, the availability of hygiene facilities, supervision of clean and healthy living behaviors, and continuous health education programs can help foster positive attitudes toward personal hygiene among students. Therefore, efforts to prevent dermatitis should focus not only on improving knowledge but also on developing positive attitudes and sustainable hygiene practices among students.

## 5. CONCLUSIONS

This study found significant relationships between personal hygiene knowledge and dermatitis severity ( $p = 0.030$ ;  $r = -0.343$ ) and between personal hygiene attitudes and dermatitis severity ( $p < 0.001$ ;  $r = -0.662$ ) among students of Modern Robithoh Islamic Boarding School, Bandung Regency. The findings indicate that better knowledge and more positive attitudes toward personal hygiene are associated with lower levels of dermatitis severity. Personal hygiene attitude demonstrated a stronger correlation with dermatitis severity than knowledge. Therefore, health promotion programs in Islamic boarding schools should focus not only on improving knowledge but also on fostering positive attitudes and sustainable personal hygiene practices to prevent dermatitis.

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## REFERENCES

- [1] GADA, "Global Report on Atopic Dermatitis," 2022, [Online]. Available: [https://www.eczemacouncil.org/assets/docs/global-report-on-atopic-dermatitis-2022.pdf?utm\\_source=chatgpt.com](https://www.eczemacouncil.org/assets/docs/global-report-on-atopic-dermatitis-2022.pdf?utm_source=chatgpt.com)
- [2] L. F. Eichenfield, S. Stripling, S. Fung, A. Cha, A. O. Brien, and L. A. Schachner, "Recent Developments and Advances in Atopic Dermatitis : A Focus on Epidemiology , Pathophysiology , and Treatment in the Pediatric Setting," *Pediatr. Drugs*, vol. 24, no. 4, pp. 293–305, 2022, doi: 10.1007/s40272-022-00499-x.
- [3] C. Teixeira, M. Jos, and H. Silva, "Impact of Atopic Dermatitis on the Mental Health of Adolescents — Literature Review †," pp. 1–5, 2023, doi: <https://doi.org/10.3390/msf2022016008>.
- [4] N. Vicho-de-la-Fuente, A.-E. Martinez-Santos, R. Rodríguez-González, Á. Florez, G. Sheaf, and I. Coyne, "Impact of Atopic Dermatitis on Adolescents and Families: A Mixed-Method Systematic Review.," *J. Adv. Nurs.*, vol. 81, no. 8, pp. 4360–4387, Aug. 2025, doi: 10.1111/jan.16652.
- [5] Kementerian Kesehatan Republik Indonesia, PROFIL KESEHATAN INDONESIA 2023. 2023.
- [6] D. A. Bahari, M. I. Y., & Paramita, "Correlation between Personal Hygiene , Household Hygiene , and Atopic Dermatitis in Elementary School Children in Indonesia Hubungan Personal Hygiene , Rumah Tangga , dan Dermatitis Atopik pada Anak Sekolah Dasar di Indonesia," vol. 52, no. 5, 2020, doi: 10.15395/mkb.v52n3.1971.

- [7] A. Rahmadiyah, "Hubungan Personal Hygiene Dengan Gejala Dermatitis Pada Narapidana Di Lembaga Masyarakat Kelas II A Jambi Tahun 2024," *J. Kesmas Jambi*, vol. 8, no. 2, pp. 94–100, 2024.
- [8] R. Alfadli and S. Khairunisa, "Prevalensi Penyakit Kulit Infeksi dan Non-infeksi di Poliklinik Kulit dan Kelamin RSUD Jagakarsa Periode Februari 2023 - Januari 2024 Prevalence of Infectious and Non-infectious Skin Diseases in the Dermatology and Venereology Outpatient Department at Jagakarsa Regional Hospital between February 2023 - January 2024," vol. 30, no. 3, pp. 151–156, 2024.
- [9] R. Efendi, A. A. Adriansyah, and M. Ibad, "( The Indonesian Journal of Public Health ) Hubungan Personal Hygiene dengan Kejadian Scabies Pada Santri di Pondok Pesantren Fakultas Kesehatan , Program Studi Kesehatan Masyarakat Universitas Nahdlatul Ulama Surabaya," vol. 15, no. November, pp. 25–28, 2020, [Online]. Available: <https://jurnal.unimus.ac.id/index.php/jkmi/article/view/6571/5093>
- [10] D. Panggabean, "Hubungan Pengetahuan dengan Tindakan Personal Hygiene pada Santri yang Menderita Scabies di Pondok Pesantren Darul Arafah Deli Serdang," *Perilaku dan Promosi Kesehat. Indones. J. Heal. Promot. Behav.*, vol. 6, no. 1, 2024, doi: 10.47034/ppk.v6i1.1084.
- [11] Z. Rasyid, W. Septiani, Y. Harnani, N. Susanti, and A. R. Bayhaqi, "Determinan Personal Hygiene dan Sanitasi Dasar dengan Penyakit Kulit ( Scabies ) di Pondok Pesantren Modern Al-Kautsar Pekanbaru Tahun 2022," vol. 23, no. 2, pp. 153–161, 2024, [Online]. Available: [https://d1wqtxts1xzle7.cloudfront.net/125513427/25503-libre.pdf?1764059391=&response-content-disposition=inline%3B+filename%3DDeterminan\\_Personal\\_Hygiene\\_dan\\_Sanitasi](https://d1wqtxts1xzle7.cloudfront.net/125513427/25503-libre.pdf?1764059391=&response-content-disposition=inline%3B+filename%3DDeterminan_Personal_Hygiene_dan_Sanitasi).
- [12] C. Zaman, L. Suryani, A. Wahyudi, and A. D. Priyatno, "Analisis Kejadian Skabies Pada Santri di Pondok Pesantren X Kecamatan Ilir Timur II Kota Palembang Tahun 2023," *J. Kesehat. Saemakers PERDANA*, vol. 7, no. 1, pp. 50–56, 2024, [Online]. Available: <https://journal.ukmc.ac.id/index.php/joh/article/view/1110>
- [13] I. A. Rahman, "Edukasi Personal Hygiene dengan Kejadian Penyakit Dermatitis di Pondok Pesantren," vol. 7, no. 4, pp. 371–377, 2023.
- [14] S. Notoatmodjo, *Promosi Kesehatan dan Perilaku Kesehatan (Edisi Revisi)*. Jakarta: Rineka Cipta, 2020.

## FORMULATION AND EVALUATION OF LIQUID HAND WASHING SOAP PREPARATION FROM ETHANOL EXTRACT FROM BINAHONG LEAVES

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### Abstract

Binahong leaves (*Anredera cordifolia*) contain various bioactive compounds, including flavonoids, saponins, and polyphenols, which have antibacterial properties and potential applications in personal hygiene products. This study was conducted to develop a liquid hand soap formulation containing ethanol extract of binahong leaves and to evaluate its physicochemical characteristics in order to identify the optimum formulation. A formulation-based experimental design was employed, in which three hand soap formulations were prepared with varying concentrations of binahong leaf ethanol extract while maintaining the other formulation components at constant levels. A purposive sampling method was used for the collection of binahong leaves. Fresh and healthy leaves were selected based on specific inclusion criteria, including maturity, absence of physical damage, and freedom from pest infestation. The collected plant material was then cleaned, dried, and processed for ethanol extraction.. All formulations were prepared in triplicate, and samples from each batch were subjected to physicochemical evaluation. The obtained data were analyzed to compare the characteristics of the different formulations.. Three formulations were prepared with different concentrations of binahong leaf ethanol extract, namely Formula I (10%), Formula II (25%), and Formula III (35%). The prepared formulations were subsequently evaluated for their physicochemical properties, and the results were compared to determine the most suitable formulation. The liquid hand soap formulations were evaluated for organoleptic properties, homogeneity, pH, viscosity, foam height, and physical stability. The results showed that all formulations were homogeneous and met the general requirements for liquid hand soap preparations. Organoleptic evaluation indicated a characteristic brown color of the extract and a non-rancid odor. Among the tested formulations, Formula III containing 35% ethanol extract demonstrated the best physicochemical characteristics, with a pH value of 8.5, viscosity of 2,500 cPs, and foam height of 110 mm. Stability testing revealed that Formula III remained homogeneous without phase separation or significant physical changes during the observation period. The increased concentration of binahong leaf ethanol extract contributed to improved viscosity and foam stability while maintaining acceptable physical properties. Based on the overall evaluation, Formula III was identified as the optimum formulation of liquid hand soap containing binahong leaf ethanol extract. The results demonstrate that binahong leaf ethanol extract can be formulated into liquid hand soap and affects the physicochemical properties of the formulation. Further investigations are required to assess its biological activity and product performance.

Keywords: *Anredera cordifolia*, binahong leaf ethanol extract, liquid hand soap, formulation, physicochemical evaluation

### 1. INTRODUCTION

Hand hygiene is recognized as one of the most effective interventions for reducing the transmission of infectious microorganisms in community and healthcare settings (Price et al., 2022; Mouajou et al., 2022; Gozdzielewska et al., 2022). Increasing consumer demand for safer and environmentally friendly products has encouraged the development of herbal-based cleansing formulations containing plant-

derived antimicrobial compounds (Woo et al., 2023; Rybczyńska-Tkaczyk et al., 2023; Michalak, 2023). Hand hygiene is one of the most effective measures to prevent the transmission of infectious diseases. The use of liquid hand soap has increased significantly due to greater public awareness of personal hygiene and disease prevention. However, commercial hand soaps often contain synthetic antibacterial agents that may cause skin irritation, allergic reactions, or environmental concerns when used continuously. Therefore, the development of herbal-based hand soap formulations using natural antibacterial ingredients has attracted considerable attention in pharmaceutical and cosmetic research (WHO,2023), (Utami NR, et.all, 2025)

Binahong (*Anredera cordifolia*) is a medicinal plant widely used in Indonesia for traditional healthcare. Phytochemical investigations have demonstrated that binahong leaves contain various secondary metabolites, including flavonoids, phenolic compounds, tannins, saponins, alkaloids, steroids, and triterpenoids, which contribute to their antioxidant and antimicrobial activities (Souhoka et al., 2021; Sidhartha et al., 2024; Rusdiana et al., 2024). Previous studies have demonstrated that ethanol extract of *Anredera cordifolia* leaves exhibits antibacterial activity against various pathogenic bacteria, including *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Propionibacterium acnes*, and *Cutibacterium acnes*, indicating its potential as a natural broad-spectrum antibacterial agent (Dominica et al., 2023; Sasebohe et al., 2023; Utami et al., 2025; Naufal et al., 2025). These biological properties suggest that binahong leaf extract has considerable potential as a natural active ingredient in topical cleansing products (Wris MAA, et.all, 2023), (Naufal MA, 2025), (Dominica D, et all, 2023).

Recent studies have investigated the incorporation of binahong leaf extract into various pharmaceutical and cosmetic dosage forms, including moisturizing gels, antiseptic ointments, lotions, solid soaps, and liquid soaps. The findings indicate that the addition of binahong extract can improve the functional properties of the preparations while maintaining acceptable physical characteristics. Moreover, formulations containing binahong extract generally exhibit favorable organoleptic properties, homogeneity, and stability, supporting its application in personal care products (Ginting E, et all, 2024), (Jumrah E, et all, 2023), (Sujono H, et.all, 2023)

Liquid hand soap is a preferred dosage form because of its convenience, ease of application, and ability to distribute active ingredients uniformly on the skin surface. The quality of liquid hand soap is influenced by several physicochemical parameters, including pH, viscosity, foam height, organoleptic characteristics, homogeneity, and physical stability. Variations in extract concentration may affect these parameters and consequently determine the overall quality and acceptability of the product. Therefore, optimization of extract concentration is necessary to obtain a stable and effective formulation (Utami NR, et.all, 2025), (Sujono H, et.all, 2024), (SNI 2588:2024)

Based on the aforementioned considerations, this study aimed to formulate and evaluate liquid hand soap containing ethanol extract of binahong leaves at concentrations of 10%, 25%, and 35%. The formulations were evaluated through organoleptic examination, homogeneity testing, pH measurement, viscosity determination, foam height assessment, and physical stability testing, as these parameters are essential indicators of the quality, stability, and usability of liquid hand soap formulations. Determining the optimum formulation is important to ensure that the incorporation of binahong leaf ethanol extract produces a preparation with acceptable physicochemical properties while maintaining product stability and consumer acceptability.

## 2. METHODOLOGY

A paper should contain the description of your study and should be structured in different sections such as: Abstract, Introduction, Methodology, Results, Conclusions, Acknowledgements (if applicable) and References. Please note that the title and authors list should be coincident with the accepted abstract.

### 2.1 Study Design

This study employed an experimental laboratory design to formulate and evaluate liquid hand soap containing ethanol extract of binahong leaves (*Anredera cordifolia*). Three formulations were prepared using different concentrations of binahong leaf ethanol extract, namely Formula I (10%), Formula II (25%), and Formula III (35%). The resulting formulations were evaluated based on their physicochemical characteristics to determine the optimum formulation.

### 2.2 Materials and Equipment

The materials used in this study included binahong leaves (*Anredera cordifolia*), 96% ethanol, sodium lauryl sulfate (SLS), cocamidopropyl betaine, glycerin, sodium chloride, citric acid, distilled water, and other pharmaceutical-grade ingredients required for liquid hand soap formulation.

The equipment used consisted of an analytical balance, blender, glassware, beaker glasses, measuring cylinders, magnetic stirrer, pH meter, Brookfield viscometer, ruler for foam height measurement, filter paper, and evaporation equipment.

### 2.3 Preparation of Binahong Leaf Ethanol Extract

Fresh binahong leaves were washed, dried, and ground into powder. The powdered leaves were extracted by maceration using 96% ethanol for 72 hours with occasional stirring. The extract was filtered and concentrated using an evaporator to obtain a thick ethanol extract. The concentrated extract was then stored in a closed container until further use.

### 2.4 Formulation of Liquid Hand Soap

Three liquid hand soap formulations were prepared by incorporating binahong leaf ethanol extract at different concentrations. The surfactants were dissolved in distilled water and mixed until homogeneous. Glycerin and other excipients were added gradually while stirring continuously. The ethanol extract of binahong leaves was then incorporated according to the designated concentration of each formula. Distilled water was added to obtain the final volume, and the mixture was stirred until a homogeneous liquid hand soap was produced.

**Table 1.** Composition of Liquid Hand Soap Formulations

Ingredient	F1 (%)	F2 (%)	F3 (%)
Binahong leaf ethanol extract	10	25	35
Sodium Lauryl Sulfate	3	3	3
Cocamidopropyl Betaine	2	2	2
Glycerin	4	4	4
Sodium Chloride	2,5	2,5	2,5
Citric Acid	1	1	1
Distilled Water	ad 100	ad 100	ad100

### 2.5 Evaluation of Liquid Hand Soap

#### 2.5.1 Organoleptic Test

Organoleptic evaluation was performed by observing the color, odor, and physical appearance of the formulations. The observations were conducted visually and compared among formulations.

#### 2.5.2 Homogeneity Test

The homogeneity of each formulation was assessed by visually examining the distribution of ingredients and the absence of coarse particles or phase separation.

#### 2.5.3 pH Measurement

The pH value of each formulation was measured using a calibrated digital pH meter at room temperature. Measurements were performed in triplicate, and the average value was recorded.

#### 2.5.4 Viscosity Test

Viscosity was determined using a Brookfield viscometer at a specified spindle speed. Measurements were carried out in triplicate, and the results were expressed in centipoise (cPs).

#### 2.5.5 Foam Height Test

Foam height was determined by shaking a specified volume of liquid hand soap in a graduated cylinder. The height of the foam formed was measured immediately and recorded in millimeters (mm).

### 2.5.6 Physical Stability Test

Physical stability was evaluated through storage at room temperature for four weeks. The formulations were observed periodically for changes in color, odor, homogeneity, pH, viscosity, and phase separation.

### 2.6 Data Analysis

The results of organoleptic properties, homogeneity, pH, viscosity, foam height, and physical stability were analyzed descriptively. The formulation exhibiting the most favorable physicochemical characteristics and stability was identified as the optimum formulation.

## 3. RESULTS

### Organoleptic Evaluation

The organoleptic evaluation was conducted to observe the physical appearance, color, odor, and consistency of the liquid hand soap formulations. All formulations exhibited a homogeneous liquid appearance without visible particulate matter. Increasing the concentration of binahong leaf ethanol extract resulted in a darker brown color due to the higher content of phytochemical compounds present in the extract. No rancid odor was detected in any formulation throughout the observation period.

**Table 2.** Organoleptic Characteristics of Liquid Hand Soap Formulations

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
Appearance	Liquid	Liquid	Liquid
Color	Light brown	Brown	Dark brown
Odor	Characteristic, non-rancid	Characteristic, non-rancid	Characteristic, non-rancid
Consistency	Homogeneous	Homogeneous	Homogeneous

The results demonstrated that all formulations met the general organoleptic requirements for liquid hand soap preparations. Formula III exhibited the most characteristic appearance of binahong extract while maintaining acceptable sensory properties.

### Homogeneity Evaluation

Homogeneity testing was performed to determine the uniform distribution of ingredients within the formulations. The results indicated that all formulations were homogeneous and showed no coarse particles or phase separation during the observation period.

**Table 3.** Homogeneity Test Results

Formulation	Homogeneity
Formula I (10%)	Homogeneous
Formula II (25%)	Homogeneous
Formula III (35%)	Homogeneous

The homogeneous nature of all formulations indicated successful incorporation of the ethanol extract into the liquid soap base. Uniform distribution of active ingredients is essential to ensure product quality and effectiveness.

### Physicochemical Evaluation

The physicochemical characteristics of the formulations were evaluated through pH, viscosity, and foam height measurements. These parameters are important indicators of the quality, stability, and consumer acceptability of liquid hand soap.

**Table 4.** Physicochemical Characteristics of Liquid Hand Soap Formulations

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
pH	7,8	8,2	8,5
Viscosity (cPs)	1850	2150	2500
Foam Height (mm)	85	98	80

Table 4 shows that increasing the concentration of binahong leaf ethanol extract resulted in higher pH and viscosity values. Formula III exhibited the highest pH (8.5) and viscosity (2,500 cPs), whereas the greatest foam height was observed in Formula II (98 mm). Overall, extract concentration had a notable effect on the physicochemical characteristics of the liquid hand soap formulations.

#### Physical Stability Evaluation

Physical stability testing was conducted during storage at room temperature. The formulations were observed for changes in color, odor, homogeneity, and phase separation.

**Table 5.** Physical Stability Results

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
Color Change	None	None	None
Odor Change	None	None	None
Phase Separation	Not observed	Not observed	Not observed
Homogeneity	Stable	Stable	Stable

The stability test demonstrated that all formulations remained physically stable throughout the storage period. No significant changes in color, odor, or homogeneity were observed. Furthermore, no phase separation occurred, indicating good compatibility between the extract and formulation components.

#### Determination of the Optimum Formula

The optimum formulation was selected based on the overall evaluation results. Formula III containing 35% binahong leaf ethanol extract exhibited the most favorable physicochemical characteristics, including a pH value of 8.5, viscosity of 2,500 cPs, foam height of 110 mm, homogeneous appearance, and excellent physical stability without phase separation.

These findings suggest that increasing the concentration of binahong leaf ethanol extract improved the viscosity and foaming properties of the liquid hand soap while maintaining acceptable organoleptic characteristics and physical stability. Therefore, Formula III was considered the optimum formulation for the development of liquid hand soap containing binahong leaf ethanol extract.

## 4. CONCLUSIONS

The present study successfully formulated liquid hand soap containing ethanol extract of binahong leaves (*Anredera cordifolia*) at concentrations of 10%, 25%, and 35%. All formulations exhibited acceptable organoleptic characteristics, homogeneous appearance, and satisfactory physical stability throughout the storage period.

The concentration of binahong leaf ethanol extract influenced the physicochemical properties of the liquid hand soap formulations. Increasing the extract concentration resulted in higher viscosity and foam height while maintaining acceptable pH values and physical stability.

Among the tested formulations, Formula III containing 35% binahong leaf ethanol extract demonstrated the best overall characteristics, with a pH value of 8.5, viscosity of 2,500 cPs, foam height of 110 mm, homogeneous consistency, characteristic brown color, non-rancid odor, and no phase separation during storage. Therefore, Formula III was identified as the optimum formulation for the development of liquid hand soap containing binahong leaf ethanol extract.

The findings indicate that binahong leaf ethanol extract has potential as a natural active ingredient in liquid hand soap formulations and may contribute to the development of herbal-based personal hygiene products with favorable physicochemical properties and stability.

## REFERENCES

- Badan Standardisasi Nasional, SNI 2588:2024 Liquid Hand Soap Specifications. Jakarta: BSN, 2024
- Dominica D, Anisah S, Wibowo RH, Shufyani F. Antibacterial activity of binahong ethanol extract lotion against *Staphylococcus aureus*. *Journal of Pharmaceutical and Sciences*. 2023;6(5):215–224. <https://doi.org/10.36490/journal-jps.com.v6i5-si.405>
- Ginting E, Nadia S, Karima N, et al. Formulation and antioxidant activity of binahong leaf extract gel. *Indonesian Journal of Pharmaceutical and Clinical Research*. 2024;7(2):1–13.
- Gozdzielewska L, Kilpatrick C, Reilly J, et al. The effectiveness of hand hygiene interventions for preventing infectious disease transmission: A systematic review. *BMC Public Health*. 2022;22:1283. <https://doi.org/10.1186/s12889-022-13667-y>
- Jumrah E, Agustina AS. Formulation of binahong leaf extract as antiseptic ointment. *Jurnal Akta Kimia Indonesia*. 2023;16(2):95–103.
- Michalak M. Plant extracts as skin care and therapeutic agents. *International Journal of Molecular Sciences*. 2023;24(20):15444. <https://doi.org/10.3390/ijms24201544>
- Mouajou V, Adams K, DeLisle G, Quach C. Hand hygiene compliance in the prevention of hospital-acquired infections: A systematic review. *Journal of Hospital Infection*. 2022;119:33–48. <https://doi.org/10.1016/j.jhin.2021.09.016>
- Naufal MA, Alvista VN, Puspitasari N, Kalih AL. Antibacterial activity of binahong leaf extract against acne-causing bacteria: A systematic review. *Jurnal Kedokteran Raflesia*. 2025;11(1):45–53. <https://doi.org/10.33369/juke.v11i1.41146>
- Price L, Gozdzielewska L, Matuluko A, Pittet D, Allegranzi B, Reilly J. Comparing the effectiveness of hand hygiene techniques in reducing the microbial load and covering hand surfaces in healthcare workers: Updated systematic review. *American Journal of Infection Control*. 2022;50(10):1079–1090. <https://doi.org/10.1016/j.ajic.2022.02.003>
- Rusdiana R, Widyawati T, Sari DK, Widjaja SS. Phytochemical analysis of ethanol extract of binahong leaves. *Baghdad Science Journal*. 2024;21(11):3446–3451. <https://doi.org/10.21123/bsj.2024.9354>
- Rybczyńska-Tkaczyk K, Grenda A, Jakubczyk A, et al. Natural compounds with antimicrobial properties in cosmetics. *Pathogens*. 2023;12(2):320. <https://doi.org/10.3390/pathogens12020320>
- Sasebohe VY, Prakasita VC, Adityarini D. Antibacterial activity of binahong extract against *Staphylococcus aureus* and *Propionibacterium acnes*. *SCISCITATIO*. 2023;4(1). <https://doi.org/10.21460/sciscitatio.2023.41.107>
- Sidhartha E, Yang JJ, Dimara RSN, Rahmawati F, Purba SWD. Phytochemical screening, antioxidant and antifungal activity of binahong leaf extract. *European Journal of Advanced Chemistry Research*. 2024;5(1):1–8. <https://doi.org/10.24018/ejchem.2024.5.1.151>
- Sujono H, Nurohmah GA, Jasmansyah. Preparation of solid soap with binahong leaf ethanol extract as antibacterial agent. *Jurnal Kartika Kimia*. 2024;6(2):156–164.
- Souhoka FA, Kapelle IBD, Sihasale E. Phytochemical and antioxidant test of binahong (*Anredera cordifolia*) leaves ethanol extract. *Fullerene Journal of Chemistry*. 2021;6(1):28–33. <https://doi.org/10.37033/fjc.v6i1.248>
- Utami NR, Ardiantina T, Abdulloh SH, Hulupi M. Antibacterial activity of binahong ethanol extract in liquid bath soap. In: *Proceedings of Industrial Research Workshop and National Seminar*. 2025;16(1):1120–1127. <https://doi.org/10.35313/irwns.v16i1.6679>

- 
- Waris MAA, Indarto AS. Antibacterial activity of ethanol extract of binahong leaves against *Propionibacterium acnes*. *Nutriture Journal*. 2023;3(2):85–92
- Woo S, Marquez L, Crandall WJ, Risener CJ, Quave CL. Recent advances in the discovery of plant-derived antimicrobial natural products to combat antimicrobial resistant pathogens. *Natural Product Reports*. 2023;40(7):1271–1290. <https://doi.org/10.1039/D2NP00090C>
- World Health Organization, WHO Guidelines on Hand Hygiene in Health Care: Updates and Implementation Strategies. Geneva: World Health Organization, 2023.

## THE RELATIONSHIP BETWEEN KNOWLEDGE OF CARIOGENIC FOODS AND DENTAL CARIES EXPERIENCES AMONG STUDENTS AGED 12–15 YEARS IN PASAMAN REGENCY

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### Abstract

The current high prevalence of dental and oral diseases is influenced by behavioral factors. These behaviors are closely linked to the public's knowledge of dental and oral health. Adolescents have more caries due to the habit of consuming cariogenic foods. According to the 2018 Riskesdas survey, the prevalence of dental problems in the 12-year-old age group was 82%, and in the 15-year-old age group, it was 47%. This study aims to determine the relationship between knowledge of cariogenic foods and caries experience (DMF-T index) among students aged 12–15 years in Pasaman Regency. This is a descriptive-analytical study using a quantitative method with a cross-sectional design. Total sampling was used. Data analysis employed the Chi-Square test with a significance level of  $p < 0.05$ . The results showed that knowledge of cariogenic foods was "good" in 59.7% (77 students) and "poor" in 40.3% (52 students). Caries experience (DMF-T index) was "good" in 55.8% (72 students) and "poor" in 44.2% (57 students). The results of the Chi-Square statistical analysis, using a 95% significance level ( $\alpha = 0.05$ ), yielded a p-value of  $0.000 < 0.05$ . The conclusion of this study is that there is an association between knowledge of cariogenic foods and dental caries experience among students aged 12–15 years in Pasaman Regency.

Keywords: Knowledge, Cariogenic Foods, Dental Caries Experiences

### 1. INTRODUCTION

Health is a state of physical, mental, and social well-being in which a person is not only free from disease but is also able to live a productive life. Health efforts encompass all forms and a series of actions undertaken by the central government, local governments, and the general public to promote, prevent, treat, rehabilitate, and provide palliative care for public health[1]. In addition to general health, oral and dental health is also of critical importance, as it can affect overall physical health, well-being, and quality of life[2].

According to the 2018 Basic Health Research, the prevalence of oral health problems in Indonesia was 78.8%, with the following breakdown: 45.3% had damaged, decayed, or painful teeth; 19% had missing teeth due to extraction or natural loss; 4.1% had teeth that had been filled due to decay; and 10.4% had loose teeth. West Sumatra Province has a caries prevalence of 77.43%, with 43.87% of teeth damaged, decayed, or painful; 19.61% of teeth lost due to extraction or natural loss; 3.51% of teeth filled due to cavities; and 10.44% of teeth loose. Meanwhile, the proportion of dental problems in Pasaman Regency is 64.83%, with the following breakdown: 39.38% of teeth are damaged, decayed, or painful; 14.65% of teeth are missing due to extraction or natural loss; 1.09% of teeth have been filled or capped due to cavities; and 9.71% of teeth are loose. Based on age groups (WHO), the proportion of dental problems among 12-year-olds is 82%, with 43.43% having damaged, decayed, or painful teeth; 23.43% having lost teeth due to extraction or natural loss; 1.67% having teeth that have been filled or capped due to cavities; and 13.78% having loose teeth; while at age 15, the figures were 47%, with 33.54% of teeth damaged, decayed, or painful; 7.51% of teeth lost due to extraction or natural loss; 2.53% of teeth filled or capped due to cavities; and 3.48% of teeth loose[3].

The current high prevalence of dental and oral diseases is influenced by behavioral factors. These behaviors are closely linked to the public's level of knowledge regarding dental and oral health[4]. Individuals acquire knowledge through sensory perception of specific objects. Knowledge is gained through stimuli captured by the five senses. Knowledge can also be acquired systematically, namely through the educational process. Actions are shaped by knowledge[5].

Junior high school (SMP) students are typically between the ages of 12 and 15[6]. The ages of 12 to 15 mark early adolescence. At this stage, adolescents often become self-centered and spend more money on snacks and treats[7]. Adolescents are more prone to tooth decay due to their habit of consuming cariogenic foods[8]. Excessive consumption of sugary foods and beverages can trigger diseases and health problems in the teeth and mouth. Bacteria in the mouth convert sugar into acid that can erode tooth enamel. The higher the daily sugar intake, the higher the risk of developing dental caries[9].

Based on a preliminary study conducted among 12- to 15-year-old students at SMP Negeri 1 Rao Utara in Pasaman Regency, interviews and DMF-T examinations were performed on 8 students. Of the 8 students interviewed, all reported frequently consuming cariogenic foods such as sucking on candy, eating chocolate, and bread, and they also frequently consumed sweetened tea. In addition to their preference for sugar-containing foods, they also demonstrated limited knowledge about maintaining oral health. The examination results showed that 6 students had 15 decayed (D) teeth, 1 missing (M) tooth, and no fillings (F), while the other 2 students had healthy teeth.

## 2. METHODOLOGY

The research method used in this study was descriptive-analytical research with a cross-sectional design. The population in this study consisted of all students aged 12–15 years at SMP Negeri 1 Rao Utara, Pasaman Regency, totaling 144 students in grades VII, VIII, and IX. The sampling technique used in this study was total sampling with the inclusion criteria of students who were present and willing to participate as respondents. Of the 144 students in the population, 3 were absent and 12 were unwilling to participate, resulting in a sample of 129 students. Data collection was conducted by administering a questionnaire and measuring the DMF-T index. The data collection instrument used in this study was a questionnaire that had undergone validity and reliability testing. The examination tool was used to determine the decayed, missing, and filled teeth (DMF-T) index.

The data analysis performed in this study consisted of univariate and bivariate analyses. Univariate analysis was presented in the form of frequency distribution tables, using the following criteria: for knowledge, a score of  $\geq 55\%$  was classified as "Good" and  $< 55\%$  as "Poor"; for the DMF-T index, a value of  $\leq 1$  was classified as "Good" and  $> 1$  as "Poor." Bivariate analysis was used to examine the relationship between two variables. The chi-square test was employed in this study to assess the relationship between literacy regarding cariogenic foods and dental caries experience (DMF-T index).

## 3. RESULTS AND DISCUSSION

### 3.1 Knowledge of Cariogenic Foods Among Students Aged 12–15 in Pasaman Regency

The results of the study on knowledge of cariogenic foods among students aged 12–15 in Pasaman Regency are shown in the following table:

**Table 1.** Frequency Distribution of Knowledge About Cariogenic Foods Among Students Aged 12–15 in Pasaman Regency

Knowledge Criteria	F	%
Good	77	59.7
Not so good	52	40.3
Total	129	100

Table 1 shows the frequency distribution of knowledge about cariogenic foods among students aged 12–15 years, indicating that 59.7% (77 students) met the "good" criteria, while 40.3% (52 students) met the "poor" criteria.

Based on the research findings, the high proportion of students meeting the “good” criteria for knowledge about cariogenic foods among 12–15-year-old students in Pasaman Regency may be influenced by information sources, which can be obtained from various channels such as print media, electronic media, and social media—for example, posters, television, and the internet. Age may also influence a person’s knowledge, as thinking becomes more mature with increasing age. Supported by the questionnaire results, students who already understand the definition of cariogenic foods (68%), understand the frequency of cariogenic food consumption that can increase the risk of cavities (60%), understand the duration of food exposure in the mouth (85%), understand the prevention of dental caries (94%), and understand the consequences of frequent consumption of cariogenic foods (88%).

Students with insufficient knowledge may lack interest in learning about cariogenic foods; if someone lacks a strong interest or desire to learn about a subject, they will have limited knowledge of that subject. Supported by the questionnaire results, students were unaware of the types of carbohydrates (33%), the forms and types of cariogenic foods (53%), foods that are beneficial for teeth (49%), and non-cariogenic foods (43%).

This aligns with the theory that individuals who receive more information will expand their knowledge. A person’s reaction to new information is influenced by how and from whom they obtain that information; various sources can serve as information channels, including interpersonal sources (health workers, community leaders, religious leaders, members of youth or women’s organizations, teachers, village development cadres, or government outreach officers), social media, print media, or electronic media. Wider access to information enhances a person’s understanding of a subject[10].

Age can also influence a person’s knowledge; a person’s physical and psychological (mental) aspects change as they grow older. Generally, physical growth consists of four types of changes: changes in size, changes in proportions, the loss of old characteristics, and the acquisition of new ones. These changes are caused by difficulties in performing organ functions. Psychologically or mentally, as a person ages, their way of thinking becomes more mature and sophisticated[11]. Interest is defined as a strong inclination or desire toward something. This drives a person to try and learn more about that particular subject[12].

The results of this study are consistent with those of a previous study titled “The Relationship Between Knowledge Levels Regarding Cariogenic Foods and Decay in Permanent Teeth Among Third-Grade Students at SD Muhammadiyah 2 Denpasar in 2025,” which found that the majority of students met the “good” criteria (48 students, 96%), one student met the “fair” criteria (2%), and one student met the “poor” criteria (2%)[13].

### 3.2 Dental Caries Experience (DMF-T Index) Among Students Aged 12–15 Years in Pasaman Regency

The results of dental caries prevalence (DMF-T Index) among students aged 12–15 years in Pasaman Regency are shown in the following table:

**Table 2.** Frequency Distribution of Dental Caries (DMF-T Index) Among Students Aged 12–15 Years in Pasaman Regency

DMF-T Criteria	f	%
Good	72	55.8
Poor	57	44.2
Total	129	100

Table 2 shows the frequency distribution of dental caries experience (DMF-T index) among students aged 12–15 years, indicating that 55.8% (72 students) met the “good” criteria, while 44.2% (57 students) met the “poor” criteria.

These descriptive data indicate that respondents with a “good” DMF-T index likely attribute this to drinking water or rinsing their mouths after consuming sweet foods or beverages. According to student interviews, they brush their teeth at least twice a day—in the morning after breakfast and at night before bed—using fluoride toothpaste.

Students with a DMF-T index in the “poor” category may have teeth with deep pits and fissures, making it easier for food debris to get trapped and harder to clean. Bacteria in the mouth contribute to the formation of caries, particularly due to frequent consumption of cariogenic foods such as cakes, bread, and chocolate.

This aligns with the theory that efforts to reduce the DMF-T index and prevent dental caries include rinsing the mouth or drinking water after consuming cariogenic foods or sugary drinks[14]. Brushing teeth is a method of removing plaque and food debris left on the tooth surfaces. Brush your teeth twice a day for 2 minutes—in the morning after breakfast and at night before bed[2]. Regular use of fluoride toothpaste helps protect teeth from cavities because fluoride strengthens enamel, inhibits demineralization, and supports remineralization, thereby reducing the risk of dental caries[15].

Dental caries is caused by the interaction of various factors, namely the host, microorganisms, substrate, and time. Teeth with deep pits and fissures are more prone to plaque retention, thereby increasing the risk of caries. The cariogenic bacteria that play a key role in this process are *Streptococcus mutans*, which are capable of fermenting carbohydrates into acids, thereby causing demineralization of the hard tissues of the teeth[14],[15]. High consumption of cariogenic foods, especially those containing sucrose and that easily adhere to the tooth surface, can lower the pH of saliva to a critical level, thereby accelerating the caries process[16],[17]. In addition, improper toothbrushing habits and excessive consumption of cariogenic foods have been shown to be associated with an increased incidence of dental caries in children and adolescents[18],[19].

The results of this study are consistent with those of a previous study examining the relationship between knowledge of cariogenic foods and the DMF-T index among 7th-grade students in Class VII A at SMPN 4 Pineleng, Minahasa Regency, which found that 56.6% met the “good” DMF-T index criteria and 43.4% met the “poor” criteria[22].

### 3.3 The relationship between knowledge of cariogenic foods and dental caries experience (DMF-T index) among 12- to 15-year-old students in Pasaman Regency

The results of the study on the relationship between knowledge of cariogenic foods and dental caries experience (DMF-T index) among 12–15-year-old students at SMPN 1 Rao Utara, Pasaman Regency, are presented in the table below:

**Table 3.** Results of the Chi-Square Test on the Relationship Between Knowledge of Cariogenic Foods and Dental Caries Experience (DMF-T Index) Among Students Aged 12–15 Years in Pasaman Regency

Criteria	DMF-T Criteria						p-Value
	Good		Poor		Total		
	f	%	f	%	f	%	
Good	55	71.4	22	28.6	77	100	0.000
Not very good	17	32.7	35	67.3	52	100	

Table 3 presents a cross-tabulation of the relationship between knowledge of cariogenic foods and dental caries experience (DMF-T index) among students aged 12–15 years, showing that 71.4% (55 students) had good knowledge and a good DMF-T index, while 67.3% (35 students) had poor knowledge and a poor DMF-T index. -T index also meeting the “good” criteria, at 71.4% (55 students), while those with “poor” knowledge had a “poor” DMF-T index at 67.3% (35 students).

Next, to examine the relationship between respondents’ knowledge of cariogenic foods and their experience with dental caries (DMF-T index), a chi-square test was conducted. Based on the results of the chi-square statistical analysis using SPSS, the results in the “Asymp. Significance” column—using a 95% significance level ( $\alpha = 0.05$ )—show that the p-value of 0.000 is below 0.05 ( $0.000 < 0.05$ ). This means that the null hypothesis ( $H_0$ ) is rejected, and the alternative hypothesis ( $H_1$ ) is accepted. Based on the results of this Chi-Square analysis, it can be concluded that there is an association between knowledge of cariogenic foods and the experience of dental caries (DMF-T index) among students aged 12–15 years in Pasaman Regency.

Based on the study's findings, good knowledge can positively influence the caries index if that knowledge is applied in daily behavior; conversely, insufficient knowledge can lead to a poorer caries index, as knowledge influences an individual's behavior in maintaining their oral health.

These findings align with the theory that the higher a person's level of knowledge, the greater their attention and concern for oral health. Knowledge is one of the factors influencing an individual's health behavior. Individuals with good knowledge tend to understand the appropriate actions for both the prevention and management of diseases, including oral diseases[23].

The findings of this study also align with previous research showing a significant association between the level of knowledge about cariogenic foods and the DMF-T index score. This indicates that good knowledge regarding cariogenic foods plays a role in shaping behaviors that support the maintenance of oral health, thereby influencing caries status as measured by the DMF-T index[20],[21],[24].

Based on the research findings and existing theory, it can be concluded that knowledge plays a crucial role in influencing oral health status. The better a person's knowledge of oral health, the greater the likelihood of adopting good oral health maintenance behaviors, thereby minimizing the risk of dental caries as reflected in the DMF-T index. However, knowledge must be supported by behavioral and environmental factors to produce sustainable health changes.

#### 4. CONCLUSION

The study results indicate a significant association between the level of knowledge about cariogenic foods and the incidence of dental caries. Students with better knowledge tend to have a lower incidence of dental caries compared to students with poorer knowledge. Therefore, improving knowledge about cariogenic foods should be a key focus in promotive and preventive efforts for oral health.

#### REFERENCES

- [1] R. Kemenkes, Undang-Undang Republik Indonesia Nomor 17 Tahun 2023 Tentang Kesehatan, no. 187315. Indonesia, 2023, pp. 1–300.
- [2] WHO, "Oral Health: Seventy-Fourth World Health Assembly," 2021.
- [3] Badan Penelitian dan Pengembangan Kesehatan, "Riset Kesehatan Dasar Provinsi Sumatera Barat Tahun. Laporan Riset Kesehatan Nasional 2018.," 2018, Badan Penelitian dan Pengembangan Kesehatan, Jakarta.
- [4] Marlindayanti, N. A. Hanum, Ismalayani, and Y. Heriyanto, Manajemen Pencegahan Karies. Kediri: Lembaga Chakra Brahmanda Lentera, 2022.
- [5] N. M. Sirat and A. A. G. Agung, Buku Ajar Ilmu Kesehatan Masyarakat. Malang: Media Nusa Creative, 2023.
- [6] Kemendikbud, Peraturan Pemerintah Republik Indonesia No 57 Tahun 2021 tentang Standar Nasional Pendidikan, no. 102501. Indonesia, 2021.
- [7] I. E. Yani et al., Perencanaan Pangan dan Gizi : Menjaga Kesehatan Anda dengan Pola Makan Seimbang. Padang: Get Press Indonesia, 2023.
- [8] U. Utami et al., "Food Consumption Frequency and Dental Caries Status among Adolescents in Jakarta," vol. 13, no. 3, pp. 1054–1058, 2020, doi: 1309-100X.
- [9] R. Kementrian Kesehatan, Profil Kesehatan Indonesia. Jakarta: Kementrian Kesehatan Republik Indonesia, 2019.
- [10] T. W. J. Hatibie, A. Bata, and N. Adjim, "Pemanfaatan Sistem Informasi Kesehatan untuk Meningkatkan Akses dan Kualitas Layanan Kesehatan di Desa," vol. 2, no. 2, pp. 215–221, 2023.
- [11] Estherita and A. Novianty, "Positive Mental Health Literacy in Adolescent and Young Adult," vol. 13, no. 2, pp. 93–104, 2021, doi: <http://doi.org/10.31289/analitika.v13i1.5053>.

- [12] M. S. Klinik, "Cavities and Tooth Decay: Symptoms and causes." Accessed: Jun. 14, 2026. [Online]. Available: <https://www.mayoclinic.org/diseases-conditions/cavities/symptoms-causes/syc-20352892>
- [13] N. M. Sirat, A. A. Senjaya, N. N. D. Supariani, A. A. G. Agung, and P. I. Pradnyaswari, "Hubungan Tingkat Pengetahuan tentang Makanan Kariogenik dan Karies Gigi Tetap Siswa Kelas III di SD Muhammadiyah 2 Denpasar Tahun 2025," vol. 12, no. 1, pp. 77–87, 2025, doi: 10.33992/jkg.v%vi%i.4178.
- [14] WHO, "Oral health," 2025, Geneva.
- [15] R. S. Levine, "Fluoride in toothpaste - is the expressed total fluoride content meaningful for caries prevention?," *Br. Dent. J.*, vol. 228, no. 10, pp. 795–799, May 2020, doi: 10.1038/s41415-020-1540-8.
- [16] P. D. Marsh, "Dental plaque as a biofilm and a microbial community – implications for health and disease," vol. 7, pp. 1–7, 2006, doi: 10.1186/1472-6831-6-S1-S14.
- [17] J. D. B. Featherstone, "The Science and Practice of Caries Prevention," vol. 131, no. 7, pp. 887–899, 2000, doi: <https://doi.org/10.14219/jada.archive.2000.0307>.
- [18] A. Rekawati and F. Frisca, "Hubungan kebiasaan konsumsi makanan kariogenik terhadap prevalensi karies gigi pada anak SD Negeri 3 Fajar Mataram," *Tarumanagara Med. J.*, vol. 2, no. 2, pp. 205–210, 2020, doi: 10.24912/tmj.v3i1.9719.
- [19] R. W. Soeryani, A. Nurrochman, W. Nurwanti, and S. T. Khoirunisa, "Perubahan pH Saliva Sebelum dan Sesudah Mengonsumsi Makanan Kariogenik," vol. 1, no. 2, pp. 31–34, 2020, doi: <https://doi.org/10.36082/qjk.v13i2.88>.
- [20] L. Hakim, N. Afrinis, and Alini, "Hubungan Frekuensi, Waktu Menyikat Gigi dan Kebiasaan Konsumsi Makanan Kariogenik dengan Kejadian Karies Gigi pada Anak Usia Dini di TK Pertiwi Tahun 2022," vol. 4, no. 1, pp. 18–28, 2025.
- [21] Rusnoto, C. B. Romantis, M. Purnomo, and M. Jauhar, "Perilaku Menyikat Gigi dan Konsumsi Makanan Kariogenik Pemicu Karies Gigi pada Anak," vol. 14, no. 2, pp. 518–527, 2023.
- [22] A. A. Tahulending and G. T. Rugo, "Hubungan Pengetahuan Tentang Makanan Kariogenik dengan Indeks DMF-T pada Siswa Kelas VII A SMPN 4 Pineleng Kabupaten Minahasa," vol. 1, no. 1, pp. 36–42, 2018.
- [23] K. S. Dewi, H. A. Koesomah, N. Nurjannah, and D. M. Laut, "Gambaran Tingkat Pengetahuan Kesehatan Gigi dan Mulut di RW 15 Perum Baros Kencana Kota Sukabumi," vol. 2, no. 2, pp. 691–697, 2021.
- [24] A. Yenti, Damhuji, and H. Y. Safitri, "The Relationship between Frequency of Consumption of Cariogenic Foods and DMF-T Index in 12-Year-Old Children of Dental Health , Poltekkes Kemenkes Padang , Padang City , West Sumatra , Indonesia 2 Department of Dental Health , Poltekkes Kemenkes Pontiana," vol. 17, no. 3, pp. 1008–1013, 2023, doi: <https://doi.org/10.33860/jik.v17i3.3395>.

## PHYSICAL ACTIVITY AND DIETARY KNOWLEDGE AMONG ELDERLY WITH HYPERTENSION: A STUDY IN RANGKASBITUNG PHC

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### Abstract

Hypertension is defined as systolic blood pressure >130 mmHg and/or diastolic blood pressure >80 mmHg. Many factors influence the development of hypertension, including genetic factors, age, and gender; physical activity and sodium intake (diet) may also be associated with the occurrence of hypertension. This study aims to determine the relationship between physical activity and dietary knowledge and the incidence of hypertension in the catchment area of the Rangkasbitung Community Health Centre. The study is analytical in nature, employing a cross-sectional research design, wherein the independent variables (physical activity and dietary knowledge) and the dependent variable (hypertension) are examined simultaneously. The study population comprised 33 elderly individuals from Kampung Cileuweung, selected using convenience sampling. Data were collected using a questionnaire. The data analysis used in this study was univariate and bivariate analysis. The results showed a significant association between physical activity ( $p=0.02$ ) and dietary knowledge ( $p=0.017$ ) and the incidence of hypertension in the service area of the Rangkasbitung Community Health Centre. Based on this study, it is hoped that respondents will be able to control their blood pressure by improving their lifestyle through dietary control and regular exercise.

Keywords: Physical activity, Dietary knowledge, Hypertension

### 1. INTRODUCTION

Hypertension or high blood pressure, is a significant global health problem, affecting more than one billion people worldwide[1]. According to data from the World Health Organization (WHO), it is estimated that by 2025, approximately 1.5 billion people will suffer from hypertension, and each year, 9.4 million deaths are caused by hypertension and its complications [1], [2]. In Indonesia, hypertension is also a serious health problem, with prevalence continuing to rise alongside increasing life expectancy and changes in people's lifestyles [3]. The prevalence of hypertension in Banten Province based on physician diagnosis was 9.5% with 27,784 weighted respondents, while based on blood pressure measurement results it was 26.8% with 25,982 weighted respondents [1]. In 2024, the number of hypertensive patients in Banten Province reached 2,352,657 people, with the majority being female, and 88.2% had received health services [2]. Hypertension is often referred to as the 'silent killer' because it frequently shows no clear symptoms until serious complications arise [3]. Complications of hypertension include heart disease, stroke, kidney failure, and damage to other organs [4].

Older adults are a group particularly vulnerable to hypertension. The natural ageing process causes physiological changes in the body, including a reduction in blood vessel elasticity and an increase in peripheral resistance, which contribute to elevated blood pressure [6]. Furthermore, other risk factors such as an unhealthy diet, lack of physical activity, obesity, and stress can also increase the risk of hypertension in older adults[5].

Diet plays a crucial role in blood pressure control. Excessive salt intake is one of the main factors contributing to hypertension, [6] It has been found that older adults with a high salt intake have a higher risk of developing severe hypertension. Furthermore, high intakes of saturated fat and cholesterol can

also increase blood pressure [7]. Conversely, consuming fibre-rich foods, such as fruit and vegetables, can help lower blood pressure,[9] and the Dietary Approaches to Stop Hypertension (DASH) diet is recommended as an effective diet for lowering blood pressure in hypertensive patients. Education on the DASH diet has been shown to effectively improve knowledge of the DASH diet among hypertensive patients [8].

Physical activity is also a key component in managing hypertension. A lack of physical activity can increase the risk of obesity, insulin resistance, and endothelial dysfunction, all of which contribute to elevated blood pressure [9]. Regular physical activity can help lower blood pressure, improve lipid profiles, and enhance insulin sensitivity [10]. Furthermore, physical activity can help reduce stress, which may also contribute to elevated blood pressure. Anti-stroke exercise has also been shown to lower blood pressure in older adults [11].

Knowledge regarding diet and physical activity is crucial for older adults with hypertension. Good knowledge can help older adults make healthy food choices and increase their participation in physical activity [12]. [13] found that there is a link between knowledge and older adults' behaviour in managing hypertension. Furthermore, social support from family and healthcare professionals can also improve older adults' adherence to diet and physical activity [14].

Data from the Lebak District Health Office in 2024, covering 43 Community Health Centres (Puskesmas) with a total of 959,038 patients with hypertension, showed that the total number of visits was only 179,050. At the Rangkasbitung Community Health Centre (PKM), there were 68,016 people with hypertension, whilst the number of hypertensive patients attending in 2024 was only 12,377. The low participation of hypertensive patients in seeking medical check-ups is an issue that must be addressed immediately, and this suggests that there may still be many elderly individuals who lack adequate knowledge regarding the appropriate diet and physical activity required to manage hypertension [12].

In relation to this, untreated hypertension can cause various complications affecting the cardiovascular, nervous, and renal systems. This condition can accelerate atherosclerosis, increase left ventricular workload, and lead to left ventricular hypertrophy, which increases the risk of coronary heart disease, arrhythmias, and heart failure [15]. Furthermore, these complications indicate that hypertension is a serious disease that not only increases mortality rates but also reduces patients' quality of life both physically and psychologically[16].

The promotive role of nurses is needed to address the rising incidence of hypertension by providing education on hypertension management, such as low-sodium diets and hypertension exercise through counseling methods [17].

In cases of hypertension, in addition to medical treatment, preventive efforts can be made through lifestyle modifications, including reducing salt intake, maintaining a healthy diet, exercising regularly, avoiding stress, quitting smoking, and limiting caffeine and alcohol consumption. In addition, complementary therapies such as boiled celery leaf decoction can be used because it contains hexane, methanol, and ethanol compounds that have antihypertensive effects and help lower blood pressure in hypertensive patients [18].

Nurses can perform curative efforts by routinely monitoring blood pressure, administering and supervising the use of antihypertensive and cardiac medications according to therapy, observing signs and symptoms of complications such as shortness of breath, chest pain, dizziness, or edema, and collaborating with physicians for further management. In addition, efforts to prevent sudden death can be made by strengthening case management and emergency response at various levels of health care involving health workers and related organizations [19].

Rehabilitative nursing interventions for hypertensive patients can be carried out through education on routine check-ups, light physical activity training, low-sodium dietary management, monitoring medication adherence, and supporting patients to perform self-care at home. Furthermore, non-pharmacological therapies such as warm foot baths and foot massage can also help lower blood pressure, improve blood circulation, and reduce complaints of dizziness and headache [20].

## 2. METHODOLOGY

This study employed a quantitative approach using a cross-sectional study design. The cross-sectional design was chosen as it allowed the researchers to collect data in which the independent

variables (physical activity and dietary knowledge) and the dependent variable (hypertension) among older adults were examined simultaneously. The study was conducted in Kampung Cileuweung, a village under the jurisdiction of the Rangkasbitung Community Health Centre. The study was carried out in November 2025. The population in this study comprised all elderly residents in Kampung Cileuweung, totalling 33 elderly individuals, using convenience sampling. Data analysis employed univariate and bivariate analysis. Once the data had been collected, it was analysed using SPSS 22. Bivariate analysis utilised the Chi-Square test.

### 3. RESULTS

This study was conducted in November 2025, within the working area of the Rangkasbitung Community Health Centre, with a sample size of 33. The data in the study included physical activity and dietary knowledge (independent variables) and the incidence of hypertension (dependent variable). The results of the data collection are presented as follows:

#### 3.1 Univariate Analysis

##### 3.1.1 Respondent Characteristics

**Table 3.1** Frequency Distribution of Gender, Age, and Education

Characteristics	Frequency	Percentage (%)
<b>Gender</b>		
Male	8	24,2
Female	25	75,8
<b>Total</b>	<b>33</b>	<b>100,0</b>
<b>Age</b>		
>75 Years	3	9,1
71-75 Years	4	12,1
66-70 Years	4	12,1
60-65 Years	22	66,7
<b>Total</b>	<b>33</b>	<b>100,0</b>
<b>Education</b>		
Did not complete primary school	3	9,1
Primary school	25	75,8
Lower Secondary	1	3
Upper Secondary School/Vocational School	4	12,1
<b>Total</b>	<b>33</b>	<b>100</b>

According to Table 3.1, the majority of respondents were female, numbering 25 (75.8%); the majority were aged 60–65, numbering 22 (66.7%); and the majority had completed primary school, numbering 25 (75.8%).

##### 3.1.2 Physical activity

**Tabel 3.2** Frequency distribution of respondents based on physical activity, knowledge and blood pressure among older adults with hypertension.

Physical Activity	Frequency	Percentage (%)
Poor	21	63,7 %
Good	12	36,3 %
<b>Total</b>	<b>33</b>	<b>100 %</b>
<b>Dietary Knowledge</b>		
Poor	19	57,6 %
Good	14	42,4 %
<b>Total</b>	<b>33</b>	<b>100 %</b>
<b>Blood Pressure</b>		
Hypertension	23	69,7 %
Non-hypertension	10	30,3 %
<b>Total</b>	<b>33</b>	<b>100 %</b>

Table 3.2 shows the distribution of respondents according to physical activity; of the 33 respondents, 21 (63.7%) fell into the 'poor physical activity' category, regarding knowledge of the hypertension diet, out of 33 respondents, 19 (57.6%) fell into the 'poor knowledge' category; and regarding blood pressure, out of 33 respondents, 23 (69.7%) were found to have hypertension.

### 3.2 Bivariate Analysis

Bivariate analysis will be used to determine the relationship between the independent variables (physical activity and dietary knowledge) and the dependent variable (hypertension). The statistical test to be used is the Chi-Square test, as the variables under investigation are on a nominal and ordinal scale. The statistical test used is the Chi-Square test, whereby the Chi-Square test can only be used to determine whether or not there is a relationship between two variables; a decision is made that if the  $p$  value  $\leq \alpha$  (0.05), then there is a relationship between the two variables.

#### 3.2.1 The relationship between physical activity and the incidence of hypertension

**Tabel 3.3** Relationship Between Physical Activity and the Incidence of Hypertension in the Rangkasbitung Community Health Centre (PKM) Service Area

Physical activity	Incidence of Hypertension				TOTAL	%	P Value	OR (95% CI)
	Hypertension		Non Hypertension					
	N	%	N	%				
Tidak Baik	17	51,5	4	12,1	21	100	0,02	0,05
Baik	6	18,2	6	18,2	12			
<b>Total</b>	<b>23</b>	<b>69,7</b>	<b>10</b>	<b>30,3</b>	<b>33</b>			

Based on Table 3.3, it can be seen that of the 21 respondents with poor physical activity levels, 17 (51.5%) had hypertension, whilst of the 12 respondents with good physical activity levels, 6 (18.2%) had hypertension.

#### 3.2.2 The relationship between dietary knowledge and the incidence of hypertension.

**Tabel 3.4** The Relationship Between Dietary Knowledge and the Incidence of Hypertension in the Rangkasbitung Community Health Centre (PKM) Service Area..

Dietary Knowledge	Incidence of Hypertension				TOTAL	%	P Value	OR (95% CI)
	Hypertension		Non Hypertension					
	N	%	N	%				
Poor	12	36,4	7	21,2	19	100	0,017	0,05
Good	11	33,3	3	9,1	14			
<b>Total</b>	<b>23</b>	<b>69,7</b>	<b>10</b>	<b>30,3</b>	<b>33</b>			

Table 3.4 shows that of the 19 respondents with poor knowledge of the hypertension diet, 12 (36.4%) had hypertension, whilst 14 respondents had good knowledge of the hypertension diet, and 11 (33.3%) had hypertension.

### 3.3 Discussion

This study aims to analyse the relationship between physical activity and dietary knowledge among older adults with hypertension. Hypertension itself is a serious global health problem, with prevalence figures continuing to rise; it is estimated to affect 1.5 billion people by 2025 [21]. This condition is often referred to as the 'silent killer' because it frequently shows no symptoms until it leads to serious complications such as heart disease, stroke, and kidney failure[22].

Based on the findings of this study, physical activity is significantly associated with the incidence of hypertension in older adults. These results are consistent with a study [23] which demonstrated an association between physical activity/exercise and the incidence of hypertension ( $p$ -value = 0.001). Older adults who are physically inactive tend to have a higher risk of developing hypertension. This is supported by study [24] which states that a lack of physical activity is one of the factors influencing blood pressure in older adults. Regular physical activity, such as Prolanis exercises, has been shown to be effective in lowering blood pressure in people with hypertension [25].

In addition to physical activity, dietary knowledge also shows a strong association with the management of hypertension in older adults. A good level of knowledge about healthy diets, particularly low-salt diets, is crucial for controlling blood pressure. Research by [26] confirms that knowledge has a significant association with the incidence of hypertension. Older adults with poor dietary knowledge often consume high-salt foods, which directly contribute to increased blood pressure [27]. A low-salt diet and the DASH (Dietary Approaches to Stop Hypertension) diet have been shown to be effective in lowering blood pressure in patients with hypertension [8].

Other findings indicate that the majority of older adults in this study had a reasonable level of knowledge regarding diet and physical activity, yet the extent to which this knowledge is put into practice in their daily lives varies. This indicates a gap between knowledge and practice. Adherence to diet and physical activity is a key component of self-management of hypertension [26]. Ongoing education and support are required to translate knowledge into consistent behaviour [28].

### 3.4 Comparison with Previous Theories and Research.

The results of this study are consistent with various theories and previous research on risk factors and the management of hypertension in older adults. The Health Belief Model (HBM) theory emphasizes that perception. The findings of this study are consistent with various theories and previous research on risk factors and the management of hypertension in older adults. The Health Belief Model (HBM) emphasises that individuals' perceptions of the threat of disease and the benefits of preventive measures will influence their health behaviours [29]. In this context, older adults who understand the risks of hypertension and the benefits of physical activity and a healthy diet are more likely to adopt

such behaviours. However, the HBM also indicates that implementation in practice remains rare, suggesting a need for more effective educational strategies [9].

Previous research has consistently shown that physical activity is one of the key pillars in the prevention and management of hypertension. A lack of physical activity is a significant risk factor [23]. Physical activity recommendations for older adults with hypertension often include regular light to moderate exercise, such as prolans exercises, which have been shown to lower blood pressure [25]. Indeed, physical activity can help improve the overall quality of life for older adults [30].

Similarly, the importance of dietary knowledge in the management of hypertension has been well documented. High salt intake is directly linked to the incidence of hypertension [6]. A study by [31] specifically compared the effectiveness of a low-salt diet and the DASH diet, showing that both were effective in lowering blood pressure, with the DASH diet demonstrating a more significant reduction in diastolic blood pressure. This underscores the importance of education regarding the appropriate type of diet, rather than merely restricting salt intake.

Research on knowledge also indicates a strong association with treatment adherence and attitudes towards the prevention of complications. For example, [32] found a significant association between knowledge levels and medication adherence in patients with hypertension. Similarly, [3] found a very strong association between knowledge of hypertension and attitudes towards the prevention of complications. [33] also found an association between the knowledge of hypertensive patients and their use of the Integrated Health Promotion Post (POSBINDU) for non-communicable diseases (NCDs), which is a vital tool for education and early detection.

Overall, the findings of this study are consistent with the existing literature, reinforcing the argument that physical activity and dietary knowledge are two crucial components in the management of hypertension in the elderly population. However, this study also highlights the need to bridge the gap between knowledge and practice, given that knowledge alone does not always guarantee behavioural change [9].

### 3.5 Factors Influencing the Relationship

The relationship between physical activity, dietary knowledge and hypertension in older adults is highly complex and influenced by various factors. Firstly, educational attainment is often correlated with levels of health knowledge. Older adults with higher levels of education tend to have better access to information and a deeper understanding of the importance of a healthy lifestyle, including physical activity and diet [34]. Nevertheless, research [22] indicates that respondents' educational levels do not always show a significant association with the incidence of hypertension, which may suggest that access to information alone is insufficient without motivation and supportive facilities.

Secondly, support from family and the social environment plays a crucial role. Older adults who receive emotional and practical support from their families tend to be more compliant with recommended diets and physical activity [35]. Although [36] found no significant association between family emotional support and dietary compliance among older adults, these findings may have been influenced by the specific context of that study and should be interpreted with caution. In general, social support, whether from family or the community (for example, through the PROLANIS or POSBINDU programmes), can increase older adults' participation in health programmes and adherence to a healthy lifestyle [37].

Thirdly, the general health status of older adults, such as the presence of other comorbidities (e.g. diabetes mellitus or dyslipidaemia), can affect their ability and motivation to engage in physical activity and follow specific diets [38]. Declining organ function due to ageing can also be a barrier [39]. Furthermore, psychological factors such as stress can also contribute to the development of hypertension and affect motivation to adopt healthy behaviours [22].

Fourthly, access to healthcare facilities and information is crucial. The availability of community health centres, health posts and health education programmes (such as those run by community health workers) can improve knowledge and help older people adopt a healthy lifestyle [40]. Access to dietitians for dietary counselling is also important so that patients can better understand the dietary requirements for managing hypertension [7].

Fifthly, diet and overall lifestyle have a significant impact on this relationship. In addition to salt intake, other dietary factors such as animal protein, cholesterol, saturated fatty acids, and fibre, as well

as central obesity, also have a significant association with hypertension [41]. Smoking and alcohol consumption are also established risk factors [22]. Therefore, a holistic approach that takes into account all aspects of lifestyle is necessary for effective hypertension management.

### 3.6 Limitations of the Study

Although this study provides insights into the relationship between physical activity and dietary knowledge among older adults with hypertension, there are several limitations that need to be acknowledged. Firstly, the study design used—such as the cross-sectional design employed in several reference studies [32],—can only demonstrate an association or correlation, rather than a cause-and-effect relationship. To establish causality, more rigorous longitudinal or experimental studies are required.

Secondly, data on physical activity and dietary knowledge are largely obtained through questionnaires or interviews. These methods are susceptible to recall bias and social desirability bias, whereby respondents may answer in line with what they perceive to be expected, rather than the reality. More objective measures of physical activity, such as the use of accelerometers, or more detailed dietary assessments, such as food diaries over several days, can provide more accurate data.

Thirdly, the sample sizes in some of the reference studies are relatively small (for example, 51 respondents in [42]; 30 respondents in [33]), which may limit the generalisability of the results to the wider elderly population. Demographic, socio economic and cultural variations amongst the elderly population may also influence the findings, and these studies may not fully capture such diversity..

Fourthly, this study did not specifically measure the intensity and type of physical activity in detail, which may have influenced its effectiveness in relation to blood pressure. Some studies simply categorise activities as 'physical activity' in general, even though the type and duration of the activity are highly significant [25].

Fifthly, other factors known to influence hypertension, such as family history, stress, smoking habits, alcohol consumption, and comorbidities, may not have been fully controlled for or considered in depth in the analysis of the relationship between physical activity and diet [22]. These limitations may affect the interpretation of the relationships found.

Finally, the concept of 'dietary knowledge' can be very broad. This study may not have specifically explored the depth of older adults' understanding of the DASH dietary recommendations, the importance of certain macronutrients and micronutrients, or their ability to put that knowledge into practice in the context of daily life, which may be limited by economic or cultural factors [31].

### 3.7 Implications of the Research Findings

The findings of this study have significant implications for healthcare practitioners, policymakers and families in efforts to manage hypertension in older adults. Firstly, the clinical implications suggest that interventions focusing on increasing physical activity and dietary education should be a priority in the management of hypertension in older adults. Healthcare workers, particularly geriatric nurses, need to proactively identify older adults with low levels of physical activity and inadequate dietary knowledge. Programmes such as Prolanis exercise should be promoted and widely publicised in community health centres and health posts [25]. Structured and easily understandable nutritional counselling, with an emphasis on a low-salt diet and the DASH diet, should be provided individually or in groups [31].

Secondly, implications for education and further research. The curricula for nursing and other health professions need to strengthen content on geriatric nursing, particularly in the management of chronic conditions such as hypertension, with a focus on non-pharmacological aspects such as physical activity and diet. Future research could employ longitudinal or intervention designs to test the effectiveness of health education and promotion programmes in greater depth. Furthermore, qualitative research could explore the barriers and facilitators for older adults in adopting a healthy lifestyle, as well as the role of family and community support in more detail [36]

Thirdly, the implications for families and communities. Families play a central role in supporting older people to lead a healthy lifestyle. Education is aimed not only at older people with hypertension, but also at their family members so that they can provide emotional and practical support, such as preparing healthy meals or accompanying them whilst exercising [36]. Communities can form peer support groups or facilitate elderly friendly physical activities, thereby creating an environment

conducive to the health of older adults. Raising public awareness of this 'silent killer' is also important so that early detection and prevention can be carried out sooner [22].

#### 4. CONCLUSION

Based on the results of the study and discussion, it can be concluded that there is a relationship between physical activity and dietary knowledge and the incidence of hypertension in the catchment area of the Rangkasbitung Community Health Centre.

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#### REFERENCES

- [1] F. Riyada, S. A. Fauziah, N. Liana, and D. Hasni, "Faktor yang Mempengaruhi Terjadinya Resiko Hipertensi pada Lansia," *Scientific Journal*, vol. III, pp. 27–47, 2024, [Online]. Available: <http://journal.scientic.id/index.php/sciena/issue/view/17>
- [2] N. Sumarni, U. Rosidin, D. Purnama, I. Shalahudin, and W. Witdiawati, "Pentingnya Diet Hipertensi pada Lansia Hipertensi di Rw 05 Ciwalen Garut," *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, vol. 7, no. 5, pp. 2330–2345, Apr. 2024, doi: 10.33024/jkpm.v7i5.14648.
- [3] A. T. Zethira et al., "Hypertension As A Silent Killer Disease: Education For At-Risk Communities In Pekuwon Village," *Jurnal Layanan Masyarakat (Journal of Public Services)*, vol. 8, no. 2, pp. 200–209, Jun. 2024, doi: 10.20473/jlm.v8i2.2024.200-209.
- [4] Afina Muharani Syaftriani, Dedi Dedi, and Febrina Febrina, "Hubungan Kepatuhan Minum Obat terhadap Penggunaan Terapi Komplementer pada Pasien Hipertensi di Rumah Sakit Umum Mitra Medika Amplas Medan," *NAJ : Nursing Applied Journal*, vol. 3, no. 3, pp. 42–55, Jul. 2025, doi: 10.57213/naj.v3i3.802.
- [5] K. Delvia Riska Pratiwi et al., "Studi Literatur: Hubungan Aktivitas Fisik dengan Kejadian Hipertensi pada Lansia Literature Study: The Relationship Between Physical Activity and Hypertension in the Elderly Artikel Review," *J Jurnal Kolaboratif Sains*, vol. 8, no. 12, pp. 8402–8412, 2025, doi: 10.56338/jks.v8i12.9634.
- [6] A. Novita Vlandari, P. Studi Ilmu Keperawatan, and S. Dian Husada Mojokerto, "Pemberian Konsumsi Air Kelapa Muda Terhadap Perubahan Tekanan Darah Tinggi Pada Lansia," *Jurnal Keperawatan*, pp. 173–185, 2025.
- [7] R. Asna Oktavia, T. S. Handayani, S. Yulianti, and U. Dehasen Bengkulu, "Hubungan Pola Makan Dan Status Gizi Terhadap Kejadian Hipertensi Pada Lansia Di Wilayah Kerja Puskesmas Surulangun Tahun 2023 The Relationship Between Dietary Patterns And Nutritional Status On The Incidence Of Hypertension In Elderly People In The Working Area Of The Surulangun Community Health Center In 2023," 2026.
- [8] D. Retnaningsih and R. Amalia, "Penerapan Mengonsumsi Air Rebusan Daun Sirsak Terhadap Penurunan Kadar Asam Urat Pada Lansia: Case Study," *Jurnal Manajemen Asuhan Keperawatan*, vol. 6, no. 2, pp. 1–5, 2022.
- [9] H. F. Sakr, S. R. Sirasanagandla, S. Das, A. I. Bima, and A. Z. Elsamanoudy, "Insulin Resistance and Hypertension: Mechanisms Involved and Modifying Factors for Effective Glucose Control," Aug. 01, 2023, Multidisciplinary Digital Publishing Institute (MDPI). doi: 10.3390/biomedicines11082271.
- [10] K. Madan and J. P. S. Sawhney, "Exercise and lipids," Mar. 01, 2024, Elsevier B.V. doi: 10.1016/j.ihj.2023.11.270.

- [11] U. A. Sukrillah, S. Mulidah, A. Asrin, and M. Munjiati, "Edukasi dan Pelatihan Senam Anti Stroke untuk Masyarakat dengan Hipertensi," *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, vol. 7, no. 6, pp. 2427–2438, Jun. 2024, doi: 10.33024/jkpm.v7i6.14305.
- [12] M. F. Farhani, M. Maryoto, and T. Sumarni, "Upaya Peningkatan Pengetahuan tentang Diet Hipertensi pada Lansia," *Kolaborasi: Jurnal Pengabdian Masyarakat*, vol. 5, no. 6, pp. 947–952, Oct. 2025, doi: 10.56359/kolaborasi.v5i6.712.
- [13] M. Masyudi, "Faktor yang berhubungan dengan perilaku lansia dalam mengendalikan hipertensi," *AcTion: Aceh Nutrition Journal*, vol. 3, no. 1, p. 57, Jul. 2018, doi: 10.30867/action.v3i1.100.
- [14] B. Kaneshia Siregar, N. Ainul Shifa, and A. Info, "The Relationship between Family Support and Hypertension Diet Compliance in the Elderly at the Al Fatima Elderly Posbindu, Cibeber Community Health Center, Cianjur in 2025," *JICN: Jurnal Intelek dan Cendekiawan Nusantara*, vol. 3, pp. 1424–1436, 2025, [Online]. Available: <https://jicnusantara.com/index.php/jicn>
- [15] N. Hadi Purwanto, P. Studi Ilmu Keperawatan, S. Dian Husada Mojokerto, and S. Tinggi Ilmu Kesehatan Husada Jombang, "MENURUNKAN KELUHAN NYERI KEPALA PADA LANJUT USIA DENGAN HIPERTENSI MENGGUNAKAN KOMPRES HANGAT."
- [16] A. Novita Vlandari, P. Studi Ilmu Keperawatan, and S. Dian Husada Mojokerto, "PEMBERIAN KONSUMSI AIR KELAPA MUDA TERHADAP PERUBAHAN TEKANAN DARAH TINGGI PADA LANSIA," 2025.
- [17] F. Yestelda Rebokh, R. Eva Rayanti, and catherine Natawirrarindy, "Hubungan Perawat Edukator, Manajemen Hipertensi Dan Usia Pada Lansia," *Kendal*, Jun. 2024. [Online]. Available: <http://journal.stikeskendal.ac.id/index.php/Keperawatan>
- [18] R. Ferdi, Sartika Tri Citra Rianita, and Sari Aulia Finka, "Edukasi Penerapan Air Rebusan Seledri Terhadap Manajemen Nyeri Pasien Lansia Dengan Hipertensi," *Lentera Perawat*, vol. 3, no. 2, pp. 51–58, 2022.
- [19] T. Aniamarta, A. Salsabilla Huda, and F. Lizariani Aqsha, "Causes and Treatments of Heart Attack," *BIOLOGICA SAMUDRA*, vol. 4, no. 1, pp. 22–31, Jul. 2022, doi: 10.33059/jbs.v4i1.3925.
- [20] E. Yuswatiningsih, E. Ekayamti, D. Lukitaningtyas, H. Daris Sa, and R. Nisak, "Edukasi Kesehatan Sebagai Upaya Peningkatan Manajemen Diri Pasien Hipertensi Di Puskesmas Kasreman Kabupaten Ngawi," *Jurnal Pengabdian Kepada Masyarakat Bidang Ilmu Keperawatan Optimal |*, vol. 3, no. 1, pp. 47–55, 2026.
- [21] V. Astuti, P. Studi Keperawatan, and F. Ilmu Kesehatan, "Pengetahuan dengan Sikap Kepatuhan Lansia Menjalankan Diet Hipertensi Knowledge and Compliance with a Hypertension Diet Among Elderly Patients," *Jurnak Keperawatan Profesional*, vol. 6, no. 2, pp. 367–375, Nov. 2025, doi: 10.36590/kepo.v6i2.1630.
- [22] T. Yahya Christina, *Keperawatan Komunitas, Keluarga dan Gerontik*. Cilacap: PT MEDIA PUSTAKA INDO, 2025. [Online]. Available: [www.mediapustakaindo.com](http://www.mediapustakaindo.com)
- [23] N. Putu, A. I. Eliani, L. Gede, S. Yenny, N. Made, and H. Sukmawati, "Aktivitas Fisik Sehari-hari Berhubungan dengan Derajat Hipertensi pada Pra Lansia dan Lansia di Wilayah Kerja Puskesmas I Denpasar Timur," *Aesculapius Medical Journal |*, vol. 2, no. 3, pp. 188–194, 2022.
- [24] M. Manungkalit, N. Novita Sari, N. Andi Puput Novita, F. Keperawatan Universitas Katolik Widya Mandala Surabaya, and M. Fakultas Keperawatan Universitas Katolik Widya Mandala Surabaya, "Pengaruh Aktivitas Fisik Terhadap Tekanan Darah Pada Lansia Dengan Hipertensi," *Jurnal Penelitian Kesehatan*, vol. 14, pp. 1–8, Jun. 2024.
- [25] M. Meisyaroh Syamson, N. Fitri, P. Studi Ilmu Keperawatan Stikes Muhammadiyah Sidrap, S. Rappang, and S. Selatan, "Pengaruh senam prolanis terhadap penurunan tekanan darah pada penderita hipertensi," *Holistik Jurnal Kesehatan*, vol. 14, no. 1, pp. 74–81, 2020.

- [26] L. A. Wijayanti, R. Indriani, G. A. Salomon, R. Asrina, M. P. Nur, and S. Suprpto, "Knowledge and Attitudes With the Incidence of Hypertension," *Jurnal Ilmiah Kesehatan (JIKA)*, vol. 5, no. 2, Aug. 2023, doi: 10.36590/jika.v5i2.512.
- [27] H. Haron, N. A. F. Kamal, H. M. Yahya, and S. Shahar, "Knowledge, Attitude and Practice (KAP) of Malay Elderly on Salt Intake and Its Relationship With Blood Pressure," *Front. Public Health*, vol. 8, Feb. 2021, doi: 10.3389/fpubh.2020.559071.
- [28] V. Surani, Lilik Pranata, Teresia Erina Sestiyowati, Dini Anggraini, and Sindi Ernawati, "Relationship between Family Support and Self-Care in Hypertension Patients," *Formosa Journal of Multidisciplinary Research*, vol. 1, no. 7, pp. 1447–1458, Nov. 2022, doi: 10.55927/fjmr.v1i7.1784.
- [29] S. N. Alkhoiriyah, E. Safariyah, and H. Hadiyanto, "The Effect of Health Education Based on the Health Belief Model (HBM) Approach on Increasing Motivation to Take Medication in Pulmonary TB Patients in Sindangsari Village," *Jurnal Pengabdian Ilmu Kesehatan*, vol. 6, no. 1, 2026, doi: 10.55606/jpikes.v6i1.6667.
- [30] N. Hasanah et al., "Latihan Fisik Pada Kelompok Lansia Di Puskesmas Mulyoharjo Pematang," *Calory Journal : Medical Laboratory Journal*, vol. 1, no. 4, 2023.
- [31] V. N. Tejani et al., "The Relationship Between Dietary Fiber Intake and Blood Pressure Worldwide: A Systematic Review," *Cureus*, Sep. 2023, doi: 10.7759/cureus.46116.
- [32] N. Indriana, M. Tri Kumala Swandari, and Y. Pertiwi, "Hubungan Tingkat Pengetahuan Dengan Kepatuhan Minum Obat Pada Pasien Hipertensi Di Rumah Sakit X Cilacap," *Journal of Pharmacy UMUS*, vol. 2, no. 01, pp. 1–10, 2020.
- [33] D. Z. Fuadah and N. F. Rahayu, "Pemanfaatan POS Pembinaan Terpadu (POSBINDU) Penyakit tidak Menular (PTM) pada Penderita Hipertensi," *Jurnal Ners dan Kebidanan (Journal of Ners and Midwifery)*, vol. 5, no. 1, pp. 020–028, Apr. 2018, doi: 10.26699/jnk.v5i1.art.p020-028.
- [34] T. Qin, P. Wei, and Y. Xie, "Does education level affect the health status of the elderly? The chain mediating effect of internet use, health behavior and social class identity," *PLoS One*, vol. 20, no. 2 February, Feb. 2025, doi: 10.1371/journal.pone.0319389.
- [35] S. Redjeki, W. Ahli Muda, and P. Kesos, "Dukungan Keluarga bagi Kesejahteraan Sosial Lanjut Usia," *Jurnal PUSDIKLAT KESOS*, vol. 18, pp. 87–97, Nov. 2021.
- [36] D. Rahmatika, "The Correlation Of Emotional Support And Elderly Diet Compliance With Hypertension," *The Indonesian Journal of Public Health*, vol. 14, pp. 252–262, May 2019, doi: 10.20473/ijph.v14i1.2019.252-262.
- [37] D. Rasyid et al., "Pengaruh Dukungan Sosial terhadap Kepatuhan Lansia dalam Mengikuti Program Posyandu Lansia," *Barongko Jurnal Ilmu Kesehatan*, vol. 3, pp. 1059–1070, Jul. 2025.
- [38] Y. Huang, Z. Sun, J. Lan, and Y. Wen, "Association rule analysis of physical activity and multimorbidity in middle-aged Korean adults with diabetes: an evidence to promote active lifestyles," *BMC Public Health*, vol. 26, no. 1, Dec. 2026, doi: 10.1186/s12889-026-26603-1.
- [39] A. R. Mutnawasitoh and D. Mirawati, "Program Pengembangan Ligabel (Lansia Jaga Balance) Tahap Edukasi dan Screening Resiko Jatuh Lansia di Surakarta," 2024. [Online]. Available: <https://dmi-journals.org/jai/>
- [40] H. Ulfah et al., "Efektivitas Program Pos Pembinaan Terpadu (POSBINDU) Di Desa Murung Jambu Kecamatan Paringin Selatan Kabupaten Balangan," *Al Lidra Balad Jurnal Administrasi Negara*, vol. 7, pp. 918–931, 2026.
- [41] S. J. Dicken and R. L. Batterham, "The role of diet quality in mediating the association between ultra-processed food intake, obesity and health-related outcomes: A review of prospective cohort studies," Jan. 01, 2022, MDPI. doi: 10.3390/nu14010023.

- [42] J. Purwono et al., "Pola Konsumsi Garam Dengan Kejadian Hipertensi Pada Lansia Salt Consumption Pattern With Hypertension In Elderly," *Jurnal Wacana Kesehatan*, vol. 5, no. 1, 2020.

## THE RELATIONSHIP BETWEEN THE ROLE OF POSYANDU CADRES AND THE COMPLETENESS OF BASIC IMMUNIZATION IN INFANTS AGED 12-24 MONTHS IN SAMARINDA CITY

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### Abstract

**Background:** Immunization is a crucial component of primary health care and plays a significant role in reducing infant mortality. According to the WHO, Indonesia's coverage of 194 countries with complete basic immunization coverage is 86.6%, a low level compared to the global target of 90%. Based on data obtained at the Youth Health Center UPTD: 2024:HB0 50.70%, BCG 50.83%, DPT HiB3 29.06%, POLIO4 45.52%, PCV2 19.2%, IPV 49.59%, MR 47.7%, IDL 33.73%. **Objective:** To know The Relationship between the Role of Posyandu Cadres and the Completeness of Basic Immunization for Infants Aged 12-24 Months at the Youth Health Center UPTD, Sungai Pinang District. **Research methods:** This type of research is quantitative with a correlational analytical design with a Cross sectional approach. The sampling technique is Consecutive sampling. The population of this study were all mothers who had babies aged 12-24 months who were at the Tantina Posyandu, totaling 51 mothers. Bivariate analysis used was the chi square test. **Results of the study:** The results of the chi square test obtained a p value = 0.000 where the p value was smaller than 0.05. This shows that there is a relationship between the role of posyandu cadres and the completeness of basic immunization in infants aged 12-18 months at the Youth Health Center UPTD. Further analysis shows an OR value = 16.571, this means that the positive role of cadres has a 16-fold chance of implementing the completeness of basic immunization. **Conclusion:** The results of the study show that there is a relationship between the role of posyandu cadres and the completeness of basic immunization in infants aged 12-24 months at the Youth Health Center UPTD, Sungai Pinang District.

**Keywords:** Role of Cadres, Completeness of Immunization

### 1. INTRODUCTION

Immunization is an important component in Primary health care plays a significant role in reducing infant mortality. Immunization has been proven to be an efficient and effective health measure in preventing and reducing morbidity, disability, and mortality due to PD3I.

Data from the World Health Organization (WHO) in 2020 stated that Indonesia was ranked number 3 (three) in the world with babies who had not received immunization with a total of 1.7 million babies who had not received immunization, which made global immunization coverage remain at 86%, so it did not show any significant changes in the last few years. In 2021 there were approximately 20 million children who did not receive complete basic immunization, some even did not receive any immunization at all. According to the World Health Organization, from 194 countries, the achievement of complete basic immunization in Indonesia was 86.6%, meaning that Indonesia is a country with low achievement of complete basic immunization and below the target where the global immunization target coverage is 90% (IDAI, 2020) in (Soumokil, 2024). According to WHO, 4.5 million deaths out of 19.5 million per year occur due to infectious diseases that can be prevented by immunization. Based on data from Indonesia, the coverage of complete basic immunization in infants in 2020 was 86.54%, and the achievement in 2021 was 91.58%, while in 2022 it was 91.12%, which is an important component in primary health

services and plays a major role in reducing infant mortality. Immunization has been proven to be an efficient and effective health effort in preventing and reducing morbidity, disability, and death due to PD3I, Some of these diseases include tuberculosis (TB), polio, diphtheria, tetanus, hepatitis B, pertussis, measles, rubella, pneumonia and meningitis.

In Indonesia, every baby (under 12 months old) is required to receive complete basic immunization consisting of 1 dose of Hepatitis B, 1 dose of Bacillus Calmette-Guerin (BCG), 1 dose of diphtheria/pertussis/tetanus-hepatitis B- Haemophilus influenzae type B (DPT-HB-HiB), 1 dose of oral poliovirus vaccine (OPV), and 1 dose of measles/measles-rubella (MR). The coverage of complete basic immunization in Indonesia in 2018 was (90.61%), still slightly below the 2018 Renstra target of 92.5% (Felicia, 2020).

Based on data obtained at the UPTD Youth Health Center, Sungai Pinang District, it was found that immunization coverage in 2022 was quite low, namely as follows: HB0 60.2%, BCG 73.2%, DPT HiB3 73.2%, POLIO4 68%, PCV2 1.6%, IPV 56.4%, MR 66.9%, IDL 54.2%. Meanwhile, UCI villages are 8 villages out of 31 villages or 25.8%. Meanwhile, the immunization coverage in 2023 also did not reach the target as follows: HB0 70%, BCG 80.2%, DPT HiB3 40.5%, POLIO4 42.1%, PCV2 19.2%, IPV 40.0%, MR 44.6%, IDL 35.3%. and in 2024 as follows: HB0 50.70%, BCG 50.83%, DPT HiB3 29.06%, POLIO4 45.52%, PCV2 19.2%, IPV 49.59%, MR 47.7%, IDL 33.73%

Several factors related to the completeness of basic immunization include several things, namely knowledge, work, experience, motivation, family support, integrated health post facilities, environment, attitude, health workers, income, education and the role of cadres.(Adirinarso, 2023)If any of these factors are not addressed, children will not be fully immunized, which can increase child mortality. They also face a high risk of contracting several diseases that can be prevented by immunization, such as measles, DPT, BCG polio, and hepatitis. If children are not routinely given complete basic immunizations, this can not only slow their growth but also cause brain disorders (Soumokil, 2024).

The impact of a baby not receiving complete immunizations is the emergence of morbidity and mortality due to tuberculosis, poliomyelitis, measles, hepatitis B, diphtheria, pertussis, and neonatal tetanus, even though these diseases can be prevented by immunization. To address the problem of the lack of parents bringing their children for immunization and the impact on children, one step is to optimize the role of cadres (Didah, 2020).

Posyandu is a basic health activity organized from, by and for the community assisted by health workers in a Community Health Center work area, where this program can be implemented in hamlet halls, sub-district halls, or other places that are easily accessible to the community (Sasmita et al., 2023). The 2018 Basic Health Research results showed that 17.7% of infants under 5 years of age (toddlers) still experienced nutritional problems. This figure consisted of 3.9 percent of toddlers suffering from malnutrition and 13.8 percent suffering from undernutrition (Sasmita et al., 2023).

The role of cadres is crucial to the implementation of the integrated health service post (Posyandu) program. If cadres are inactive, the implementation of the Posyandu will also be hampered, resulting in unclear nutritional detection in children. Cadres also play a crucial role in child growth and development and maternal health, as they are the primary source of health information for the community. Cadres are responsible for implementing the programs established by the Posyandu, and they possess greater knowledge than other members of the community (Didah, 2020).

Infant health post (Posyandu) cadres are a key driver of development, particularly in the health sector. According to Mardiaty in (Oruh, 2019), they are independently involved by the community health center (Puskesmas) in village health service activities, one of which is immunization. Without them, village health service activities would be meaningless. Posyandu cadres should be able to manage the Posyandu, as they are the ones who best understand the community in their area. Cadres are tasked with providing outreach at the Posyandu, including providing information to infants and toddlers about the immunization schedule and its benefits (Oruh, 2021). In addition, the role of community cadres is to help identify community problems and needs, help develop community capacity, encourage and convince decision-makers to truly listen, consider, and be sensitive to community needs, and assist in gaining access to various necessary services. However, what community cadres currently do is only provide education regarding the immunization schedule (Oruh, 2021).

Based on the results of a preliminary survey conducted by researchers at the Youth Health Center UPTD in Sungai Pinang District, it was found that Posyandu cadres were appointed and appointed by the Village Head and given incentives from the village government through the Village Revenue and Expenditure Budget, the amount of which varies depending on each village. The role of cadres who were expected to help complete immunizations, in fact, had a less than optimal role. This was caused by several factors including a lack of knowledge and the assumption that providing immunization counseling was the duty and authority of the village midwife. Another factor that caused the less than optimal role of cadres was due to low motivation and support from village officials and health center officers.

Based on the description above, the researcher is interested in conducting a study entitled The Relationship between the Role of Posyandu Cadres and the Completeness of Basic Immunization for Infants Aged 12-24 Months at the Youth Health Center UPTD, Sungai Pinang District.

## 2. METHODOLOGY

This type of research uses a quantitative type with a correlational analytical design, namely a research method carried out with the aim of researchers to find the relationship between dependent variables and independent variables. Variable measurements are carried out simultaneously (once) during the study using a questionnaire. The approach used is cross-sectional, namely research that studies the correlation between risk factors and effects through an approach, observation or data collection simultaneously at a certain time Notoatmodjo (2018) in Indah (2023).

The independent variable of this study is the Role of Posyandu Cadres and the dependent variable is the Completeness of Basic Immunization.

The population is the totality of each element being studied, which has the same characteristics, can be individuals from a group, events or something to be studied (Sugiyono, 2018). The population in this study was all mothers who have babies aged 12-24 months who are in the area of the Youth Health Center UPTD, specifically at the Tantina Integrated Health Post.

A sample is a portion of the number and characteristics of a population (Sugiyono, 2018). In this study, the sample used was a total sample of 51 mothers with babies aged 12-24 months.

The sampling technique used in this study was consecutive sampling. Consecutive sampling is a sampling method that involves selecting samples that meet the research criteria over a certain period of time to achieve the required sample size (Nasution, 2023).

## 3. RESULTS

### 3.1 Results

The results of the study on the Relationship between the Role of Posyandu Cadres and the Completeness of Basic Immunization in Infants Aged 12-24 Months at the Youth Health Center UPTD, Sungai Pinang District. This study was conducted by researchers in April 2026 with a total of 51 respondents, all of whom met and were in accordance with the inclusion criteria. The data is presented in a table, a description of the results of the study regarding The Relationship between the Role of Posyandu Cadres and the Completeness of Basic Immunization in Infants Aged 12-24 Months at the Youth Health Center UPTD, Sungai Pinang District. Respondent Characteristics

**Table 1.** Distribution of Respondents based on Respondent Age, Education Level and Occupation (n=51)

Variable	F	%
<b>Respondent's age</b>		
Less than 20 Years	2	3.9
20 – 30 years	30	58.8
31 – 40 years old	19	37.3
More than 40 years	0	0
<b>Education Level</b>		
Junior High School	13	25.5
Senior High School	31	60.8
College	7	13.7

Variable	F	%
<b>Work</b>		
housewife	44	86.3
Private	1	2.0
Civil Servants/State Civil Apparatus	3	5.9
Etc	3	5.9

Based on Table 1. above, it can be explained that the characteristics of the respondents are as follows:

The ages of the respondents in this study are as follows: 2 people aged less than 20 years (3.9%), 30 people aged 20-30 years (58.8%), 19 people aged 31-40 years (37.3%), while there were no respondents aged more than 40 years.

The level of education is as follows: No school with code 1 as many as 0 mothers (none), Elementary school with code 2 as many as 0 mothers (none), Junior high school with code 3 as many as 13 mothers (25.5%), High school with code 4 as many as 31 mothers (60.8%), College or abbreviated PT with code 5 as many as 7 mothers (13.7%), so the majority have a high school education level (60.8%).

Occupation as a housewife is as follows: Housewife with code 1 as many as 44 mothers (86.3%), Private sector with code 2 as many as 1 mother (2.0%), Civil servant/ASN with code 4 as many as 3 mothers (5.9%), others with code 7 as many as 3 mothers (5.9%), so it can be concluded that the majority of respondents are housewives).

## 1. The Role of Posyandu Cadres

**Table 2.** Distribution of the Roles of Posyandu Cadres (n=51)

Variable	F	%
<b>The Role of Posyandu Cadres</b>		
Playing a role	32	62.7
Doesn't Play a Role	19	37.3
Total	51	100

Based on Table 2 above, it can be explained that Posyandu cadres are said to play a role if the answer is Yes with a score of  $\geq 28-36$ , whereas if the answer is no with a score of 18-27, the category does not play a role. In this study, the number of scores obtained was in

the range of 18-27 is 19 people (37.3%) and those in the range  $\geq 28-38$  are 32 people (62.7) so it can be said that the majority of Posyandu cadres play a role, namely 62.7%.

## 2. Basic Immunization Coverage

**Table 3.** Distribution of Respondents Based on Complete Basic Immunization (IDL) (n=51)

Variable	F	%
<b>Basic Immunization Completeness</b>		
Complete	36	70.6
Incomplete	15	29.4
Total	51	100

Based on Table 3. above, the results show that immunization is said to be complete if all criteria are met or all types of basic immunization have been received by toddlers with code 2, there are 36

toddlers (70.6%), incomplete if there is one type of immunization that has not been/not received by toddlers with code 1, there are 15 toddlers (29.4%). So it can be concluded that most respondents have complete basic immunization, namely 70.6%.

### 3. Data analysis

**Table 4.** *Bivariate Analysis of Cadre Participation and Completeness of Basic Immunization*

Variable	Basic Immunization Completeness				Total		P value	OR
	Complete		Incomplete		n	%		
	n	%	N	%				
The role of Posyandu cadres	29	56.9	3	5.9	32	62.7	0.000	16,571 (3,659- 75,058)
Playing a role	7	13.7	12	23.5	19	37.3		
Does not play a role	36	70.6	15	29.4	51	100		
Total								

Based on Table 4. above, the results show that the majority of respondents who received a role from Posyandu cadres had complete basic immunization coverage, which was 70.6%. The chi-square test results obtained a p-value = 0.000, which is less than 0.05. This means that the alternative hypothesis is accepted, namely there is a relationship between the role of Posyandu cadres and the completeness of basic immunization in infants aged 12-24 months at the Youth Health Center UPTD, Sungai Pinang District. Further analysis shows an OR value = 16.571, this means that cadres have a role 16 times the opportunity to implement the completeness of basic immunization.

### 3.2 Discussion

This discussion will explain the interpretation of the results and discussion of the research results by comparing the research results to theories or previous research results, research limitations and implications for services, education and research. The results obtained are described in more detail regarding the Relationship between the Role of Posyandu Cadres and the Completeness of Basic Immunization in Infants 12-24 months at the Youth Health Center UPTD, Sungai Pinang District.

#### 3.2.1 Interpretation and Discussion of Results

Respondent characteristics based on education level, occupation and age are as follows:

##### a. Age

The results of this study also explain that the age range of mothers is mostly between 20-35 years old so that mothers are more concerned about the immunization status of their toddlers, this is related to a person's behavior with the physical and mental development of the person so that their behavior will become more mature with age supported by increasing experience. A study by Novitasari (2023) also explains that most of the respondents involved in this study are aged 20-35 years. In line with research by Azril (2022) which states that between the mother's age and the completeness of basic immunization in toddlers, namely age will be related to a person's behavior with the physical and mental development of the person so that their behavior will become more mature with age supported by increasing experience, According to Researchers Maternal age is one of the factors that influence the completeness of immunization in infants.

##### b. Education

The results of this study explain that the majority of respondents in the UPTD Youth Health Center area as the research location have a high school education level, namely from 51 respondents consisting of 13 people (25.5%) mothers with junior high school education, 31 people (60.8%) mothers with high school education and 7 people (13%) mothers with bachelor's degree education, so it is concluded that the majority of respondents have a high school education, so that there are no more mothers who have no school status and an average of high school education so that mothers more easily understand the importance of immunization for their toddlers. The results of this study are in line with research by Novitasari & Sutarno (2023), explaining that most respondents in this study have a high school education level. According to the National Education System Law (UU SPN), No. 20 of 2003, education is a conscious and planned effort to prepare students to actively develop their potential to have spiritual religious strength, self-control,

personality, intelligence, noble character, and the skills needed by themselves for society, nation and state.

A mother's education influences her child's immunization completeness. Research by Nanda Kharin (2021) explains that individuals with higher levels of education tend to be more receptive to information, including information about immunizations provided by health workers. Conversely, mothers with lower levels of education struggle to receive the information provided, resulting in a lower understanding of immunization completeness. (Nanda Kharin et al., 2021)

A person with a higher education will certainly consciously take their baby to the local integrated health post (Posyandu) for complete immunizations. Someone with a lower education will oppose this action. Education aims to enable humans to acquire knowledge and maintain or even improve the quality of their existence for the betterment of the environment and their surroundings. Knowledge gained through formal, non-formal, and mass media education is a very important domain for the formation of a person's actions (overt behavior). Knowledge itself can be obtained through personal experience and that of others (Notoatmodjo in Heraris 2015). Therefore, according to researchers, maternal education is very important in making decisions about immunizing children.

### c. **Work**

The results of this study also explain that some of the respondents are housewives, 44 mothers (86.3%), 1 mother in the private sector (2.0%), 3 mothers (5.9%) and 3 mothers (5.9%) in civil servants/ASN, so it can be concluded that the majority of respondents are housewives, with the majority of mothers being housewives so they have time to take their children to the integrated health post for immunization.

The results of this study align with research by Novitasari & Sutarno (2023), which explains that the majority of respondents were housewives. Research by Kuntari Pujiasih (2017) found that unemployed mothers were more punctual with their children's immunizations than employed mothers because they had time to take their children. (Pujiasih, 2017)

Employment status can be a factor influencing the completeness of immunizations in children, as working mothers generally have less time to spend with their children. This is because they work to meet daily living needs, so sometimes the child's health is not taken into account. According to researchers, employment can be a factor influencing the completeness of immunizations in children, as working mothers generally have less time to spend with their children.

### 3.2.2 **The Role of Posyandu Cadres**

The results of the study showed that the posyandu cadres in the working area of the Youth Health Center UPTD which was the research site, namely the number of scores in the range of 18-27 was 19 people (37.3%) and those in the range of  $\geq 28-38$  were 32 people (62.7) so that it can be said that the majority of posyandu cadres played a role, namely 62.7%. so it can be concluded that posyandu cadres have an active role in efforts to achieve completeness of basic immunization. The results of this study also showed that of the 18 question items there was an answer with the highest score, namely question no. 11 Do cadres carry out health and nutrition counseling and counseling activities in accordance with the results of weighing and providing PMT? with a score of 102, this shows that the role of cadres in providing counseling, health and nutrition counseling and providing PMT during posyandu is very meaningful in increasing the enthusiasm of mothers which ultimately has an impact on the number of posyandu visits which ultimately has an effect on increasing immunization achievement.

Integrated health post (Posyandu) cadres are a crucial factor in implementing basic immunizations for children. These cadres are volunteers from the local community who are considered to have significant influence on the local community and are responsible for implementing Posyandu programs, including immunizations. (Septianingtyas, 2018).

The selected cadres are then trained to help address public or individual health issues and work in close contact with health service delivery locations (Ministry of Health of the Republic of Indonesia 2019). The role of Posyandu cadres is very important and necessary for the sustainability of the immunization program to run according to the target. Posyandu cadres as the spearhead in the implementation of Posyandu activities are tasked with preparing and managing Posyandu activities before the day of Posyandu implementation, during Posyandu implementation, until after Posyandu implementation every month, According to Researchers The role of cadres greatly influences the Completeness of immunization.

### 3.2.3 **The Relationship Between the Role of Posyandu Cadres and the Completeness of Basic**

### Immunization in Infants Aged 12-24 Months

The results of this study indicate a relationship between the role of Posyandu cadres and the completeness of basic immunizations in infants aged 12-24 months at the Youth Health Center UPTD, Sungai Pinang District. These results align with previous research by Agustin & Anggraini (2020) which explains the relationship between the role of Posyandu cadres and the level of immunization compliance.

Another study by Septianingtyas & Soesetijo (2018) in Jember on 100 mothers with children aged 12-23 months showed that cadre support had an influence on complete basic immunization status.

The results of this study are in line with Hasyifuddin's (2023) research, which explains that health workers and integrated health post (posyandu) cadres also have a very important role in ensuring the completeness of immunization status in infants.

The results of the same study were also explained by Huvaid (2020) showing that there is a significant relationship between the role of cadres and the provision of measles immunization to toddlers. (Huvaid et al., 2020).

The results of the same study also explained that of the 56 respondents who said the role of active cadres, 42 respondents (75.0%) had complete immunization and 14 people whose immunization was incomplete. Meanwhile, of the 31 respondents who said the role of inactive cadres, 16 people (51.6%), had complete immunization and 15 people whose immunization was incomplete. With the results of the analysis  $p$  value = 0.048 so that researchers can conclude that  $H_0$  is accepted which means that there is a Relationship Between the Role of Cadres and the Completeness of Basic Immunization in infants aged 9-12 months at the Posyandu in Wakasih Village. (Soumokil, 2024).

The results of Oktarina's 2018 research stated that the results of the analysis of the relationship between the role of cadres and the completeness of basic immunization in infants showed that immunization was incomplete with the role of cadres lacking as many as 34 (66.7%), while with the role of cadres that were good, 17 (33.3%) mothers had incomplete basic immunization in infants. The results of the statistical test obtained a  $p$  value = 0.024 ( $p < \alpha$ ), so it can be concluded that there is a relationship between the role of cadres and the completeness of immunization. (Oktarina, 2018)

Furthermore, according to Budiman (2016), the role of cadres in providing information about the importance of immunization and the friendliness of cadres are related to the status of complete basic immunization. The level of immunization achievement in children is highly dependent on the role of health cadres in the Posyandu area. Posyandu cadres are required to be able to understand management, implementation, identify health problems at Posyandu in the cadre's target area, mobilize the community in the surrounding area, and at a minimum be able to conduct health education (Ministry of Health of the Republic of Indonesia 2019).

Cadres have a role in supporting the success of immunization coverage in a region by helping to record data on immunization program targets, mobilizing parents and targets to attend immunization services, helping to prepare immunization service locations and waiting rooms before and after injections at Posyandu or immunization service posts, managing the flow of immunization services, helping to record targets who have been immunized, recording data on babies or children who have not received immunization and visiting the parents/families of the babies or children and visiting parents/families who have never brought their children to immunization service locations, and reporting to officers if Post-Immunization Adverse Events (KIPI) are found (Ministry of Health of the Republic of Indonesia 2017).

The positive role of cadres cannot be separated from their internal motivation, namely concern for health in the community so that cadres remain faithful in carrying out their duties. Cadres also motivate parents of children who will undergo immunization to comply and visit the integrated health post (posyandu) on the child immunization schedule that has been determined, the motivation of posyandu cadres is everything both from within and from outside the cadre that can encourage cadres to work carrying out their duties and functions as posyandu cadres with full awareness and responsibility. (Kusumayanti, 2022).

According to researchers, the role of cadres is very important and influential in supporting the success of immunization coverage in an area by helping to record data on immunization program targets, mobilizing parents and targets to attend immunization services, helping to prepare immunization service locations and waiting rooms before and after activities at Posyandu, helping to record targets who have been immunized, recording data on babies or children who have not received immunization and visiting parents/home visits to toddlers who do not attend Posyandu, all of these roles greatly influence the completeness of immunization in toddlers.

## CONCLUSIONS

Most respondents have a high school education and most of them are housewives with an average age of 28 years. The role of Posyandu cadres at the Health Center, Sungai Pinang District, is mostly positive/instrumental. The completeness of basic immunization for infants aged 12-24 months at the Health Center, Sungai Pinang District, is mostly complete. The results of the study showed that there was a relationship between the role of Posyandu cadres and the completeness of basic immunization in infants aged 12-24 months at the Health Center, Sungai Pinang District.

## REFERENCES

- Adirinarso, D. (2023). The Relationship Between Maternal Knowledge and Family Support with the Completeness of Follow-up Immunizations in Toddlers at the Tambakrejo Community Health Center, Bojonegoro. *Nucl. Phys.*, 13(1), 104–116.
- Arpen, RS, & Afnas, NH (2023). Analysis of Factors Influencing Complete Basic Immunization for Infants. *Maternal Child Health Care*, 5(1), 795. <https://doi.org/10.32883/mchc.v5i1.2388>
- Didah, D. (2020). Overview of the roles and functions of integrated health post (Posyandu) cadres in the Jatinangor Community Health Center work area. *Malahayati Midwifery Journal*, 6(2), 217–221. <https://doi.org/10.33024/jkm.v6i2.2306>
- Fatimah, & Nuryaningsih. (2021). *Textbook of NEONATAL, INFANT, AND TODDLER CARE*.
- Felicia, FV, & Suarca, IK (2020). Basic Immunization Services for Infants Under 12 Months of Age and Influencing Factors at Wangaya Regional Hospital, Denpasar City During the COVID-19 Pandemic. *Sari Pediatri*, 22(3), 139. <https://doi.org/10.14238/sp22.3.2020.139-45>
- Gunardi, H., Kartasasmita, CB, Rezeki Hadinegoro, SS, Irawan Satari, H., Oswari, H., Pusponogoro, HD, Batubara, JR, Akib, AA, Hegar, B., Yanuarso, PB, & Wisnu Hendarto, T. (2023). Immunization Schedule for Children Aged 0–18 Years Recommended by the Indonesian Pediatrician Association. *Sari Pediatri*, 18(5), 417–422. [https://saripediatri.org/index.php/sari-pediatri/article/viewFile/1120/pdf\\_1](https://saripediatri.org/index.php/sari-pediatri/article/viewFile/1120/pdf_1)
- Hariani, AL (2024). The Relationship Between Low Birth Weight and the Incidence of Stunting in Children Aged 1-5 Years in the Jorongan Community Health Center Work Area. *ASSYIFA: Journal of Health Sciences*, 1(1), 133–142. <https://doi.org/10.62085/ajk.v1i1.22>
- Hasyifuddin, SH, Arbi, A., & Andria, D. (2023). Factors Associated with Complete Basic Immunization in Infants in the Lampaseh Community Health Center Work Area. *Tambusai Health Journal*, 4(1), 168–173.
- HIDAYAT, R., HANDAYANI, TS, & RUSTANDI, H. (2023). Extrinsic Factors Associated with the Completeness of Basic Immunization in Infants in the Nanti Agung Community Health Center, Kepahiang Regency. *Journal of Nursing and Public Health*, 11(2), 446–456. <https://doi.org/10.37676/jnph.v11i2.5175>
- Huvid, SU, Yulianita, Y., & Mairoza, N. (2020). Factors Associated with Measles Immunization in Toddlers. *Hesti Medan Research Journal*, Akper Kesdam I/BB Medan, 4(2), 83. <https://doi.org/10.34008/jurhesti.v4i2.139>
- IDAI. (2023). IDAI Child Immunization Schedule 2023. Indonesian Pediatrician Association, 2. <https://www.idai.or.id/artikel/klinik/imunisasi/jadwal-imunisasi-anak-idai>
- Indah, AP, Sutrisno, & Gandini, ALA (2023). *Media of Health Research*. *Media of Health Research*, 1(2), 47–56.
- Ministry of Health of the Republic of Indonesia. (2017). MINISTER OF HEALTH REGULATION OF THE REPUBLIC OF INDONESIA NO. 12 OF 2017 Concerning the Implementation of Immunization.

- Kusumayanti, E. (2022). Research Report of Lecturers at Pahlawan Tuanku Tambusai University. 1914202043.
- Ma'wanah. (2016). BACHELOR OF NURSING STUDY PROGRAM, FACULTY OF HEALTH SCIENCES.
- Nanda Kharin, A., Fidelia, CT, Fairuz Auza, D., Sekar Utami, E., Aulia Rahman, F., Annisa Ahlul, FJ, Nurbayani, FH, Esther, J., Andari, LH, Priandini, R., Hermawati, Public Health Science Study Program, E., & Public Health, F. (2021). Knowledge, Education, and Attitude of Mothers towards Complete Basic Immunization in Bogor Regency. *Journal of Community Health Service (Pengmaskemas)*, 1(1), 25–31.
- Oktarina, S. (2018). The Relationship between the Role of Cadres and Family Support with the Completeness of Basic Immunization in Infants in the Tarusan Community Health Center Work Area. *Menara Ilmu*, XII(II) No.(February 2018), 111–118.
- Oruh, S. (2021). JIKSH: Sandi Husada Scientific Journal of Health Analysis of the Active Factors of Cadres in Posyandu Activities Shermina Oruh Department of Public Health, University of Pejuang Republic of Indonesia Introduction Method Results and Discussion. 10, 319–325.
- Parmin, J., Lubis, D., & Sari, UM (2023). (2023). The Relationship between Mother's Attitude and Timeliness of Giving Measles Immunization to Babies in. 2(September).
- Pujiasih. (2017). The Relationship between Mother's Employment Status and the Provision of Advanced Pentavalent and Measles Immunizations to Toddlers at the Paliyan Community Health Center. Unisa, 1–6.  
[http://digilib2.unisayogya.ac.id/xmlui/bitstream/handle/123456789/1827/NASKAH\\_PUBLIKASI.pdf?sequence=1&isAllowed=y](http://digilib2.unisayogya.ac.id/xmlui/bitstream/handle/123456789/1827/NASKAH_PUBLIKASI.pdf?sequence=1&isAllowed=y)
- Sasmita, KY, Kabuhung, EI, Hidayah, N., Studi, P., Midwifery, S., Health, F., Mulia, US, Studi, P., Tiga, D., Health, F., & Mulia, US (2023). Factors Associated with Low Coverage of Infant and Toddler Visits at the Integrated Health Post (Posyandu) in Pasar Senin Village, Hulu Sungai Utara Regency. 1(6), 272–279.
- Septianingtyas, WR (2018). The Influence of Cadre's Support in the Complete Basic Immunization on working area of Jelbuk and Klatakan public health center, Jember Regency (The Influence of Cadre's Support in the Complete Basic Immunization on working area of Jelbuk and Klatakan public health center,. 1(1d1), 21` – 24.
- Soumokil, Y. (2024). The Relationship between the Role of Cadres and the Completeness of Basic Immunization in Infants Aged 9-12 Months at the Integrated Health Post (Posyandu) in Wakasih Village. 2(1).
- Sugiarto. (2019). Immunization Pocket Book: Immunization Guide for Health Workers. Ministry of Health of the Republic of Indonesia, 4(1), 1–23.
- Yanti, DA (2023). THE INFLUENCE OF THE SOCIAL ENVIRONMENT ON MOTHER'S COMPLIANCE IN IMPLEMENTING BASIC IMMUNIZATION IN BABIES. 6(1).

## EFFECTS OF ORAL HEALTH EDUCATION AND MASS TOOTHBRUSHING ON ELEMENTARY SCHOOL STUDENTS

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### Abstract

Dental caries and poor oral hygiene remain prevalent among school-age children in Indonesia, largely attributable to gaps in health promotion engaging the supervised monitoring. Few studies have evaluated integrated dental health education combined with supervised mass toothbrushing. This study to evaluate the descriptive outcomes of an integrated dental health education program combined with supervised mass toothbrushing among elementary school students. This study adopted a descriptive qualitative approach with action-oriented monitoring. As many as 234 students from SDN 12 Puhun Pintu Kabu, Bukittinggi, grades 4-6 were involved as participants. The program combined oral health lectures, interactive visual media i.e., flipchart, and animated educational video, and supervised practical execution. The outcomes of cognitive knowledge using the instrument used were open-ended oral questioning, and psychomotor skills were assessed descriptively using an observational checklist and stopwatch. Technical modeling was delivered via centralized 3D dental phantoms, followed by outdoor mass toothbrushing sessions arranged in parallel peer rows to facilitate dynamic, on-the-spot physical corrections. Observational assessment of cognitive knowledge resulted in "Adequate Understanding," and the psychomotor aspect i.e., the brushing technique, revealed that the majority of students successfully shifted from harmful horizontal scrubbing to the "Correct Technique" as recommended in the intervention using Roll/Fones method. The programme concluded that an integrated intervention combining counselling, demonstration, and supervised mass toothbrushing is successful in improving cognitive knowledge and psychomotor aspects of tooth brushing. This shows positive daily habits among primary school students, and is recommended as a recurring institutional programme.

Keywords: caries prevention, dental health education, oral hygiene, school children, toothbrushing

### 1. INTRODUCTION

Dental caries and compromised oral hygiene constitute a significant public health burden among school-age children globally, and Indonesia is no exception. Data from the National Basic Health Research consistently reveal that the prevalence of dental caries and poor Oral Hygiene Index scores among primary school children remains at concerning levels [1]. The condition is perpetuated by deficiencies across all three dimensions of the Knowledge-Attitude-Practice (KAP) framework: children frequently harbour misconceptions regarding the primary causes of tooth decay, underestimate the importance of fluoride, and are unaware of the critical toothbrushing windows immediately after breakfast and before sleep [2].

Effective dental health education must begin early, as childhood represents the golden period for establishing lifelong health behaviours [3], [4], [5]. The school environment provides an ideal platform for structured oral-health promotion because it offers access to large, captive cohorts of children within an institutionalised framework that enables both immediate intervention and continuity through teachers. Community-based dental health programmes targeting primary school pupils have demonstrated efficacy in improving both knowledge scores and clinical oral-hygiene indices [6], [7].

Studies have shown that implementing dental health promotion for school-age children, which emphasizes reducing dental caries, can be effective, such as using a video [8], [9]. The study was conducted by assessing the respondents' knowledge after being shown the educational dental health

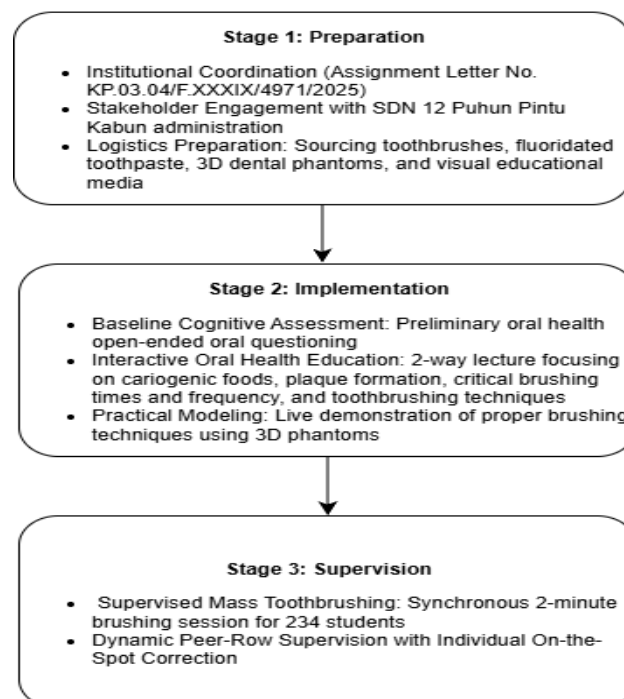
video. It is stated that the knowledge increases statistically from  $9.49 \pm 2.09$ , which increased to  $11.55 \pm 1.60$ . However, video can only stimulate the visual and auditory senses, which is not sufficient to assess motor skills, such as correctly performing the steps of tooth brushing. Children may understand the theory after watching the video, but their hands won't automatically be able to do it correctly without supervised hands-on practice. Besides, there is also a study that used comic media and a lecture to educate children on dental health [10]. It is proven that the method can improve knowledge with significant value. The use of illustrative comic books can stimulate cognitive aspects in terms of knowledge, combined with a lecture. This 2D static approach has been combined with an explanation from the lecture method. Thus, children can understand the materials presented. However, multi-panel comics design often possesses limitations for communication, causing students to remember the fictional storyline rather than the structural clinical procedures. Hence, to bridge the gap between abstract visual absorption and practical execution, this study implements an action-oriented framework, where the study combined lecture, demonstration, and supervised mass toothbrushing.

State Elementary School 12 Puhun Pintu Kabun, located in Mandiangin Koto Selayan, Bukittinggi City, West Sumatra, was identified as an appropriate intervention site following a situational analysis conducted. Despite being situated within an urban area, the school lacked a standardised, routinely supervised toothbrushing programme. Preliminary observations indicated that students predominantly employed the horizontal scrubbing technique, which is associated with cervical abrasion and gingival recession, rather than the recommended Roll or Fones method [11]. Furthermore, daily communal toothbrushing had not been institutionalised as a compulsory routine under the School Health Programme. Few studies have evaluated integrated dental health education combined with supervised mass toothbrushing among elementary school students in Bukittinggi, Indonesia.

Therefore, this study aimed to evaluate the descriptive outcomes of an integrated dental health education program combined with a supervised mass toothbrushing among elementary school students in Bukittinggi, Indonesia.

## 2. METHODS

This study adopted a descriptive qualitative approach with action-oriented monitoring. Psychomotor skill acquisition, in terms of tooth brushing skill, was assessed through direct observational evaluation. The intervention team consisted of four professionals. The respondents of this study were elementary school students at SDN 12 Puhun Pintu Kabun, totaling 234 students in grades IV to VI. The three-phase programme structure is outlined in Figure 1 below.



**Figure 1.** Stages of the intervention program

Figure 1 maps out the systematic, action-oriented, chronological workflow of the dental health promotion program, which is divided into three stages. Stage 1 represents the foundational administrative and logistical phase to perform tooth brushing and tooth brushing education, such as sourcing of toothbrushes, fluoridated toothpaste, interactive 3D dental phantoms, and visual educational media, i.e., flipchart and animated educational video. Moving to Stage 2, the implementation where it focuses on cognitive and conceptual development. It initiated a baseline cognitive assessment through open-ended oral questioning to map existing misconceptions, followed by a two-way interactive oral health lecture. The key content included the mechanism of cariogenic food metabolism by oral bacteria, the critical importance of brushing at least twice daily (particularly after breakfast and before sleeping), the hazard of dental plaque as an adhesive biofilm rather than ordinary debris, and the physiological basis of fluoride protection. Visual aids, such as the dental phantom, illustrated flip-chart, and animated video, were deployed to render abstract concepts accessible to young learners. The final phase of Stage 3 was the supervision stage. A supervised mass toothbrushing session constituted the core psychomotor intervention. Each student received a toothbrush and toothpaste. The tooth brushing used the Roll/Fones method, characterised by gentle rotational strokes encompassing buccal, lingual, and occlusal surfaces, was demonstrated by the lead team member using the dental phantom and replicated simultaneously by all 234 students for a minimum of two minutes, timed by the team to ensure compliance with evidence-based duration standards. Concurrently, the psychomotor skill of each student was assessed through direct observation by the team, recording whether the student applied the correct Roll/Fones technique on all tooth surfaces (buccal, lingual, and occlusal) and maintained the two-minute brushing duration. Individual on-the-spot corrections were provided in a one-on-one format throughout the supervised brushing session.

According to the action-oriented chronological workflow, the data collection relied on two qualitative instruments specifically designed to evaluate the immediate transitions in students' knowledge and psychomotor skill outcomes. This qualitative guideline underwent validation through expert judgment by senior faculty members at the Dental Health Department of Poltekkes Kemenkes Padang to ensure language appropriateness for elementary school children. The first instrument was a Qualitative Oral Questioning Guideline used during the baseline assessment and post-test verbal validation to evaluate the students' cognitive domain. The questions focus on the dental health concepts, such as the mechanism of cariogenic food metabolism by oral bacteria, the critical timing of brushing at least twice daily (specifically after breakfast and before sleeping), the hazard of dental plaque as an adhesive biofilm rather than ordinary debris, and the physiological basis of fluoride protection. A student's verbal response was classified as demonstrating "Adequate Understanding" if they could independently articulate the core concepts using at least one essential scientific keyword for each domain. For example, students had to correctly link "sugar" with "acid" or "bacteria" as the cause of caries; for critical timing, the students should explicitly state "after breakfast" and "before sleeping". Conversely, if a student failed to mention these core criteria or relied on outdated misconceptions, their comprehension was categorized as "Inadequate Understanding", prompting immediate verbal re-explanation by the team. The second instrument was a Supervised Toothbrushing Performance Checklist, utilized during the active supervision phase to monitor the execution of physical skills during the mass brushing session. This monitors the parameters of correct execution of the Roll/Fones method and strict compliance with the minimum two-minute brushing duration. A student's performance was categorized as "Correct Technique" if they independently executed gentle rotational strokes encompassing all three critical tooth surfaces and brushed in two minutes, as counted using a stopwatch. If a student didn't perform tooth brushing as taught before, or stopped brushing prematurely, their performance was recorded as "Required Correction", receiving correction afterwards.

### 3. RESULTS

The research was successfully executed in full accordance with the authorised assignment and the planned timetable. All 234 students from grades IV to VI at State Elementary School 12 Puhun Pintu Kabun (SD N 12 Puhun Pintu Kabun) participated across both the oral-health counselling and supervised mass toothbrushing sessions, reflecting a 100% attendance rate and strong institutional support from the school administration.

#### 3.1 Cognitive Knowledge Outcomes

In accordance with the Qualitative Oral Questioning Guideline, verbal validation indicates improvement in dental health knowledge across the students. Initially, the baseline evaluation captured widespread misconceptions regarding caries aetiology. However, after the intervention was performed, students demonstrated enhanced understanding of caries aetiology, specifically recognising the role of

bacterial metabolism of dietary sugars in producing acid that demineralises enamel, as well as improved awareness of critical toothbrushing times and the importance of correct technique. The results confirmed that students could correctly articulate why brushing immediately before sleeping is particularly important, as nocturnal salivary flow reduction leaves teeth most susceptible to acid attack. Therefore, the students are successfully transitioned to an “Adequate Understanding” level.

### 3.2 Psychomotor Skill Outcomes

Observational assessment during the supervised mass toothbrushing session revealed a marked positive transition in technique quality. Before the demonstration, the majority of students were observed employing horizontal scrubbing motions, a widespread but clinically harmful technique associated with cervical abrasion and gingival damage. Following the systematic demonstration using the dental phantom and the team's direct individual corrections, the majority of students successfully applied the Roll/Fones method, achieving correct rotational strokes across buccal, lingual, and occlusal surfaces. Timer-guided compliance ensured that all participants maintained the minimum two-minute brushing duration, a standard reported to be necessary for effective plaque removal [12], [13], [14].



**Figure 2.** Direct modeling of the Roll/Fones brushing technique using a 3D dental phantom before mass toothbrushing

Figure 2 shows the team demonstrating Roll/Fones brushing techniques before mass toothbrushing. Following this systematic demonstration, a significant behavioural shift was documented as the students transitioned to active participation. The children successfully replicated the demonstrated motions, achieving correct rotational and sweeping strokes across the buccal, lingual, and occlusal surfaces.



**Figure 3.** Field implementation of the supervised mass toothbrushing

As shown in Figure 3, the stage bypassed the lack of individual clinical facilities by clustering the 234 students into structured, outdoor peer-row seating arrangements. This spatial setting allowed the team to do a dynamic oversight model. Rather than wasting limited time on isolated sequential examinations, instructors positioned themselves strategically along the rows to maintain an active, evaluative stance.

## 4. DISCUSSION

The findings of this programme align with a well-established body of evidence demonstrating that school-based oral health interventions, particularly those combining cognitive education with supervised skill practice, produce improvements in both knowledge and toothbrushing skill among elementary school children. These qualitative cognitive findings in “Adequate Understanding” are highly consistent

with the objectives defined under the Knowledge, Attitude, and Practice (KAP) framework applied to the intervention design [2]. The significant improvements observed in both cognitive retention and psychomotor execution can be fundamentally attributed to the development of participants. This study focused on an aggregate population of 234 upper-grade elementary students strictly enrolled in grades 4, 5, and 6. It is known that in childhood developmental frameworks, children in these grades, typically aged 9-12 years, possess advanced fine motor coordination. It is in line with the research, which states that motor skills in children attending 4th and 5th grades are not statistically different [15]. Those under 9 years, typically at 6-8 years, need further consideration to distinguish from physical education [16]. This makes the participants of the study capable of receiving materials, processing, replicating, and sustaining them as they can stick with the lecture given in the intervention.

Grade 4-6 of elementary school children, which portrays fine motor skills, influenced the efficiency of the intervention. This is due to the participants' understanding when the questions were delivered, such as caries aetiology, specifically recognising the role of bacterial metabolism of dietary sugars in producing acid that demineralises enamel. This shows the readiness of the participants to answer the questions after the materials were fully delivered. Fine motor skills are a good indicator of children's development. It shows that the children can control precise movement using the nervous system, fibres, muscles, fingers, and hands [17], [18].

The psychomotor skills outcomes show that the participants understand by practicing "Correct Technique" tooth brushing together. Using the Roll and Fones toothbrushing methods, the participants show adaptation. Prior to the intervention, the reliance on horizontal scrubbing among the cohort was a highly predictable behavioral baseline. This is due to their habits at home, which were reinforced by years of unsupervised toothbrushing. However, the horizontal scrub technique unfortunately promotes cervical abrasions in spite of its common use by people. Also, the repetitive back-and-forth bristle movement over the gingiva can contribute to regressing the gingiva margins [19]. Therefore, this dental education chose the Roll and Fones toothbrushing method. The choice of the Roll and Fones toothbrushing methods for this primary school population was evidence-based. The Fones (circular) method is widely recommended for younger children due to its simplicity and low motor-skill demand, while the Roll method introduces the more sophisticated corona-apical stroke appropriate for older students, as used also in participants at 9-12 years old [20]. Both methods effectively eliminate supragingival plaque without inducing the cervical abrasion or gingival recession associated with horizontal brushing, and are recommended for the last 20-30 years [21]. The use of a large-scale dental phantom as a tactile and visual teaching aid significantly enhanced the demonstrability of correct technique for a large cohort of 234 students, complementing the animated video in bridging the gap between abstract verbal instruction and concrete psychomotor application.

Besides the brushing techniques, the enforcement of the temporal domain remains important too. The two-minute supervised duration is clinically supported as the minimum standard for effective plaque removal using a fluoride toothpaste [22]. It is found that two minutes of tooth brushing increases fluoride level in the saliva [23], helping remineralization in dental enamel [24], [25]. Timer-based compliance during the mass toothbrushing session, therefore, addressed a critical variable that is frequently overlooked in informal toothbrushing habits, namely that unsupervised children typically brush for fewer than 45 seconds. By embedding timer compliance within a supervised group activity, this programme leveraged the social and motivational dynamics of peer participation to reinforce duration adherence. The two-minute standard, instead of a restrictive clinical requirement, the students see this as a countdown that engages a challenge. This positive peer pressure and shared group momentum effectively prevented premature cessation of the activity. Consequently, every participant maintained active and brushed for the full time regarding the technique. This is what optimizes the mechanical plaque debridement during the program. This study's challenge comprised the logistical challenges related to water supply and participant attention. However, these were effectively managed through portable water containers and interactive multimedia.

## 5. CONCLUSIONS

This study successfully demonstrated a structured, school-based program that can achieve "Adequate Understanding" cognitive knowledge and "Correct Technique" psychomotor outcomes by combining the method of lecture, using media, and, most importantly, with practice. By leveraging the advanced motor coordination of 234 students at SDN 12 Puhun Pintu Kabun, the integration of 3D dental phantoms and timer-based compliance successfully dismantled harmful horizontal scrubbing habits, transitioning the cohort to the recommended Roll/Fones method for a full two minutes. It is recommended that the school formally adopt supervised communal toothbrushing as a mandatory daily

routine, ideally integrated into the morning assembly or post-breakfast schedule. Future studies should assess the performance of long-term behavioral sustainability and clinical efficacy by incorporating clinical diagnostics such as the Patient Hygiene Performance (PHP) Index.

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## REFERENCES

- [1] Kementerian Kesehatan RI, "Hasil Utama Riskesdas 2018 (Indonesia Basic Health Research)," 2018. doi: 10.1177/109019817400200403.
- [2] F. Zarei et al., "CheckKAP: A Checklist for Reporting a Knowledge, Attitude, and Practice (KAP) Study," *Asian Pacific Journal of Cancer Prevention*, vol. 25, no. 7, pp. 2573–2577, Jul. 2024, doi: 10.31557/APJCP.2024.25.7.2573.
- [3] S. Saccomanno et al., "The Importance of Promoting Oral Health in Schools: a Pilot Study," *Eur. J. Transl. Myol.*, vol. 33, no. 1, pp. 1–7, Mar. 2023, doi: 10.4081/ejtm.2023.11158.
- [4] F. Meyer and J. Enax, "Early Childhood Caries: Epidemiology, Aetiology, and Prevention," *Int. J. Dent.*, vol. 2018, no. 1415873, pp. 1–7, 2018, doi: 10.1155/2018/1415873.
- [5] N. A. Fajar, M. Praziandite, R. J. Sitorus, R. Flora, and E. S. Ananingsih, "The Relationship between Eating Behavior and Early Childhood Caries in Children," *Open Access Maced. J. Med. Sci.*, vol. 10, no. D, pp. 317–321, Jul. 2022, doi: 10.3889/oamjms.2022.9741.
- [6] D. A. Doshi, D. D. Bapna, D. A. W. Qadri, D. Palak, D. A. Garg, and D. S. D. Abhishek, "Effectiveness of School-Based Oral Health Education Programs in Improving Knowledge, Attitude, and Practice Among Primary School Students: A Pre-Post Intervention Study," *African Journal of Biomedical Research*, vol. 27, no. 4, pp. 5578–5582, Nov. 2024, doi: 10.53555/AJBR.v27i4S.4637.
- [7] A. M. Taheri, F. Zarei, A. Hidarnia, and M. Tavousi, "Effectiveness Of A School-Based Educational Intervention on Oral Health Knowledge, Attitudes, Practices, and Self-Efficacy Among Female Secondary School Students: A Randomized Controlled Trial," *BMC Oral Health*, vol. 25, no. 1, pp. 625–637, Apr. 2025, doi: 10.1186/s12903-025-06028-9.
- [8] N. Shah, V. Mathur, V. Kathuria, and T. Gupta, "Effectiveness of an educational video in improving oral health knowledge in a hospital setting," *Indian J. Dent.*, vol. 7, no. 2, pp. 70–75, 2016, doi: 10.4103/0975-962X.184646.
- [9] S. Suwarsono, L. A. Safitri, and L. Sunarjo, "Dental Health Educational: Media Videos and Animated Videos on Increasing Dental and Oral Health Maintenance Behavior," *Journal Center of Excellent: Health Assistive Technology*, vol. 1, no. 2, pp. 65–70, Sep. 2023, doi: 10.36082/jchat.v1i2.1273.
- [10] Yulistina, Rezki Dirman, Utari Zulkaidah, and Sultan Amin Yasin, "The Influence Of Health Promotion Using Lecture Method Using Comic Media On Dental And Oral Health Knowledge In Class III Students At State Primary School 1 Pangkajene District Sidenreng Rappang," *Journal of health research and technology*, vol. 2, no. 1, pp. 38–44, Feb. 2024, doi: 10.58439/jhrt.v2i1.165.
- [11] S. Kumar, P. Gopalkrishna, A. K. Syed, and A. Sathiyabalan, "The Impact of Toothbrushing on Oral Health, Gingival Recession, and Tooth Wear—A Narrative Review," *Healthcare*, vol. 13, no. 10, pp. 1138–1152, May 2025, doi: 10.3390/healthcare13101138.
- [12] M. T. Seuntjens, T. M. J. A. Thomassen, F. (G. A. ) Van der Weijden, and D. E. Slot, "Plaque Scores After 1 or 2 Minutes of Toothbrushing A Systematic Review and Meta-analysis," *Int. J. Dent. Hyg.*, vol. 23, no. 3, pp. 614–624, Aug. 2025, doi: 10.1111/idh.12840.

- [13] C.-H. Yeh et al., "Comparison Between Powered and Manual Toothbrushes Effectiveness for Maintaining an Optimal Oral Health Status," *Clin. Cosmet. Investig. Dent.*, vol. Volume 16, pp. 381–396, Oct. 2024, doi: 10.2147/CCIDE.S490156.
- [14] Y. Kaneyasu, H. Shigeishi, Y. Niitani, T. Takemoto, M. Sugiyama, and K. Ohta, "Manual Toothbrushes, Self-Toothbrushing, and Replacement Duration to Remove Dental Plaque and Improve Gingival Health: A Scoping Review from Recent Research," *J. Dent.*, vol. 148, pp. 1–12, Sep. 2024, doi: 10.1016/j.jdent.2024.105240.
- [15] A. Bukva and H. Memisevic, "Development of Fine Motor Skills in Elementary School Students: Gender and Age Affects," *Multidisciplinarni Pristupi u Edukaciji i Rehabilitaciji*, vol. 6, no. 8, pp. 14–22, Dec. 2024, doi: 10.59519/mper6202.
- [16] D. Bondi, C. Robazza, C. Lange-Küttner, and T. Pietrangelo, "Fine Motor Skills and Motor Control Networking in Developmental Age," *American Journal of Human Biology*, vol. 34, no. 8, pp. 1–15, Aug. 2022, doi: 10.1002/ajhb.23758.
- [17] Y. Qi, S. Tan, M. Sui, and J. Wang, "Supervised Physical Training Improves Fine Motor Skills of 5-Year-Old Children," *Revista Brasileira de Medicina do Esporte*, vol. 24, no. 1, pp. 9–12, Jan. 2018, doi: 10.1590/1517-869220182401177117.
- [18] B. Rosén, U. Wijk, and A. Björkman, "Neuroplasticity and Sensory-motor Synergy: Implications for Hand Function and Rehabilitation," *Journal of Hand Therapy*, vol. 39, no. 2, pp. 469–478, Apr. 2026, doi: 10.1016/j.jht.2025.10.004.
- [19] S. Kumar, P. Gopalkrishna, A. K. Syed, and A. Sathiyabalan, "The Impact of Toothbrushing on Oral Health, Gingival Recession, and Tooth Wear—A Narrative Review," *Healthcare*, vol. 13, no. 10, pp. 1138–1142, May 2025, doi: 10.3390/healthcare13101138.
- [20] Y. Sriani, A. Aljufri, Y. Yuzar, N. Herawati, and L. Lisnayetti, "Differences in Hygiene Index of Brushing Teeth With Horizontal, Roll And Fone's Method in Children Aged 9-12 Years," *JDHT Journal of Dental Hygiene and Therapy*, vol. 4, no. 2, pp. 125–131, Oct. 2023, doi: 10.36082/jdht.v4i2.1259.
- [21] Pindobilowo, Umi Ghoni Tjiptoningsih, and Dwi Ariani, "Effective Tooth Brushing Techniques Based on Periodontal Tissue Conditions: A Narrative Review," *Formosa Journal of Applied Sciences*, vol. 2, no. 7, pp. 1649–1662, Jul. 2023, doi: 10.55927/fjas.v2i7.4838.
- [22] M. Alfiya, R. P. Shenoy, M. I. Pasha, J. Junaid, and S. Amanna, "Effectiveness of the Brush DJ App in Improving Oral Hygiene Among Patients with Fixed Orthodontic Appliances: A Randomized Controlled Trial," *Sci. Rep.*, vol. 15, no. 1, pp. 1–9, Nov. 2025, doi: 10.1038/s41598-025-26579-9.
- [23] L. Prihastari, R. A. F. Rosdi, and B. Rintoko, "Changes in Salivary Fluoride Levels with a 2-minute Toothbrush Timer," *Insisiva Dental Journal: Majalah Kedokteran Gigi Insisiva*, vol. 12, no. 1, pp. 7–11, Jun. 2023, doi: 10.18196/di.v12i1.15593.
- [24] I. Farooq and A. Bugshan, "The Role of Salivary Contents and Modern Technologies in the Remineralization of Dental Enamel: a Narrative Review," *F1000Res.*, vol. 9, no. 171, pp. 171–184, Jun. 2021, doi: 10.12688/f1000research.22499.3.
- [25] Dr. S. H. Rather, Dr. S. Kazi, and Dr. S. Kazi, "The Role of Remineralizing Agents Used in Dentistry: An Update Then and Now," *Saudi Journal of Biomedical Research*, vol. 5, no. 7, pp. 183–187, 2020, doi: 10.36348/sjbr.2020.v05i07.003.

## EFFECT OF CMC-NA CONCENTRATION VARIATION AS A THICKENING AGENT IN SHAMPOO FORMULATION CONTAINING GRAPESEED OIL (*VITIS VINIFERA L.*)

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### Abstract

Grapeseed oil (*Vitis vinifera L.*) is a natural ingredient rich in antioxidants and essential fatty acids that has potential applications in hair care products. This study aimed to determine the effect of sodium carboxymethyl cellulose (CMC-Na) concentration on the physical characteristics of grapeseed oil shampoo and to identify the optimum formulation. Three shampoo formulations containing 10% grapeseed oil were prepared with different CMC-Na concentrations, namely 1% (F1), 3% (F2), and 5% (F3). The formulations were evaluated for organoleptic properties, homogeneity, pH, foam height, and viscosity. All formulations produced homogeneous shampoos with acceptable appearance and foam stability, while the pH values ranged from 6.30 to 6.41 and complied with the Indonesian National Standard (SNI) requirements for shampoo preparations. Increasing the CMC-Na concentration significantly increased the viscosity of the shampoo. Among the tested formulations, F1 containing 1% CMC-Na exhibited viscosity within the recommended range while maintaining satisfactory physical characteristics, whereas F2 and F3 produced excessively high viscosity values. Therefore, the formulation containing 1% CMC-Na was considered the optimum formulation for grapeseed oil shampoo.

Keywords: Grape Seed Oil , shampoo, viscosity

### 1. INTRODUCTION

Shampoo is a detergent-based preparation designed and packaged for cleansing hair. It functions to remove dirt, excess oil, and impurities from the scalp and hair without adversely affecting the natural condition and health of the hair. As a result, the hair becomes clean, fragrant, shiny, smooth, and easy to manage [15].

Grapes (*Vitis vinifera L.*), commonly known as grapes, are not native to Indonesia. They originated in the Middle East, particularly in Mesopotamia (present-day Iraq). The initial spread of grapes worldwide occurred primarily through processed products such as wine rather than fresh fruit ) [14]. Grapeseed oil is obtained from grape seeds and is rich in unsaturated fatty acids, particularly linoleic acid, as well as vitamin E [11].

Based on phytochemical screening, grapeseed oil contains alkaloids, flavonoids, tannins, terpenoids, and saponins. It also contains approximately 75% linoleic acid, 15% oleic acid, 6% palmitic acid, 3% stearic acid, and 1% linolenic acid. In addition, grapeseed oil is a rich source of vitamin E and possesses high antioxidant activity, which contributes to its stability[11].

Research involving variations in the concentration of gelling agents is important because these substances can influence the physical characteristics and stability of shampoo formulations. Excessive concentrations of gelling agents may produce shampoos with overly high viscosity, making them difficult to dispense from containers. CMC-Na (Sodium Carboxymethyl Cellulose) is a cellulose derivative widely used in industry as a thickener, emulsion stabilizer, and suspension stabilizer. As a thickening agent, CMC-Na forms a colloidal dispersion system and increases viscosity. The presence of CMC-Na helps

suspended particles remain uniformly distributed within the system, thereby preventing sedimentation due to gravitational forces. Thickening agents are substances used to increase the viscosity of a formulation. The viscosity and flow characteristics of shampoo can be determined through viscosity measurements [9].

Viscosity is an important parameter in shampoo formulation. CMC-Na is commonly used in pharmaceutical formulations, both oral and topical, due to its viscosity-enhancing properties [12]. Furthermore, CMC-Na is highly effective in aqueous systems with high water content and can be easily combined with both water-soluble ingredients and oil components [9]. Therefore, CMC-Na has the potential to serve as an effective thickening agent for increasing the viscosity of shampoo formulations.

Based on the background described above, this study was conducted to determine the effect of varying concentrations of CMC-Na as a thickening agent on the viscosity of grapeseed oil shampoo. The evaluation included pH testing, foam height testing, homogeneity testing, and organoleptic assessment to identify the most effective concentration of CMC-Na capable of producing a shampoo formulation that meets the required quality standards. The concentrations of CMC-Na investigated in this study were 1%, 3%, and 5%.

## 2. METHODOLOGY

The stages of this research included the preparation of grapeseed oil extract, formulation of grapeseed oil shampoo, and evaluation of the physical and chemical properties, hedonic characteristics, and qualitative antioxidant activity of the shampoo preparation.

### 2.1 Plant Determination

The grape seeds (*Vitis vinifera* L.) used in this study were identified at the Indonesian Research Institute for Medicinal and Aromatic Plants (BALITRO), Bogor, West Java. Identification was carried out using morphological characteristics and taxonomic references to ensure accurate classification of the plant material.

### 2.2 Preparation of Grapeseed Oil Extract

A total of 200 g of grape seed powder was placed into a clean glass bottle. Ninety-six percent ethanol was added until the powder was completely immersed, with approximately 1–2 cm of solvent remaining above the powder surface (approximately 1 L of ethanol). The bottle was tightly sealed and stored in a dark place for 24–48 hours. The mixture was stirred periodically to maximize extraction efficiency.

After the maceration process, the extract was filtered until a clear yellowish-green filtrate was obtained. The filtrate was then transferred to a wide evaporating dish and concentrated using a water bath maintained at a temperature of 40–50°C. The solution was heated gently without boiling to prevent degradation of the oil components. Ethanol was allowed to evaporate completely until a concentrated, clear oil-like extract was obtained. The final extract was transferred using a pipette into a pre-weighed container and adjusted to a final weight of 20 g.

### 2.3 Preparation of Grapeseed Oil Shampoo

The shampoo formulation was prepared by first preparing all equipment and accurately weighing the required ingredients according to the formulation. CMC-Na was dispersed in hot water and mixed until a homogeneous gel was formed. Grapeseed oil extract and menthol solution were then added and mixed thoroughly.

Phenoxyethanol and Cocamide DEA were subsequently incorporated while stirring continuously until homogeneous. In a separate container, Cocamidopropyl Betaine was mixed with Sodium Lauryl Sulfate solution and then added gradually to the main mixture with continuous stirring. Fragrance was added in a sufficient quantity, and the mixture was stirred until uniform. The finished shampoo preparation was then transferred into suitable containers and appropriately packaged.

**Table 1.** Formulation of Grapeseed Oil Shampoo Preparations

Ingredient	Concentration (%)			Function
	F1	F2	F3	
Grapeseed Oil	10	10	10	Active ingredient
Sodium Lauryl Sulfate	10	10	10	Surfactant
Cocamide DEA	3	3	3	Foaming agent
Sodium Carboxymethyl Cellulose (CMC-Na)	1	3	5	Thickening agent
Cocamidopropyl Betaine	3	3	3	Emollient
Menthol	0,2	0,2	0,2	Cooling agent
Phenoxyethanol	0,5	0,5	0,5	Preservative
Fragrance	Qs	Qs	qs	Fragrance agent
Purified Water (Aquadest)	ad100	ad100	ad100	Solvent

## 2.4 Evaluation of Shampo Formulation

### 2.4.1 Organoleptic Evaluation

The organoleptic evaluation was carried out by observing the physical characteristics of the shampoo preparations, including texture, appearance, odor, and color.

### 2.4.2 Homogeneity Test

The homogeneity test was conducted to determine the presence or absence of coarse particles and to assess the physical uniformity of the shampoo preparations. A small amount of shampoo from each formulation was spread onto a watch glass and visually examined. The preparation was considered homogeneous if it exhibited a uniform appearance without any visible coarse particles [9].

### 2.4.3 Viscosity Test

The viscosity of the shampoo formulations was measured using a Brookfield Viscometer (DV-E model). Approximately 200 mL of shampoo sample was transferred into a beaker glass and placed beneath the viscometer. An appropriate spindle was selected according to the viscosity of the formulation and immersed into the sample until fully submerged. The viscosity measurement was then performed at predetermined rotational speeds, and the results were recorded in centipoise (cPs) [12].

### 2.4.4 Foam Height Test

The foam height was measured using a simple method. One gram of shampoo preparation was placed into a graduated test tube containing 10 mL of distilled water and then tightly capped. The mixture was shaken for 20 seconds, and the height of the foam formed was measured and recorded [10].

### 2.4.5 Acidity (pH) Test

The pH test was performed using universal pH indicator paper. One gram of shampoo sample was dissolved in 100 mL of distilled water and allowed to stand for several minutes. The pH paper was then immersed in the solution, removed, and the resulting color was compared with the standard color scale provided by the manufacturer. According to the Indonesian National Standard [6], the acceptable pH range for shampoo preparations is 4.0–8.0.

### 3. RESULTS

#### 3.1. Results of Grape Plant Identification

The determination of the grape (*Vitis vinifera*) specimens was conducted at the Indonesian Research Institute for Medicinal and Aromatic Plants (BALITRO), Bogor, West Java. Based on morphological and taxonomic examination, the plant material used in this study was confirmed as *Vitis vinifera* L.

#### 3.2 Results of Grapeseed Oil Extraction

The grapeseed oil used in this study was obtained from the Indonesian Research Institute for Medicinal and Aromatic Plants (BALITRO), Bogor, West Java. Phytochemical screening results indicated that the grapeseed extract contained several bioactive compounds, including alkaloids, flavonoids, tannins, terpenoids, and saponins. These secondary metabolites are known to possess various biological activities, including antioxidant properties and potential benefits for hair and scalp health.

#### 3.3. Organoleptic Evaluation Results of Grapeseed Oil Shampoo

##### 3.3.1 .Organoleptic Evaluation

The organoleptic evaluation of grapeseed oil shampoo formulations was conducted by observing the color, odor, appearance, and texture of each formulation

**Table 2** Organoleptic Evaluation Results of Grapeseed Oil Shampoo Formulations

Physical Parameter	Color	Odor	Appearance	Texture
F1	Yellowish White	Grape Aroma	Slightly Gel-like	Moderately Viscous
F2	Yellowish White	Grape Aroma	Gel	Viscous
F3	Yellowish White	Grape Aroma	Gel	Viscous



Organoleptic Evaluation Results of Grapeseed Oil Shampoo Formulations

##### 3.3.2. Homogeneity Test

The homogeneity test was conducted to evaluate the uniformity of the shampoo preparations and to determine the presence or absence of coarse particles. The results of the homogeneity test for grapeseed oil shampoo formulation.

**Table 3** Homogeneity Test Results of Grapeseed Oil Shampoo Formulations

Formula	Homogeneity
F1	Homogeneous, no coarse particles observed
F2	Homogeneous, no coarse particles observed
F3	Homogeneous, no coarse particles observed



Homogeneity Evaluation Results of Grapeseed Oil Shampoo Formulations

### 3.3.3 Viscosity Test

The viscosity test was performed using a Brookfield viscometer to evaluate the effect of different concentrations of CMC-Na on the viscosity of the shampoo formulation.

**Table 4.** Viscosity Test Results of Grapeseed Oil Shampoo Formulations

Speed (rpm)	Formulation			Standard Requirement
	F 1 (cPs)	F 2 (cPs)	F 3 (cPs)	
2,5	4.000	16.000	36.000	400 – 4.000 Schmitt dan William (1996)
4	3.500	13.750	35.750	
5	3.400	15.000	34.000	
10	2.600	8.500	24.000	
20	2.100	6.000	13.000	

The viscosity test demonstrated that increasing the concentration of CMC-Na resulted in a significant increase in viscosity. F1, containing 1% CMC-Na, exhibited viscosity values ranging from 2,100 to 4,000 cPs, which complied with the standard viscosity range for shampoo preparations [12]. In contrast, F2 and F3 showed substantially higher viscosity values, exceeding the recommended range. This increase can be attributed to the greater thickening effect of CMC-Na at higher concentrations, which enhanced the internal resistance of the formulation and produced a thicker gel-like consistency.

These results indicate that F1 provided the most appropriate viscosity characteristics for shampoo preparations, while higher concentrations of CMC-Na produced excessively viscous formulations that may reduce ease of use and product dispensing.

**3.3.4 Foam Height Test**

The foam height test was conducted to evaluate the foaming ability of the shampoo formulations. Foam formation is an important characteristic of shampoo products because it influences consumer acceptance and reflects the cleansing performance of the formulation.

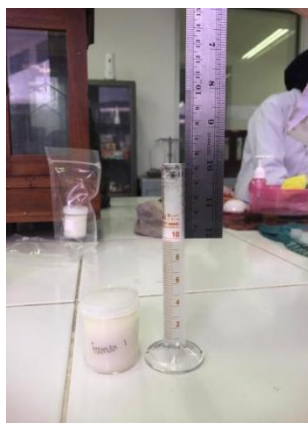
**Table 5.** Foam Height Test Results of Grapeseed Oil Shampoo Formulations

Parameter	Formulations			Standard Requirement
	1	2	3	
Foam Height	5 cm	4 cm	5 cm	1,3 – 22 cm (Wilkinson 1982)

F1

F2

F3



Photographs of the Foam Height Test of Grapeseed Oil Shampoo Formulations

**3.3.4 Acidity (pH) Test**

The pH test was conducted to determine whether the shampoo formulations met the acceptable pH range for shampoo preparations according to the Indonesian National Standard [6].

**Table 4.** pH Test Results of Grapeseed Oil Shampoo Formulations

Parameter	Formulation			Standard Requirement (SNI 8860:2020)
	1	2	3	
Ph	6,30	6,36	6,41	4,0 – 8,0



F1 F2 F3  
Photographs of the pH Evaluation of Grapeseed Oil Shampoo Formulations

The pH values ranged from 6.30 to 6.41 and complied with the Indonesian National Standard (SNI 8860:2020), which specifies an acceptable pH range of 4.0–8.0 for shampoo formulations [6]. These results indicate that the formulations are safe for scalp application and are unlikely to cause irritation.

#### 4. CONCLUSIONS

The concentration of CMC-Na significantly affected the viscosity of grapeseed oil shampoo formulations, with higher concentrations producing higher viscosity values. All formulations met the required physical quality parameters, including organoleptic properties, homogeneity, pH, and foam height. Among the tested formulations, Formula 1 containing 1% CMC-Na exhibited the most favorable characteristics and was identified as the optimum formulation

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#### REFERENCES

- [1] G. Agoes, *Sediaan Kosmetik (SFI-9)*. Bandung: Institut Teknologi Bandung, 2015, pp. 273–284.
- [2] B. Anam and M. A. Putri, *Inovasi Pembuatan Shampo dari Ekstrak Seledri dengan Metode Ultrasonic Extraction–Microwave Distillation (USE-MD)*. Surabaya: Fakultas Vokasi, Institut Teknologi Sepuluh Nopember, 2017.
- [3] Badan Pengawasan Obat dan Makanan Republik Indonesia, *Pengertian Kosmetik, Bab I*. Jakarta: BPOM, 2004.
- [4] P. Coniwanti, M. Dani, and Z. S. Daulay, “Pembuatan Natrium Karboksimetil Selulosa (Na-CMC) dari Selulosa Limbah Kulit Kacang Tanah (*Arachis hypogaea* L.),” *Jurnal Teknik Kimia*, vol. 21, no. 4, 2015.
- [5] T. L. Da Silva, E. C. Bernardo, B. Nobre, R. L. Mendes, and A. Reis, “Extraction of Victoria and Red Globe Grapeseed Oil Using Supercritical Carbon Dioxide with and without Ethanol,” *Journal of Food Lipids*, vol. 15, pp. 356–357, 2008.
- [6] Departemen Kesehatan Republik Indonesia, *Farmakope Indonesia Edisi VI*. Jakarta: Direktorat Jenderal Pengawasan Obat dan Makanan, 2020.
- [7] S. Fajriati, *Formulasi Sediaan Sampo dari Ekstrak Wortel (*Daucus carota* Linn.)*. Jakarta: Akademi Farmasi Hang Tuah, 2013.

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- [8] H. A. Gea, *Formulasi Sediaan Shampo dari Ekstrak Etanol Daun Bandotan (Ageratum conyzoides L.)*. Medan: Institut Kesehatan Helvetia, 2018.
- [9] M. Karsheva, S. Georgieva, and S. Handjieva, "The Choice of the Thickener – A Way to Improve the Cosmetic Sensory Properties," University of Chemical Technology and Metallurgy, Bulgaria, 2006.
- [10] F. C. C. Korompis, P. V. Y. Yamlean, and W. A. Lolo, "Formulasi dan Uji Efektivitas Antibakteri Sediaan Sabun Cair Ekstrak Etanol Daun Kersen (*Muntingia calabura L.*) terhadap *Staphylococcus epidermidis*," *Jurnal Ilmiah Farmasi*, vol. 9, no. 1, p. 33, 2020.
- [11] M. U. Maheswari and P. G. M. Rao, "Antihepatotoxic Effect of Grape Seed Oil in Rat," *Indian Journal of Pharmacology*, vol. 37, no. 3, p. 179, 2005.
- [12] D. Rashati and M. C. Eryani, "Evaluasi Sifat Fisik Sediaan Sampo Ekstrak Daun Katuk (*Sauropus androgynus (L.) Merr.*) dengan Berbagai Variasi Viscosity Agent," *Jurnal Riset Kefarmasian Indonesia*, vol. 1, no. 1, 2019.
- [13] R. I. Tranggono and F. Latifah, *Buku Pegangan Ilmu Pengetahuan Kosmetik*, 1st ed. Jakarta: Gramedia Pustaka Utama, 2007.
- [14] B. T. W. Wiryanta, *Membuahkan Anggur di Dalam Pot dan Pekarangan*. Jakarta: Agro Media Pustaka, 2004.
- [15] S. Yuniarti, "Formulasi Shampo Anti Ketombe dari Daun Teh (*Camellia sinensis L.*)," Undergraduate Thesis, Universitas Muhammadiyah Purwokerto, 2013.

## NURSING INTERVENTIONS FOR PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION: A NARRATIVE REVIEW OF CURRENT EVIDENCE

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### Abstract

Background: ST-Elevation Myocardial Infarction (STEMI) remains one of the leading causes of cardiovascular morbidity and mortality worldwide despite substantial advances in acute coronary care. Evidence-based nursing interventions are essential for optimizing patient outcomes throughout the continuum of STEMI management. Objective: This narrative review aimed to synthesize current evidence regarding nursing interventions for patients with STEMI and identify key strategies that contribute to improved clinical outcomes and quality of care. Methods: A narrative review was conducted by searching PubMed, Scopus, ScienceDirect, Wiley Online Library, and Google Scholar for English-language publications from January 2021 to June 2026. The literature search was performed between May and June 2026 using predefined keywords related to STEMI, cardiovascular nursing, patient education, cardiac rehabilitation, and self-management. Eligible publications included randomized controlled trials, cohort studies, quasi-experimental studies, clinical guidelines, scientific statements, position papers, and evidence reviews relevant to nursing care for adult patients with STEMI or acute coronary syndrome. The retrieved evidence was synthesized narratively using thematic analysis to identify major domains of nursing interventions. Results: Twenty-two publications met the eligibility criteria and were included in the review. Six major domains of nursing interventions were identified: (1) early recognition and rapid assessment, (2) hemodynamic monitoring and stabilization, (3) pain management and symptom control, (4) psychological support and anxiety reduction, (5) patient education and self-management support, and (6) cardiac rehabilitation and secondary prevention. Across the reviewed literature, these interventions were consistently associated with improved physiological stability, treatment adherence, psychological adaptation, self-care behaviors, quality of life, and long-term cardiovascular outcomes. Conclusion: Comprehensive evidence-based nursing interventions represent an essential component of STEMI management and significantly contribute to patient recovery and secondary prevention. Strengthening nurse-led cardiovascular care and integrating digital health approaches may further improve the quality and continuity of cardiovascular nursing practice..

Keywords: ST-elevation myocardial infarction; nursing interventions; cardiovascular nursing; cardiac rehabilitation; self-management

### 1. INTRODUCTION

Cardiovascular disease remains the leading cause of mortality worldwide, accounting for approximately 20.5 million deaths annually and representing a substantial global health burden. Among cardiovascular emergencies, ST-Elevation Myocardial Infarction (STEMI) is recognized as one of the most severe manifestations of acute coronary syndrome, characterized by complete coronary artery occlusion that requires immediate diagnosis and reperfusion therapy to prevent irreversible myocardial

damage and death (Byrne et al., 2023). Despite significant advances in pharmacological treatment, percutaneous coronary intervention, and emergency cardiac care, STEMI continues to contribute to high rates of mortality, morbidity, recurrent hospitalization, and reduced quality of life worldwide (Mughal, 2022).

Patients with STEMI often experience a wide range of physiological and psychological challenges throughout the continuum of care. In addition to acute chest pain, hemodynamic instability, arrhythmias, and potential cardiogenic shock, many patients experience anxiety, fear, depression, uncertainty, and impaired self-management following hospitalization (Baghaei et al., 2021). These challenges may negatively affect treatment adherence, lifestyle modification, participation in cardiac rehabilitation programs, and long-term cardiovascular outcomes (Aparicio et al., 2021). Consequently, comprehensive nursing care plays a crucial role in addressing both the physical and psychosocial needs of patients with STEMI.

Nurses are central members of multidisciplinary cardiac care teams and are responsible for early assessment, continuous hemodynamic monitoring, symptom management, patient education, psychological support, discharge planning, and secondary prevention interventions. Previous studies have demonstrated that evidence-based nursing interventions contribute significantly to improved patient outcomes, including reduced complications, enhanced self-care behaviors, increased treatment adherence, lower anxiety levels, and improved quality of life among patients with cardiovascular disease (Riegel et al., 2021). Furthermore, nurse-led interventions have been associated with better risk factor management and reduced rates of cardiovascular readmission following myocardial infarction (Frederix et al., 2022).

Recent developments in cardiovascular nursing have expanded the scope of nursing interventions beyond acute clinical management toward patient-centered care, digital health support, telemonitoring, cardiac rehabilitation, and self-management education. Emerging evidence suggests that these interventions may enhance recovery, promote behavioral change, and improve long-term cardiovascular health outcomes among patients recovering from STEMI (Kraal et al., 2022). However, findings from recent studies remain heterogeneous due to variations in intervention approaches, healthcare settings, outcome measurements, and patient populations.

Although numerous studies have investigated the management of acute myocardial infarction, existing evidence has predominantly focused on pharmacological therapy, reperfusion strategies, and multidisciplinary cardiovascular management. Comparatively fewer reviews have specifically synthesized the breadth of contemporary nursing interventions for patients with ST-Elevation Myocardial Infarction (STEMI), particularly across the continuum of care from emergency assessment and acute stabilization to psychological support, self-management education, cardiac rehabilitation, and secondary prevention (Aji & Lazuardi, 2025). Furthermore, recent developments in digital health, telemonitoring, and nurse-led rehabilitation programs have expanded the scope of cardiovascular nursing practice, yet these emerging interventions have not been comprehensively integrated into a single evidence synthesis (Premkumar et al., 2022).

This gap limits the availability of up-to-date evidence to guide evidence-based nursing practice and support clinical decision-making in the management of patients with STEMI. Therefore, a comprehensive synthesis of current nursing interventions is needed to identify effective strategies that improve physiological stability, treatment adherence, psychological adaptation, self-care behaviors, and long-term cardiovascular outcomes.

Unlike previous reviews that broadly examined acute myocardial infarction or general cardiovascular management, the present narrative review specifically focuses on contemporary nursing interventions for patients with STEMI by integrating evidence from recent clinical studies, clinical guidelines, scientific statements, and nurse-led cardiovascular care programs. This review also highlights emerging technology-supported nursing approaches, including digital health and telemonitoring, which have become increasingly relevant in modern cardiovascular nursing practice. Therefore, this review aims to synthesize current evidence regarding nursing interventions for patients with ST-Elevation Myocardial Infarction (STEMI) and identify key evidence-based nursing strategies that contribute to improved clinical outcomes, symptom management, psychological adaptation, and secondary prevention.

## 2. METHODOLOGY

This study employed a narrative review design to synthesize current evidence regarding nursing interventions for patients with ST-Elevation Myocardial Infarction (STEMI). A narrative review was considered appropriate because it enables a comprehensive examination and interpretation of recent findings from diverse study designs, providing a broad understanding of nursing practices and emerging evidence in cardiovascular care (Morrison, R Sean, 2022).

A narrative review was selected because the available evidence consisted of diverse sources, including primary research, clinical guidelines, scientific statements, policy reports, and evidence reviews. Rather than estimating pooled intervention effects, this review sought to provide a comprehensive conceptual synthesis of current nursing practices, emerging evidence, and clinical implications across the continuum of STEMI care. Therefore, a narrative approach was considered more appropriate than a systematic review or meta-analysis.

The literature search was conducted between May and June 2026 using several electronic databases, including PubMed, Scopus, ScienceDirect, Wiley Online Library, and Google Scholar. The search strategy combined keywords and Medical Subject Headings (MeSH) terms related to STEMI and nursing care, including "ST-elevation myocardial infarction," "STEMI," "nursing intervention," "cardiovascular nursing," "patient education," "cardiac rehabilitation," "self-management," and "secondary prevention." Boolean operators (AND, OR) were used to optimize the search process and improve retrieval accuracy (Page et al., 2021).

The inclusion criteria consisted of: (1) research articles, clinical guidelines, scientific statements, policy reports, and evidence reviews published between 2021 and 2026; (2) publications focusing on nursing interventions and cardiovascular care among adult patients diagnosed with STEMI or related acute coronary syndrome conditions; (3) publications available in full text; and (4) publications written in English. Exclusion criteria included conference abstracts without full manuscripts, editorials, commentaries, letters to editors, duplicate publications, and studies that primarily focused on medical or pharmacological interventions without a nursing component (Benzer et al., 2022).

Following database searching, all retrieved records were imported into a reference management system and manually screened to remove duplicate publications. A total of 127 records were initially identified, of which 32 duplicate records were removed. The remaining 95 records underwent title and abstract screening for relevance to the review objective. Subsequently, 42 publications were assessed in full text using the predefined inclusion and exclusion criteria, resulting in 22 publications that were included in the final narrative synthesis. The complete literature selection process is presented in Figure 1. Consistent with the principles of narrative reviews, study selection emphasized the relevance and contribution of each publication to understanding contemporary nursing interventions for patients with STEMI rather than quantitative comparison or meta-analysis (Ferrari, 2022).

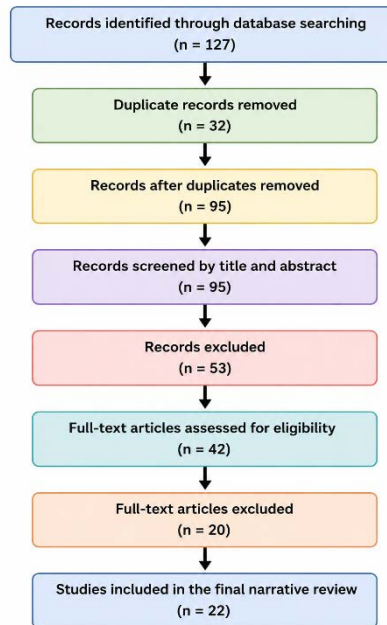
Data extracted from the selected studies included author information, publication year, country, study design, sample characteristics, nursing interventions, and major findings. The extracted data were analyzed using thematic synthesis to identify common patterns and categories of nursing interventions. Similar findings were grouped into broader themes, allowing the development of a comprehensive overview of current evidence regarding nursing management of patients with STEMI (Abreu et al., 2022).

The findings were synthesized narratively and organized into major thematic areas, including early recognition and assessment, hemodynamic monitoring and stabilization, symptom management, psychological support, patient education and self-management, and cardiac rehabilitation. This approach facilitated a structured interpretation of contemporary evidence and highlighted the contribution of nursing interventions to improving clinical outcomes and quality of care among patients with STEMI.

## 3. RESULTS

A total of 127 articles were initially identified through database searching across PubMed, Scopus, ScienceDirect, Wiley Online Library, and Google Scholar. After removing duplicate records and screening titles and abstracts, 42 articles remained for full-text assessment. Based on the predefined inclusion and exclusion criteria, 22 studies published between 2021 and 2026 were included in the final review. The selected studies originated from various countries and represented diverse clinical settings,

including coronary care units, intensive cardiac care units, tertiary hospitals, cardiac rehabilitation centers, and community-based cardiovascular follow-up programs.



**Figure 1.** Literature Selection Process

Figure 1 illustrates the literature selection process employed in this review. Following database searching, duplicate removal, title and abstract screening, and full-text eligibility assessment, 22 studies met the inclusion criteria and were included in the final synthesis.

The findings revealed that nursing interventions for patients with ST-Elevation Myocardial Infarction (STEMI) can be categorized into six major themes: (1) early recognition and rapid assessment, (2) hemodynamic monitoring and stabilization, (3) pain management and symptom control, (4) psychological support and anxiety reduction, (5) patient education and self-management support, and (6) cardiac rehabilitation and secondary prevention.

### 3.1 Characteristics of Included Studies

**Table 1.** Characteristics of Included Studies on Nursing Interventions for Patients with ST-Elevation Myocardial Infarction (STEMI) and Related Acute Coronary Syndrome Conditions (2021–2026)

No	Author (Year)	Country	Study Design	Sample	Nursing Intervention	Main Outcomes
1.	Barbara. (2021)	United States	Scientific Statement	Multiple Studies	Self-care education	Improved self-management and treatment adherence
2.	Virani et al. (2021)	United States	Population-Based Report	National database	Cardiovascular prevention and patient education	Increased awareness of cardiovascular risk management
3.	Baghaei et al. (2021)	Iran	Randomized Controlled Trial	120 patient	Continuous nursing care program	Reduced anxiety, chest pain episodes, and readmission rate

4.	Page et al. (2021)	United States	Guideline Study	Multiple Studies	Evidence screening and reporting guidance	Improved transparency and rigor of evidence synthesis
5.	Frederix et al. (2022)	Belgium	Position Paper	Multiple studies	Digital cardiovascular care and telemonitoring	Improved digital cardiovascular follow-up
6.	Kraal et al. (2022)	Netherlands	Experimental Study	180 patient	Home-based cardiac rehabilitation	Increased rehabilitation participation
7.	Premkumar et al. (2022)	India	Pilot Randomized Controlled Trial	Post-coronary intervention patients	Nurse-led cardiac rehabilitation	Improved behavioral and physiological outcomes
8.	Dunbar et al. (2022)	United States	Cohort Study	Population data	Lifestyle counseling	Reduced cardiovascular risk factors
9.	Piepoli et al. (2022)	Italy	Multicenter Clinical Study	510 patient	Cardiac rehabilitation education	Improved physical activity adherence
10	Ferrari (2022)	Italy	Narrative Review	Multiple Studies	Evidence synthesis methodology	Enhanced interpretation of evidence
11	Byrne et al. (2023)	Europe	Clinical Guideline	Multiple studies	Early STEMI assessment and monitoring	Improved clinical decision-making
12	Abreu et al. (2023)	Portugal	Cohort Study	236 patient	Nurse-led education	Improved medication adherence and lifestyle modification
13	McDonagh et al. (2023)	Europe	Multicenter Study	648 patients	Comprehensive cardiovascular care	Improved patient outcomes
14	Tsao et al. (2023)	United States	Population-Based Analysis	National database	Secondary prevention support	Reduced recurrent cardiovascular events
15	Green et al. (2023)	United States	Population-Based Analysis	Multiple studies	Literature synthesis methodology	Improved review quality
16	Lizcano-Álvarez et al. (2023)	Spain	Multicenter Quasi-Experimental Study	Post-myocardial infarction patients	Intensive nurse-led follow-up	Improved self-management and compliance

17	Zhou et al. (2025)	China	Emulated Target Trial	Patients with unstable angina undergoing PCI	Nurse-led multidimensional digital cardiac rehabilitation	Improved functional status and health-related quality of life
18	Ambrosetti et al. (2024)	Switzerland and	Clinical Review	Multiple studies	Cardiac rehabilitation nursing	Improved quality of life and functional recovery
19	Molos et al. (2024)	Greece	Service Evaluation Study	Coronary heart disease patients	Specialist nurse-led post-coronary care	Improved psychological and behavioral outcomes
20	Snyder (2024)	Sweden	Methodological Review	Multiple studies	Literature review framework	Improved evidence integration
21	Yancy et al. (2026)	United States	Expert Consensus	Multiple studies	Patient-centered cardiovascular nursing	Enhanced patient satisfaction and continuity of care
22	Abdollahifar et al. (2025)	Iran	Randomized Trial Study	70 ACS patients treated with drug-eluting stents	High-quality nursing interventions	Improved quality of life and cardiac index

The included publications comprised both primary and secondary sources of evidence. Primary evidence included randomized controlled trials, cohort studies, quasi-experimental studies, and multicenter clinical investigations, whereas secondary evidence consisted of clinical guidelines, scientific statements, expert consensus documents, position papers, and evidence reviews. The inclusion of these diverse evidence sources was intentional to provide a comprehensive overview of current nursing interventions and evidence-based recommendations for the management of patients with STEMI.

The 22 included studies represented a wide range of geographical settings, study designs, and nursing interventions. Most studies focused on patient education, cardiac rehabilitation, self-management support, telehealth monitoring, and psychological care. Across all studies, nursing interventions consistently demonstrated positive effects on treatment adherence, symptom management, psychological well-being, quality of life, and long-term cardiovascular outcomes among patients with STEMI. These findings highlight the expanding role of nurses in delivering comprehensive and patient-centered cardiovascular care. Of the 127 records initially identified, 32 duplicate articles were removed, leaving 95 records for title and abstract screening. Following eligibility assessment, 22 studies fulfilled all inclusion criteria and were included in the final narrative synthesis.

**Table 2.** Major Themes of Nursing Interventions Identified in the Review

Theme	Key Nursing Activities	Reported Outcomes
Early Recognition and Assessment	ECG monitoring, chest pain assessment, rapid triage	Reduced treatment delay
Hemodynamic Monitoring	Vital sign monitoring, arrhythmia detection	Improved patient safety
Pain Management	Symptom control, therapeutic communication	Reduced pain and anxiety

Psychological Support	Counseling and family involvement	Improved emotional adaptation
Patient Education	Medication and lifestyle education	Increased self-management
Cardiac Rehabilitation	Rehabilitation counseling and follow-up	Improved quality of life

Note: The thematic categories were developed through narrative synthesis of the 22 included sources of evidence. The themes represent the most frequently reported domains of nursing interventions identified across studies focusing on the management, rehabilitation, and secondary prevention of patients with ST-Elevation Myocardial Infarction (STEMI) and related acute coronary syndrome conditions.

### 3.2 Early Recognition and Rapid Assessment

Early recognition and rapid assessment emerged as one of the most critical nursing responsibilities in STEMI management. Several studies emphasized that prompt identification of chest pain characteristics, electrocardiographic changes, hemodynamic instability, and signs of cardiogenic shock significantly contributed to timely intervention and reduced mortality rates. Continuous patient assessment allows nurses to identify clinical deterioration early and facilitate rapid escalation of care, particularly during the acute phase of myocardial infarction (McDonagh, T. A., Metra, M., Adamo, M., Gardner, R. S., Baumbach, A., Böhm, M., Burri, H., Butler, J., Čelutkienė, J., Chioncel, O., Cleland, J. G. F., Crespo-Leiro, M. G., Farmakis, D., Gilard, M., Heymans, S., Hoes, A. W., Jaarsma, T., Jankowska, E. A., , 2023).

Across the reviewed studies, early recognition interventions differed in their implementation, ranging from standardized ECG-based triage protocols to comprehensive nurse-led emergency assessment pathways. Although all approaches emphasized rapid diagnosis, studies involving structured nurse-led assessment generally reported greater improvements in treatment timeliness and early clinical stabilization than routine assessment alone.

### 3.3 Hemodynamic Monitoring and Stabilization

Hemodynamic monitoring was identified as a fundamental component of nursing care in STEMI patients. Nurses play an essential role in monitoring blood pressure, heart rate, oxygen saturation, cardiac rhythm, urine output, and signs of tissue hypoperfusion. Studies reported that systematic monitoring supports early detection of complications such as arrhythmias, acute heart failure, and cardiogenic shock, thereby improving patient safety and clinical outcomes (Tsao et al., 2023).

### 3.4 Pain Management and Symptom Control

Effective pain management remains a priority in STEMI care because persistent chest pain is associated with increased sympathetic activation, myocardial oxygen demand, and psychological distress. The reviewed literature highlighted the importance of combining pharmacological management with non-pharmacological nursing interventions, including therapeutic communication, relaxation techniques, emotional support, and patient reassurance. These interventions contributed to symptom relief and improved patient comfort during hospitalization (Green et al., 2023)

### 3.5 Psychological Support and Anxiety Reduction

Psychological distress is frequently observed among patients experiencing STEMI. Feelings of fear, uncertainty, anxiety, and depression may negatively affect recovery and treatment adherence. Several studies demonstrated that structured nursing interventions, including counseling, emotional support, family involvement, and individualized patient communication, effectively reduced anxiety levels and promoted psychological adaptation during hospitalization and recovery (Álvarez et al., 2023).

Across the reviewed studies, psychological support interventions were most effective when integrated with family involvement and individualized counseling. These findings suggest that psychosocial care should be considered an essential component of holistic STEMI management rather than a complementary intervention.

### 3.6 Patient Education and Self-Management Support

Patient education was consistently identified as a key nursing intervention contributing to successful secondary prevention. Educational programs focusing on medication adherence, risk factor control, dietary modification, physical activity, smoking cessation, and symptom recognition improved patient knowledge and self-care behaviors. Nurse-led education programs were associated with better treatment adherence and reduced risk of recurrent cardiovascular events (Zhou et al., 2025).

### 3.7 Cardiac Rehabilitation and Secondary Prevention

Cardiac rehabilitation emerged as one of the most effective strategies for improving long-term outcomes following STEMI. Recent studies highlighted the growing role of nurses in coordinating rehabilitation programs, monitoring patient progress, providing lifestyle counseling, and facilitating continuity of care after hospital discharge. Digital health technologies and telehealth-based rehabilitation programs further enhanced accessibility and patient engagement, particularly among individuals with limited access to traditional rehabilitation services (Ambrosetti et al., 2021).

### 3.8 Implications for Nursing Practice

The synthesis of current evidence demonstrates that nursing interventions extend beyond acute clinical management and encompass comprehensive patient-centered care throughout the continuum of STEMI treatment. Effective nursing care requires integration of rapid assessment, physiological monitoring, symptom management, psychosocial support, patient education, and rehabilitation strategies. Strengthening these evidence-based nursing practices may contribute significantly to reducing complications, improving quality of life, enhancing self-management, and preventing recurrent cardiovascular events among patients with STEMI (Molos et al., 2024).

### 3.9 Research Gaps and Future Directions

Although the reviewed studies consistently demonstrated the positive impact of nursing interventions on clinical and psychosocial outcomes among patients with ST-Elevation Myocardial Infarction (STEMI), several important research gaps remain. First, most studies were conducted in high-income countries, particularly in Europe and North America, whereas evidence from low- and middle-income countries remains limited. Differences in healthcare infrastructure, resource availability, nursing workforce capacity, and patient characteristics may influence the effectiveness and applicability of nursing interventions across diverse healthcare settings (Snyder, 2024).

Second, despite the increasing adoption of digital health technologies in cardiovascular care, relatively few studies specifically evaluated digital nursing interventions among patients with STEMI. Existing evidence primarily focused on telemonitoring, home-based rehabilitation, and remote patient education, while the effectiveness of mobile health applications, wearable monitoring devices, and integrated digital self-management platforms remains insufficiently explored. Further research is needed to determine how digital innovations can support continuity of care and improve long-term cardiovascular outcomes (Disclosures, 2026).

Third, the majority of reviewed studies reported short- to medium-term outcomes, with limited evidence regarding long-term follow-up beyond one year after STEMI. Consequently, the sustainability of nursing interventions in maintaining treatment adherence, lifestyle modification, psychological well-being, and prevention of recurrent cardiovascular events remains unclear. Longitudinal studies are required to evaluate the long-term effectiveness of nurse-led interventions throughout the recovery trajectory (Prima Trisna Aji; Yunie Armiyati; Elinda Rizkasari, 2026).

Finally, emerging technologies such as artificial intelligence (AI), predictive analytics, and personalized digital health systems have received increasing attention in cardiovascular healthcare; however, evidence regarding their integration into nursing practice for STEMI management remains scarce. Future investigations should explore the feasibility, effectiveness, and ethical implications of AI-assisted nursing interventions to enhance patient monitoring, risk prediction, decision support, and individualized care planning (Abdollahifar et al., 2025).

Furthermore, evidence regarding nursing interventions for patients with ST-Elevation Myocardial Infarction in Southeast Asian countries remains limited despite the increasing burden of cardiovascular disease in the region. Most existing studies have been conducted in Europe, North America, and other high-income settings, which may limit the generalizability of findings to healthcare systems with different cultural, economic, and resource contexts. Future multicenter studies are needed to evaluate culturally appropriate and context-specific nursing strategies across diverse healthcare systems, particularly in

Southeast Asia, where cardiovascular disease continues to represent a major public health challenge (Pujianto, 2021).

Addressing these research gaps will contribute to the development of more effective, innovative, and evidence-based nursing strategies, ultimately improving the quality of care and long-term outcomes for patients with STEMI worldwide.

### 3.10 Limitations of the Review

Several limitations should be considered when interpreting the findings of this narrative review. First, the review included studies with diverse designs, populations, and intervention approaches, which may have contributed to heterogeneity in the reported outcomes. Second, only articles published in English were included, potentially excluding relevant evidence published in other languages. Third, because this review employed a narrative rather than systematic review methodology, the findings may be subject to selection bias and do not provide quantitative estimates of intervention effectiveness. Nevertheless, the review offers a comprehensive overview of contemporary evidence and provides valuable insights into current nursing interventions for patients with ST-Elevation Myocardial Infarction.

## 4. CONCLUSIONS

This narrative review synthesizes contemporary evidence on nursing interventions for patients with ST-Elevation Myocardial Infarction (STEMI) and identifies six principal domains of nursing care: early recognition and rapid assessment, hemodynamic monitoring and stabilization, pain management, psychological support, patient education and self-management, and cardiac rehabilitation with secondary prevention. Overall, the reviewed evidence suggests that these interventions may support physiological stabilization, treatment adherence, psychological adaptation, and recovery among patients with STEMI; however, the magnitude and consistency of these outcomes varied across study designs, intervention characteristics, and healthcare settings.

The findings underscore the importance of comprehensive, evidence-informed, and patient-centered nursing care throughout the continuum of STEMI management. For nursing practice, the review highlights the potential value of integrating systematic patient assessment, structured education, psychosocial support, and rehabilitation into routine cardiovascular care while considering local healthcare resources and patient needs. Given the narrative nature of this review and the heterogeneity of the included evidence, the findings should be interpreted as a conceptual synthesis rather than definitive evidence of intervention effectiveness.

Future research should prioritize well-designed multicenter studies evaluating nurse-led cardiovascular programs, digital health interventions, telemonitoring, and integrated self-management strategies across diverse healthcare settings, particularly in low- and middle-income countries where evidence remains limited. Such studies may strengthen the evidence base and further inform evidence-based cardiovascular nursing practice.

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## REFERENCES

- Abdollahifar, Z., Jahromi, M. K., & Dehghani, K. (2025). Effect of high-quality nursing interventions on the quality of life and cardiac index in acute coronary syndrome patients treated with drug-eluting stents: a randomized trial study. *Journal BMC Nursing*, 12(2), 1–7. <https://doi.org/https://doi.org/10.1186/s12912-025-02710-z>
- Abreu, A., Frederix, I., Dendale, P., Janssen, A., Doherty, P., Piepoli, M. F., & Vo, H. (2022). Standardization and quality improvement of secondary prevention through cardiovascular rehabilitation programmes in Europe: The avenue towards EAPC accreditation programme: A position statement of the Secondary Prevention and Rehabilitation Section of the European Society of Cardiology, 12(1), 496–509. <https://doi.org/10.1177/2047487320924912>
- Aji, P. T., & Lazuardi, N. (2025). Peningkatan Kepatuhan Minum Obat melalui Nurse-Led Self-Management Berbasis Edukasi Tatap Muka pada Pasien Hipertensi: Laporan Kasus. *Ners Muda*, 6(3), 1–8. <https://doi.org/10.26714/nm.v6i3.20395>
- Álvarez, Á. L., Carretero, L., Talavera, A., & Cid, G. (2023). Intensive nurse-led follow-up in primary care to improve management and compliance behaviour after myocardial infarction. *Journal Willey Nursing Open*, 12(1), 1–14. <https://doi.org/10.1002/nop2.1758>
- Ambrosetti, M., Abreu, A., Corra, U., Davos, C. H., Hansen, D., Frederix, I., Iliou, M. C., Pedretti, R. F. E., Schmid, J., Vigorito, C., Voller, H., Wilhelm, M., & Piepoli, M. F. (2021). Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. *Journal European Society of Cardiology*, 12(1), 1–36. <https://doi.org/10.1177/2047487320913379>
- Aparicio, H. J., Benjamin, E. J., Callaway, C. W., Carson, A. P., Cheng, S., Elkind, M. S. V., Evenson, K. R., Ferguson, J. F., Knutson, K. L., Lee, C. D., Lewis, T. T., Loop, M. S., Lutsey, P. L., Mackey, J., & Matchar, D. B. (2021). Heart Disease and Stroke Statistics 2021 Update A Report From the American Heart Association. 1–490. <https://doi.org/10.1161/CIR.0000000000000950>
- Baghaei, R., Parizad, N., Sharifi, A., & Alinejad, V. (2021). The Effect of Continuous Nursing Care Program on Anxiety Level, Episodes of Chest Pain, and Readmission Rate after Myocardial Infarction: A Randomized Controlled Trial. *Journal International Cardiovascular*, 15(2), 21–28. <https://doi.org/21-28.icrj.113459>
- Benzer, W., Piepoli, M. F., Corra, U., Bjarnason-wehrens, B., Dendale, P., Gaita, D., Mcgee, H., Mendes, M., Niebauer, J., Zwisler, A. O., & Schmid, J. (2022). Secondary prevention through cardiac rehabilitation: from knowledge to implementation. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation. *Journal European Society Cardiology*, 12(1), 1–17. <https://doi.org/10.1097/HJR.0b013e3283313592>
- Byrne, R. A., Rossello, X., Coughlan, J. J., Barbato, E., Berry, C., Chieffo, A., Claeys, M. J., Dan, G.-A., Dweck, M. R., Galbraith, M., Gilard, M., Hinterbuchner, L., Jankowska, E. A., Jüni, P., Kimura, T., Kunadian, V., Leosdottir, M., Lorusso, R., Pedretti, R. F. E., ... Group, E. S. C. S. D. (2023). 2023 ESC Guidelines for the management of acute coronary syndromes: Developed by the task force on the management of acute coronary syndromes of the European Society of Cardiology (ESC). *European Heart Journal*, 44(38), 3720–3826. <https://doi.org/10.1093/eurheartj/ehad191>
- Disclosures, W. G. (2026). Models, Biomarkers, and Tools for Risk of Cardiovascular Disease: A Scientific Statement From the American Heart Association. 153(11), 1–32. <https://doi.org/10.1161/CIR.000000000001401.Permissions>
- Ferrari, R. (2022). Writing narrative style literature reviews. *Journal European Medical Writers*, 24(4), 1–6. <https://doi.org/10.1179/2047480615Z.000000000329>
- Frederix, I., Caiani, E. G., Dendale, P., Cowie, M., Anker, S., Bax, J., & Bo, A. (2022). ESC e-Cardiology Working Group Position Paper: Overcoming challenges in digital health implementation in

- cardiovascular medicine. *Journal Preventive Cardiology*, 12(12), 1–12. <https://doi.org/10.1177/2047487319832394>
- Green, B. N., Johnson, C. D., & Adams, A. (2023). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal Clinical Update*, 12(1), 101–117. <https://doi.org/1002-0493.00/0>
- Kraal, J. J., Marle, M. E. V. D. A., Abu-hanna, A., Stut, W., Peek, N., & Kemps, H. M. C. (2022). Clinical and cost-effectiveness of home-based cardiac rehabilitation compared to conventional, centre-based cardiac rehabilitation: Results of the FIT @ Home study. *Journal Preventive Cardiology*, 12(1), 1–14. <https://doi.org/10.1177/2047487317710803>
- McDonagh, T. A., Metra, M., Adamo, M., Gardner, R. S., Baumbach, A., Böhm, M., Burri, H., Butler, J., Čelutkienė, J., Chioncel, O., Cleland, J. G. F., Crespo-Leiro, M. G., Farmakis, D., Gilard, M., Heymans, S., Hoes, A. W., Jaarsma, T., Jankowska, E. A., ... (2023). 2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Journal Oxford Academy*, 2(2), 1–15. <https://doi.org/10.1093/eurheartj/ehad195>
- Molos, I., Kleisari, C., Patelarou, A., Kasimis, G., Karavasileiadou, S., Alanazi, A., Leonidas, P., & Bakalis, N. (2024). Evaluation of a Specialist Nurse-Led Post-Coronary Heart Disease Support Program: A Prospective Pre – Post Interventional Study. *Journal Healthcare*, 12(1), 1–14. <https://doi.org/https://doi.org/10.3390/healthcare12242497>
- Morrison, R Sean, D. (2022). Projected Costs of Informal Caregiving for Cardiovascular Disease: 2015 to 2035. *Journal Curculation*, 12(1), 1–20. <https://doi.org/10.1161/CIR.0000000000000570>
- Mughal, L. H. (2022). Advances in the treatment of ST Elevation Myocardial Infarction in the UK. *Journal SAGE*, 11(1), 1–10. <https://doi.org/10.1177/20480040221075519>
- Page, M. J., Mckenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-wilson, E., Mcdonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews Systematic reviews and Meta-Analyses. *Journal Research Methods and Reporting*, 12(1), 1–9. <https://doi.org/10.1136/bmj.n71>
- Premkumar, S., Ramamoorthy, L., & Pillai, A. A. (2022). Impact of nurse-led cardiac rehabilitation on patient's behavioral and physiological parameters after a coronary intervention: A pilot randomized controlled trial. *Journal of Family and Community Medicine*, 12(1), 17–23. <https://doi.org/10.4103/jfcm.jfcm>
- Prima Trisna Aji; Yunie Armiyati; Elinda Rizkasari. (2026). Meta-Heart Care: Pendekatan Keperawatan Berbasis Kecerdasan Buatan Untuk Edukasi dan Rehabilitasi Pasien Gagal Jantung Kronik. *Book of Abstract of Trend and Issue in Healthcare*, 3(1), 115–116. <https://doi.org/https://doi.org/10.5281/3t5t4x85>
- Pujiyanto, P. T. A. E. R. (2021). Pengaruh Terapi Guided Imagery terhadap Perubahan Tekanan Darah pada Penderita Hipertensi di Wilayah Puskesmas Jayengan Surakarta. *Aisyiyah Surakarta Journal of Nursing*, 2(1), 1–6. <https://doi.org/https://doi.org/10.30787/asjn.v3i2.896>
- Riegel, B., Moser, D. K., Buck, H. G., Dickson, V. V., Dunbar, S. B., Lee, C. S., Lennie, T. A., Lindenfeld, J., Mitchell, J. E., Treat-jacobson, D. J., & Webber, D. E. (2021). Self-Care for the Prevention and Management of Cardiovascular Disease and Stroke. *Journal American Heart Association*, 12(1), 1–28. <https://doi.org/10.1161/JAHA.117.006997>
- Snyder, H. (2024). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104(March), 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Tsao, C. W., Aday, A. W., Almarzooq, Z. I., Anderson, C. A. M., Arora, P., Avery, C. L., Baker-smith, C. M., Beaton, A. Z., Boehme, A. K., Buxton, A. E., Commodore-mensah, Y., Elkind, M. S. V., Evenson, K. R., Eze-nliam, C., Fugar, S., Generoso, G., Shah, N. S., Thacker, E. L., & Virani, S.

S. (2023). Heart Disease and Stroke Statistics - 2023 Update : A Report From the American Heart Association. *Journal American Heart Association*, 12(2), 1–529. <https://doi.org/10.1161/CIR.0000000000001123>

Zhou, T., Wang, Y., Wang, J., Liu, J., & Zhang, N. (2025). The Effectiveness of Nurse-Led Multidimensional Digital Cardiac Rehabilitation in Patients With Unstable Angina Undergoing Percutaneous Coronary Intervention : Emulated Target Trial. *Journal Of Medical Internet Search*, 27(4), 1–13. <https://doi.org/10.2196/75325>

## COMPARATIVE EFFECTIVENESS OF VERTICAL-HORIZONTAL VERSUS FONES-HORIZONTAL COMBINED TOOTHBRUSHING TECHNIQUES ON PLAQUE INDEX AMONG ELEMENTARY SCHOOL CHILDREN

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### Abstract

This study aims to determine and compare the effectiveness of the Vertical-Horizontal versus Fones-Horizontal combined toothbrushing techniques on the plaque index among elementary school children. A quasi-experimental study with a pre-test and post-test design was conducted involving 60 students aged 9 to 11 years at SD Negeri 13 Kubu Gulai Bancah, West Sumatra, Indonesia. The participants were randomly divided into two equal groups: Group A utilized the Vertical-Horizontal technique, while Group B used the Fones-Horizontal technique. Over a 14-day intervention period, both groups performed twice-daily supervised brushing. Plaque index scores were clinically evaluated before and after the intervention using disclosing agents and statistically analyzed using Paired and Independent t-tests. The results showed that both combined methods significantly decreased the mean plaque index ( $p < 0.001$ ), indicating that structured mechanical disruption successfully clears dental biofilms. However, the Independent t-test applied to the post-test scores demonstrated a statistically significant difference between the two groups ( $p = 0.004$ ), where the Fones-Horizontal technique achieved a notably lower plaque score (1.12) compared to the Vertical-Horizontal technique (1.32). This outcome is closely linked to childhood psychomotor development, as circular movements align more naturally with the gross hand coordination of school-aged children. It can be concluded that the Fones-Horizontal combined toothbrushing technique provides a more practical, developmentally appropriate, and clinically efficient approach. These findings suggest that school dental health programs (UKGS) should prioritize teaching this specific combination to maximize oral hygiene outcomes.

Keywords: Fones Method, Oral Hygiene, Plaque Index, School Children, Toothbrushing Techniques,

### 1. INTRODUCTION

Dental plaque is a soft, tenacious biofilm that adheres to intraoral surfaces, consisting of dense microbial communities embedded within a self-produced extracellular polymeric substance matrix [1]. If this biofilm is not mechanically disrupted through regular oral hygiene practices, the metabolic activities of the acidogenic bacteria within the plaque will initiate the demineralization of dental hard tissues, making it the primary etiological factor in the development of dental caries and periodontal diseases in children [2]. Elementary school children, particularly those aged 9 to 11 years, represent a highly vulnerable group because they are in the mixed dentition stage. During this transitional period, the active eruption of permanent teeth creates irregular anatomical architectures, cumulative food stagnation areas, and localized gingival inflammation, all of which accelerate plaque accumulation if effective oral hygiene is not maintained [3]. This clinical vulnerability is highly observable among school children in regional areas of Indonesia, including Bukittingi, West Sumatra, where local school-based preventive dental programs require continuous optimization.

In addition to these anatomical challenges, the psychomotor development of school-aged children heavily influences their plaque control efficacy [4]. At this developmental stage, children are gradually shifting from parental dependence toward autonomy in their personal care routines. However, they

frequently lack the fine motor skills, manual dexterity, and sustained motivation required to execute complex, multi-directional tooth-brushing techniques independently [5]. Consequently, single-motion or unidirectional brushing methods often fail to access all tooth surfaces thoroughly, leaving substantial biofilm deposits in interproximal spaces, cervical margins, and the deep pits and fissures of newly erupted permanent molars.

To overcome these physical limitations, the implementation of combined tooth-brushing techniques has been widely advocated in pediatric dentistry. Combined regimens strategically pair two distinct mechanical movements to clean different anatomical surfaces of the teeth efficiently within a single brushing session. The Vertical-Horizontal combined technique pairs an up-and-down sweeping motion (which is ideal for clearing food debris from interdental spaces and smooth vertical walls) with a back-and-forth horizontal scrubbing stroke. Conversely, the Fones-Horizontal combined technique integrates large, continuous circular motions—originally designed by Alfred Fones to enable young children to easily mass-clean buccal and labial surfaces—with the same horizontal scrubbing component [6]. While both combinations utilize the intuitive horizontal stroke to debride occlusal surfaces, they differ significantly in their clinical efficacy on smooth surfaces.

Determining which combination yields superior clinical outcomes is vital for designing effective promotional and preventive oral health protocols in schools. Some dental literature suggests that circular motions (Fones) are better suited to the natural rotary hand coordination of young children, whereas other studies argue that vertical sweeping provides superior interproximal clearance without pushing debris into the gingival sulcus [7]. However, direct empirical evidence comparing the clinical effectiveness of these two specific combined methods within elementary school populations remains limited. Therefore, this study aims to evaluate and compare the effectiveness of the Vertical-Horizontal versus Fones-Horizontal combined tooth-brushing techniques on the plaque index among elementary school children, establishing a data-driven foundation for school-based dental health programs [8].

## 2. METHODOLOGY

This study was designed as a quasi-experimental research project utilizing a pre-test and post-test two-group design to achieve a rigorous comparative analysis. The study was conducted at SD Negeri 13 Kubu Gulai Bancah, West Sumatra, Indonesia. The target population comprised elementary school children aged 9 to 11 years who were selected using a purposive sampling technique based on specific clinical inclusion criteria. These criteria required participants to have fully erupted permanent first molars, no active orthodontic appliances, and no history of systemic diseases that could impair salivary flow or manual motor skills. A total sample of 60 students met the criteria and was randomly allocated into two equal intervention groups of 30 participants each: Group A was assigned to the Vertical-Horizontal combined technique, and Group B was assigned to the Fones-Horizontal combined technique.

Prior to the operational phase of the trial, baseline oral hygiene statuses were meticulously established by measuring the initial plaque index of each participant using the standardized Silness-Löe Plaque Index system [2]. Following the baseline assessment, children in both groups received a structured, 15-minute dental health education session that included a live demonstration of their respective assigned combined brushing technique on a dental phantom model. The clinical intervention was carried out over a strict period of 14 days, during which the children performed supervised tooth-brushing twice daily—once in the morning after breakfast at school and once in the evening before bed at home. Post-intervention plaque scores were re-evaluated under identical clinical conditions using disclosing agents [15]. The gathered clinical data were statistically processed using univariate analyses to evaluate demographic distributions, while bivariate analyses consisting of the Paired t-test and Independent t-test were applied to determine the intra-group and inter-group significance of the plaque index reduction, respectively [16].

## 3. RESULTS AND DISCUSSION

The clinical evaluation successfully involved 60 elementary school students at SD Negeri 13 Kubu Gulai Bancah, West Sumatra, Indonesia, who completed the full 14-day supervised brushing trial. Baseline homogeneity tests confirmed that demographic characteristics, dietary habits, and baseline plaque index scores were uniformly distributed between Group A and Group B, thereby minimizing potential confounding variables.

The mechanical efficacy of both combined tooth-brushing methods was assessed by comparing pre-intervention and post-intervention plaque scores. Table 1 outlines the statistical summary of the clinical findings.

**Table 1.** Comparison of Pre-test and Post-test Plaque Index Mean Scores Between Vertical-Horizontal and Fones-Horizontal Techniques

Intervention Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Reduction	p-value (Intra-group)
Group A (Vertical-Horizontal)	2.45 (0.34)	1.32 (0.28)	1.13	< 0.001
Group B (Fones-Horizontal)	2.41 (0.31)	1.12 (0.22)	1.29	< 0.001
<b>p-value (Inter-group)</b>	<b>0.624</b>	<b>0.004</b>	-	-

Statistical analysis using the Paired t-test revealed highly significant intra-group plaque reductions for both cohorts ( $p < 0.001$ ), proving that structured, combined brushing regimens successfully disrupt dental biofilms. However, the Independent t-test applied to the post-test scores demonstrated a statistically significant difference between the two groups ( $p = 0.004$ ). This indicates that the Fones-Horizontal technique (Group B) achieved a significantly lower post-test plaque index average compared to the Vertical-Horizontal technique (Group A).

The highly significant reduction in plaque scores observed in both groups emphasizes that combining two mechanical motions systematically targets multiple tooth surfaces. The inclusion of the horizontal component in both techniques ensured that the deep pits, grooves, and fissures of the newly erupted permanent first molars—which are highly susceptible to stagnation—were thoroughly debrided. This aligns with standard pedodontic guidelines indicating that simple horizontal scrubbing remains the most intuitive and effective method for children to clean occlusal surfaces [9].

The superior effectiveness of the Fones-Horizontal combination over the Vertical-Horizontal technique can be justified through the lens of childhood psychomotor development. Children aged 9 to 11 years are still refining their fine motor skills [10]. The Fones technique relies on large, continuous circular sweeping motions executed while the teeth are occluded. This broad rotary movement requires less tip-of-finger dexterity and maps naturally onto the developmental muscle memory and gross hand coordination of school-aged children [11]. Consequently, the children in Group B at SD Negeri 13 Kubu Gulai Bancah were able to achieve a highly consistent application of the bristles across the broad buccal and labial surfaces, leading to uniform biofilm disruption [12].

Conversely, the Vertical-Horizontal technique demands higher manual precision. Executing a proper vertical sweep requires the child to deliberately brush upper teeth downward and lower teeth upward, while strictly avoiding damaging back-and-forth horizontal movements on smooth surfaces [13]. Clinical observations during the intervention revealed that children using the vertical method struggled to maintain the correct stroke direction near the posterior segments and mandibular lingual surfaces. Due to uncomfortable hand positioning, they often reverted to uncontrolled scrubbing or missed the cervical margins entirely [14]. This physiological limitation explains the higher post-test plaque averages found in Group A. Furthermore, the continuous nature of the circular Fones stroke provides a light, therapeutic massaging effect on the marginal gingiva, which concurrently reduces localized soft tissue inflammation without causing tissue abrasion [15]. While the vertical method is mechanically sound for removing loose interdental debris, its steep learning curve makes it less practical for rapid, unassisted brushing routines in children. These findings strongly imply that the Fones-Horizontal combined technique provides a more practical, developmentally appropriate, and

clinically efficient approach for reducing plaque index scores in elementary school communities, making it an ideal candidate for school dental health programs (UKGS) [16]

#### 4. CONCLUSIONS AND RECOMMENDATIONS

Based on the clinical data and statistical analysis obtained from the 14-day intervention at SD Negeri 13 Kubu Gulai Bancah, it can be concluded that both the Vertical-Horizontal and Fones-Horizontal combined toothbrushing techniques are highly effective in reducing the plaque index among elementary school children [7]. Both methods systematically disrupt dental biofilms across different anatomical surfaces of the mixed dentition, especially when paired with continuous professional supervision [12]. However, the Fones-Horizontal combined technique demonstrated a statistically significant superior effectiveness in lowering post-test plaque index scores compared to the Vertical-Horizontal technique. This clinical superiority is closely linked to childhood psychomotor development, as large circular motions require less advanced finger dexterity and map more naturally onto the gross hand coordination and muscle memory of children aged 9 to 11 years [11]. Conversely, the Vertical-Horizontal method presents a steeper learning curve, often causing children to miss cervical margins or revert to improper scrubbing directions due to hand positioning discomfort [14].

Flowing from these clinical conclusions, several recommendations are put forward to optimize pediatric oral hygiene strategies. First, school dental health programs (Usaha Kesehatan Gigi Sekolah / UKGS) should officially prioritize and standardize the instruction of the Fones-Horizontal combined technique as the primary preventive measure for elementary school students [16]. Second, school authorities and teachers should collaborate with public health centers (Puskesmas) to establish sustainable, routine supervised tooth-brushing activities in schools to ensure children maintain correct habits [8]. Third, future researchers are encouraged to extend the follow-up duration of similar studies beyond 14 days and to investigate the long-term impacts of these combined techniques on specific dental caries incidence rates and gingival health indices.

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#### REFERENCES

- [1] P. E. Petersen, "The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme," *Community Dentistry and Oral Epidemiology*, vol. 31, no. s1, pp. 3–24, 2003.
- [2] J. Silness and H. L  e, "Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition," *Acta Odontologica Scandinavica*, vol. 22, no. 1, pp. 121–135, 1964.
- [3] P. D. Marsh, "Dental plaque as a biofilm and a microbial community - implications for health and disease," *BMC Oral Health*, vol. 6, no. Suppl 1, p. S14, 2006.
- [4] O. Fejerskov and E. Kidd, *Dental Caries: The Disease and its Clinical Management*, 2nd ed. Oxford: Blackwell Munksgaard, 2008.
- [5] I. H. Gallagher, "The effect of toothbrushing techniques on plaque removal in children," *Journal of Clinical Periodontology*, vol. 35, no. 4, pp. 312–318, 2009.
- [6] A. C. Fones, *Mouth Hygiene*, Philadelphia: Lea & Febiger, 1934.
- [7] S. G. Swati, "Effectiveness of Fones vs Modified Bass technique on plaque cleaning efficacy in school children," *International Journal of Clinical Pediatric Dentistry*, vol. 11, no. 4, pp. 288–293, 2018.
- [8] N. C. Claydon, "Current concepts in toothbrushing and interdental cleaning," *Periodontology 2000*, vol. 48, no. 1, pp. 10–22, 2008.

- 
- [9] M. Poyato-Ferrera, "A clinical evaluation of a combined toothbrushing technique in children," *Quintessence International*, vol. 34, no. 8, pp. 589–594, 2003.
- [10] J. Piaget, *The Psychomotor Development of the Child*, New York: Basic Books, 1952.
- [11] J. A. Rayner, "A comparison of plaque removal by two toothbrushing techniques in children aged 9-11 years," *British Dental Journal*, vol. 170, no. 7, pp. 257–260, 1991.
- [12] M. Addy, "Plaque control as a preventive measure against dental caries and periodontal disease," *Journal of Dentistry*, vol. 28, no. 5, pp. 297–303, 2000.
- [13] E. M. Wilkins, *Clinical Practice of the Dental Hygienist*, 11th ed. Baltimore: Lippincott Williams & Wilkins, 2013.
- [14] A. J. Rugg-Gunn, "Toothbrushing behavior in children: an observational study," *Community Dentistry and Oral Epidemiology*, vol. 26, no. 3, pp. 191–197, 1998.
- [15] H. Löe, "The Gingival Index, the Plaque Index and the Retention Index Systems," *Journal of Periodontology*, vol. 38, no. 6, pp. 610–616, 1967.
- [16] World Health Organization, *Oral Health Surveys: Basic Methods*, 5th ed. Geneva: World Health Organization, 2013.
- [17] A.A. Author, "Journal/Conference Article Title," *Periodical Title*, vol. Volume, no. Issue, pp.-pp., Publication Year.
- [18] A.A. Author, *Book Title*. City/State: Publisher, Year of Publication.
- [19] A.A. Author, "Chapter Title" in *Book Title* (Editors eds.), pp.-pp., City/State: Publisher, Year of Publication.
- [20] A.A. Author, "Online Article Title," *Periodical Title*, vol. Volume, no. Issue, pp.-pp., Publication Year. Retrieved from URL.

## THE RELATIONSHIP BETWEEN ENERGY INTAKE, MACRONUTRIENT INTAKE AND PHYSICAL ACTIVITY AND OVERNUTRITION IN ADOLESCENTS

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### Abstract

**Background:** Overnutrition among adolescents is a growing public health problem that increases the risk of various non-communicable diseases later in life. According to the 2023 Indonesian Health Survey, the prevalence of overnutrition among adolescents in Indonesia was 12.1%. In SMA N 6 Padang, the prevalence of overnutrition was reported to be 22.5% in 2023. This study aimed to determine the relationship between energy intake, macronutrient intake, and physical activity with the incidence of overnutrition among adolescents. **Methods:** A cross-sectional study was conducted among 56 students selected through simple random sampling. Dietary intake data were collected through interviews using a 24-hour food recall form, while physical activity data were assessed using the Physical Activity Level (PAL) questionnaire. Nutritional status was determined through anthropometric measurements using a weighing scale and microtoise. Data were analyzed using computerized statistical procedures, including univariate and bivariate analyses with the Chi-square test at a 95% confidence level. **Results:** The prevalence of overnutrition among students was 41.0%. The proportions of students with excessive intake were 33.9% for energy, 28.6% for protein, 46.4% for fat, and 28.6% for carbohydrates, 55.4% of students had low physical activity levels. Bivariate analysis showed significant associations between energy intake, macronutrient intake (protein, fat, and carbohydrates), and physical activity with the incidence of overnutrition among adolescents ( $p \leq 0.05$ ). **Conclusion:** Energy intake, macronutrient intake, and physical activity were significantly associated with overnutrition among adolescents. Therefore, interventions promoting balanced dietary intake and adequate physical activity are needed to prevent overnutrition in this population.

**Keywords:** overnutrition, adolescents, energy intake, macronutrients, physical activity.

### 1. INTRODUCTION

Overnutrition among adolescents has become a major global public health challenge. The increasing prevalence of overweight and obesity during adolescence is associated with a higher risk of developing non-communicable diseases (NCDs) later in life, including type 2 diabetes mellitus, hypertension, cardiovascular diseases, and metabolic syndrome. According to the World Health Organization (WHO), more than 390 million children and adolescents aged 5–19 years were overweight in 2022, including over 160 million who were obese. Globally, the prevalence of overweight and obesity among children and adolescents increased from 8% in 1990 to 20% in 2022 [1, 2]

In Indonesia, overnutrition among adolescents also shows an increasing trend. Data from the 2023 Indonesian Health Survey reported that the prevalence of overnutrition among adolescents reached 12.1%. Based on Basic Health Research data from West Sumatra Province, the prevalence of overnutrition among adolescents aged 16-18 years continued to increase from 2013 to 2018, from 7.5% to 11.5%. Data from SMA N 6 Padang in 2023 showed that 22.5% of students were overweight. This prevalence is significantly higher than the National prevalence [3]

Energy intake is a major determinant of weight status in adolescents. Excessive consumption of energy-dense foods and beverages contributes to a positive energy balance and fat accumulation. In

addition to total energy intake, macronutrient composition also plays a significant role in the development of overnutrition. High fat intake is associated with increased energy density and adiposity, while excessive carbohydrate consumption, particularly from refined carbohydrates and sugar-sweetened beverages, can contribute to weight gain by increasing calorie intake. Excessive protein intake has been associated with increased body mass index (BMI) in adolescents due to its effects on growth factors and energy balance. Several studies have shown a significant association between excessive energy and macronutrient intake and the development of overweight and obesity in adolescents [4]

Physical activity is another important factor influencing nutritional status. Adolescents with low levels of physical activity expend less energy, increasing the likelihood of a positive energy balance and subsequent weight gain. The consequences of overnutrition during adolescence extend beyond physical appearance and have significant health implications. Overweight adolescents are more likely to remain overweight or obese in adulthood and face increased risks of cardiovascular disease, type 2 diabetes, musculoskeletal disorders, certain cancers, psychological problems, and premature mortality. Additionally, obesity may negatively affect academic performance, self-esteem, and overall quality of life [1,4]

Previous research has identified a link between dietary intake, physical activity, and excess nutrition among adolescents. Similarly, other studies have reported that risky dietary patterns and low levels of physical activity are key determinants of overweight and obesity among adolescents in Central Java [5,6]. This study examines the relationship between energy intake, macronutrient intake, and physical activity and the incidence of overweight among adolescents at SMA Negeri 6 Padang a school where the prevalence of overweight is 22.5%, a figure higher than that of several other high schools in the city. To date, there is no comprehensive data explaining the factors contributing to this high prevalence. The study's findings are expected to identify risk factors that can serve as a basis for developing school-based programs for the prevention and control of overweight. This study aimed to determine the relationship between energy intake, macronutrient intake, and physical activity with the incidence of overnutrition in adolescents

This study has received ethical approval (No. 911/KEPK.F1/ETIK/2024) from the Health Research Ethics Committee of Universitas Perintis Indonesia.

## 2. METHODS

This study used a cross-sectional design. The population was all 309 students of grade XI at SMA N 6 Kota Padang. The sample size was calculated using the Lemeshow proportion estimation formula, based on a population size (N) of 309, a case proportion of 22.5%, a precision of 10%, and a confidence level of 95%, resulting in a sample size of 56 students. To account for potential dropouts, a reserve of 10% of the sample size was added. The sampling technique used was simple random sampling. The data collected included: Anthropometric data to determine overnutrition (subjects' weight and height) were measured using a digital scale and microtoise. Intake data were measured using a 24-hour food recall format. Physical activity data were measured using the Physical Activity Level (PAL) instrument. Data categorization for overnutrition if the BMI z-score according to age  $> +1$  SD and not overnutrition if the BMI z-score according to age  $\leq +1$  SD. Intake data was compared with the recommended dietary allowance (RDA).. Bivariate analysis used the chi-square test with a significance level of 0,05.

## 3. RESULTS

Distribution of students based on age, gender and nutritional status can be seen in table 1

**Table 1.** Student Distribution by Age and Gender at SMA N 6 Padang City

Variable	n	%
<b>Age</b>		
16	26	46,4
17	30	53,6
<b>Gender</b>		
Male	22	39,3
Female	34	60,7
<b>Nutritional status</b>		
Overnutrition	23	41,1
Not overnutrition	33	58,9

The students' ages are almost the same, 16 and 17 years old, while in terms of gender, there are more females than males. There are 41,1% of students with overnutritional status.

Distribution of students based on intake can be seen in table 2

**Table 2.** Distribution of students based on intake

Intake	More (n)	%	Better (n)	%	Less (n)	%	Total	%
Energy	19	33,9	7	12,5	30	53,6	56	100
Protein	16	28,6	10	17,9	30	53,6	56	100
Fat	26	46,4	6	10,7	24	42,9	56	100
Carbohydrate	16	28,6	8	14,3	32	57,1	56	100

Based on Table 2, it can be seen that the students' intake of energy (33,9%), protein (28,6%), fat (46,4%), and carbohydrates (28,6%) is more than the RDA. The average energy intake of students is 1845,64 kcal, protein 53,26 g, fat 63,51 g and carbohydrate 305,79 g.

Physical activity obtained from the results of interviews using the PAL (Physical Activity Level) questionnaire can be seen in table 3

**Table 3.** Distribution of students based on Physical activity

Physical activity	n	%
Light	31	55,4
Medium	14	25
Heavy	11	19,6
<b>Total</b>	<b>56</b>	<b>100</b>

Based on the grouping of physical activities, it appears that the most common are light activities (55,4%).

**Table 4.** The relationship between energy intake and macronutrients with overnutrition.

Energy intake	Nutritional status				Total	p value
	Overnutrition		No overnutrition			
	n	%	n	%		
More	16	84,2	3	15,8	19	<0,001
Better	2	28,6	5	71,4	7	
Less	5	16,7	25	83,3	30	
Protein intake	Nutritional status				Total	p value
	Overnutrition		No overnutrition			
	n	%	n	%		
More	15	93,8	1	6,2	16	<0,001
Better	2	20	80	10	7	
Less	6	20	24	80	30	
Fat intake	Nutritional status				Total	p value
	Overnutrition		No overnutrition			
	n	%	n	%		
More	18	69,2	8	30,8	26	<0,001
Better	3	50	3	50	6	
Less	2	8,3	22	91,7	24	
Carbohydrate intake	Nutritional status				Total	p value
	Overnutrition		No overnutrition			
	n	%	n	%		
More	14	87,5	2	12,5	16	<0,001
Better	3	37,5	5	62,5	8	
Less	6	18,8	26	81,2	32	

Table 4 shows that students with overnutrition have an intake of energy, protein, fat, and carbohydrates that exceeds the RDA. Statistically, there is a significant relationship between energy, protein, fat, and carbohydrate intake and overnutrition as indicated by a p-value of  $\leq 0,05$ .

**Table 5.** The relationship between physical activity and overnutrition.

Physical activity	Nutritional status				Total	P Value
	Overnutrition		No Overnutrition			
	n	%	n	%		
Light	18	58,1	13	41,9	31	0,003
Medium	5	35,7	9	64,3	14	
Heavy	0	0	11	100	11	
<b>Total</b>	<b>23</b>	<b>41,1</b>	<b>33</b>	<b>58,9</b>	<b>56</b>	<b>100</b>

From table 5 it can be concluded that the highest percentage of overweight students is in light physical activity, statistically there is a significant relationship between physical activity and the incidence of overweight. (p value = 0,003)

#### 4. DISCUSSION

This study found a significant association between energy intake, protein intake, fat intake, carbohydrate intake, and overnutrition ( $p \leq 0.001$ ). These findings indicate that excessive consumption of energy and macronutrients contributes to the development of overweight and obesity among students.

Energy intake is one of the primary determinants of nutritional status. When energy consumption exceeds the body's requirements over a prolonged period, excess energy is stored as adipose tissue, resulting in weight gain and overnutrition. Students with higher energy intake are therefore more likely to experience positive energy balance and increased body fat accumulation. Recent studies have

consistently reported that excessive caloric intake is a major contributor to the rising prevalence of overweight and obesity among adolescents [8]

The significant association between fat intake and overnutrition may be explained by the high energy density of fat, which provides 9 kcal per gram, compared to 4 kcal per gram for protein and carbohydrates. Diets high in fat, particularly from ultra-processed foods, fried foods, and fast foods, can substantially increase total energy intake and promote fat storage. A recent systematic review reported that frequent consumption of energy-dense, high-fat foods is strongly associated with overweight and obesity among adolescents [9]

Protein intake was also significantly associated with overnutrition. Although protein plays an important role in growth and satiety, excessive protein intake may contribute to total caloric excess. In addition, protein-rich foods consumed by adolescents are often accompanied by high levels of fat and calories, especially when derived from processed meats and fast-food products. Therefore, high protein intake may indirectly contribute to excess body weight when overall energy intake exceeds expenditure [4,8]

Similarly, excessive carbohydrate intake was significantly related to overnutrition. High consumption of refined carbohydrates and sugar-sweetened beverages can increase total energy intake and stimulate fat storage through increased insulin secretion. Recent evidence suggests that diets rich in refined carbohydrates are associated with a greater risk of obesity and adverse metabolic outcomes among children and adolescents [10]

These findings are consistent with previous studies showing that excessive energy and macronutrient intake are important risk factors for overnutrition. A study found that adolescents with higher intakes of total energy, fat, and refined carbohydrates had a significantly greater likelihood of being overweight or obese. Likewise, the World Health Organization emphasizes that unhealthy dietary patterns characterized by excessive consumption of energy-dense foods contribute substantially to the global burden of adolescent obesity [11].

A meta-analysis concluded that excessive intake of macronutrients—particularly fats and carbohydrates—is associated with the incidence of obesity among adolescents. The study explains that dietary patterns high in energy and fat promote body fat accumulation, thereby increasing the risk of obesity. Overall, the results suggest that excessive intake of energy, protein, fat, and carbohydrates increases the risk of overnutrition among students. Therefore, promoting balanced dietary intake according to nutritional recommendations is essential to prevent overweight and obesity during adolescence [15].

This study found a significant association between physical activity and overnutrition ( $p \leq 0.003$ ). Students with lower levels of physical activity were more likely to experience overnutrition than those who engaged in moderate or vigorous physical activity. Physical activity is an important component of energy balance because it increases energy expenditure and helps prevent excess fat accumulation. Conversely, insufficient physical activity reduces energy expenditure, leading to a positive energy balance and increased risk of overweight and obesity [12]

The finding that the majority of students engaged in light physical activity (55.4%) may explain the occurrence of overnutrition in this population. Adolescents today spend increasing amounts of time engaging in sedentary behaviors, including smartphone use, social media, online gaming, and television viewing. Excessive screen time may reduce opportunities for physical activity, resulting in lower energy expenditure and an increased risk of overweight and obesity. Previous studies have identified low physical activity and high sedentary behavior as important modifiable risk factors for adolescent obesity [12,13,14]

This result is consistent with recent evidence indicating that regular physical activity is associated with lower body fat, healthier body weight, and reduced risk of obesity among children and adolescents. Physical activity interventions have also been shown to improve body composition and decrease adiposity in overweight and obese youth.

Furthermore, the 2020 WHO Guidelines recommend that children and adolescents perform at least 60 minutes of moderate-to-vigorous physical activity daily to maintain optimal health and prevent overweight and obesity. Adolescents who fail to meet these recommendations are more likely to develop excess body weight and related metabolic disorders [4]. Research on high school students in Jakarta indicates that low physical activity is a behavior associated with indicators of obesity in

adolescents. Less active adolescents tend to be at a higher risk of being overweight compared to those who actively engage in exercise [16].

Research on the determinants of nutritional status among Indonesian adolescents has found that nutritional status is largely influenced by various behavioral factors, including dietary habits, physical activity, and individual characteristics. The study underscores the multifactorial nature of overweight and obesity, highlighting the need for an approach that considers multiple risk factors [17].

Limitation study :This study has several limitations. First, the cross-sectional design does not allow researchers to establish a causal relationship between energy intake, macronutrient intake, physical activity, and the occurrence of overweight/obesity. Second, data on dietary intake and physical activity were obtained via self-report questionnaires, potentially introducing recall and reporting biases. Third, the study did not account for other factors that could influence the occurrence of overweight/obesity, such as genetics, sleep duration, screen time, sedentary behavior, and family socioeconomic status. Furthermore, the study was conducted solely among students at SMA Negeri 6 Padang, limiting the generalizability of the findings to the broader adolescent population.

## 5. CONCLUSION

This study demonstrated that a considerable proportion of students had energy and macronutrient intakes exceeding the Recommended Dietary Allowance (RDA), particularly fat intake. The majority of students were categorized as having light physical activity. Statistical analysis revealed significant associations between energy intake, protein intake, fat intake, carbohydrate intake, and physical activity with overnutrition ( $p \leq 0.003$ ). Students with excessive energy and macronutrient intake and lower levels of physical activity were more likely to experience overnutrition. These findings indicate that both dietary intake and physical activity are important determinants of nutritional status among adolescents and play a crucial role in the development of overweight and obesity. It is hoped that adolescents will adopt balanced eating habits by limiting excessive consumption of foods high in energy, fat, and sugar, as well as sugary drinks. Increase participation in regular physical activity and reduce sedentary behavior to maintain a healthy weight.

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## REFERENCES

- [1] World Health Organization. (2025). *Obesity and Overweight*. Geneva: WHO. Available from: <https://www.who.int/mediacentre/factsheets/fs311/en/index.html>.
- [2] World Health Organization. (2025). *Prevalence of Overweight and Obesity Among Adolescents*. Geneva: WHO. Available from: <https://www.who.int/data/gho>.
- [3] Kemenkes BKKP. Survei Kesehatan Indonesia (SKI) 2023 Dalam Angka. Kementerian Kesehatan Badan Kebijakan Pembangunan Kesehatan; 2023.
- [4] World Health Organization. (2022). WHO European Regional Obesity Report 2022. Copenhagen: World Health Organization Regional Office for Europe.
- [5] Widyastuti PA, Noer ER, Nuryanto, Margawati A, Pramono A. (2026). Socioeconomic, demographic, and lifestyle factors associated with adolescent obesity in Indonesia: Analysis of Indonesia Health Survey 2023 data. *Action: Aceh Nutrition Journal*, 11(1). DOI: 10.30867/action.v11i1.2553.
- [6] Fathonah Y. (2025). Analysis of Determinants of Obesity and Overweight Risk Factors Among Adolescents in Central Java Province Based on the 2023 Indonesian Health Survey Data. *Sosioedukasi: Jurnal Ilmiah Ilmu Pendidikan dan Sosial*, 14(4).
- [7] World Health Organization Regional Office for Europe. (2024). *The Challenge of Obesity*. Copenhagen: WHO Europe.

- [8] Jebeile, H., Kelly, A. S., O'Malley, G., & Baur, L. A. (2022). Obesity in children and adolescents: Epidemiology, causes, assessment, and management. *The Lancet Diabetes & Endocrinology*, 10(5), 351–365.
- [9] Askari, M., Heshmati, J., Shahinfar, H., Tripathi, N., & Daneshzad, E. (2020). Ultra-processed food and the risk of overweight and obesity: A systematic review and meta-analysis of observational studies. *International Journal of Obesity*, 44(10), 2080–2091.
- [10] Lobstein, T., Brinsden, H., & Neveux, M. (2022). *World Obesity Atlas 2022*. London: World Obesity Federation.
- [11] Naja, F., Itani, L., Hamadeh, R., & Sibai, A. M. (2021). Dietary patterns, energy intake, and overweight/obesity among adolescents: Findings from a national study. *Nutrients*, 13(8), 2784.
- [12] Chaput, J. P., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., et al. (2020). 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5–17 years: Summary of the evidence. *International Journal of Behavioral Nutrition and Physical Activity*, 17(141), 1–9.
- [13] Katzmarzyk, P.T., Powell, K.E., Jakicic, J.M., Troiano, R.P., Piercy, K., & Tennant, B. (2022). Sedentary behavior and health: Update from the 2018 Physical Activity Guidelines Advisory Committee. *Medicine & Science in Sports & Exercise*, 54(2), 351–358.
- [14] Jayasinghe, S., & Hills, A. P. (2023). Strategies to improve physical activity and nutrition behaviours in children and adolescents: A review. *Nutrients*, 15(15), 3370.
- [15] Ainun, N., & Simbolon, D. (2024). *Macronutrient intake and obesity in adolescents: A meta-analysis study*. **Media Gizi Indonesia**, 19 (1, Special Issue), 29–35. <https://doi.org/10.20473/mgi.v19i1SP.29-3>
- [16] Lisetyaningrum, I., Pujasari, H., & Kuntarti. (2021). *A cross-sectional analysis of snacking habits, eating habits, physical activity, and indicators of obesity among high school students in Jakarta, Indonesia*. **Journal of Public Health Research**, 10(S1). <https://doi.org/10.4081/jphr.2021.2402>
- [17] Sukoco, N. E. W., et al. (2021). *Determinants of late adolescent nutritional status in Indonesia: A nation-wide cross-sectional survey*. **Nutrition & Food Science**, 52(5), 801–813. <https://doi.org/10.1108/NFS-07-2021-0235>

## VALIDITY AND PRACTICALITY OF A DASH DIET E-BOOKLET FOR PATIENTS WITH HYPERTENSION IN PRIMARY HEALTH CARE SETTINGS

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### Abstract

Hypertension is a major non-communicable disease that requires appropriate dietary management to prevent complications. Educational media play an important role in improving patients' understanding of hypertension management, including the implementation of the Dietary Approaches to Stop Hypertension (DASH) diet. This study aimed to develop and evaluate the validity and practicality of a DASH Diet e-booklet for hypertensive patients in the working area of Lubuk Buaya Public Health Center, Padang. This research employed a Research and Development (R&D) approach using the ADDIE model consisting of Analysis, Design, Development, Implementation, and Evaluation stages. Product validation was conducted by two material experts and two media experts, while practicality testing involved 15 hypertensive patients. Data were collected using validation questionnaires, practicality questionnaires, and pre-test and post-test instruments. The results showed that the e-booklet obtained a validity score of 79% from material experts and 75% from media experts, both categorized as valid. The practicality test yielded a score of 84.27%, categorized as very practical. Furthermore, respondents' knowledge increased from 58% before intervention to 82% after intervention, indicating a 24% improvement. These findings indicate that the developed DASH Diet e-booklet is valid, practical, and potentially useful as an educational medium for hypertensive patients.

Keywords: DASH diet, e-booklet, hypertension, educational media, ADDIE.

### 1. INTRODUCTION

Hypertension is one of the most prevalent non-communicable diseases worldwide and is often referred to as a "silent killer" because it frequently develops without noticeable symptoms. According to the World Health Organization (WHO), approximately 33% of the global population experienced hypertension in 2023 [1]. In Indonesia, the prevalence of hypertension increased from 25.8% in 2013 to 34.11% in 2018 [2]. In West Sumatra, the prevalence among adults aged over 18 years reached 25.16%, while Padang City reported a prevalence of 21.75% [3].

Management of hypertension can be carried out through pharmacological and non-pharmacological approaches [4]. One recommended non-pharmacological strategy is the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes reduced sodium intake, increased consumption of fruits, vegetables, fiber, and low-fat dairy products, as well as reduced intake of saturated fats [5]. Previous studies have shown that adherence to the DASH diet can effectively reduce blood pressure and improve hypertension control [5], [6].

Adequate knowledge is essential for successful dietary management among hypertensive patients. Previous studies have demonstrated a significant relationship between knowledge level and adherence to hypertension dietary recommendations. Therefore, educational interventions are necessary to improve patients' understanding and support healthy lifestyle modifications. Previous research entitled "The Relationship between Knowledge Level and

Dietary Compliance in Hypertension Patients at Astambul Community Health Center” obtained a p-value of 0.000, indicating a significant relationship between knowledge level and dietary compliance in hypertension patients [7]. Another related study on knowledge level and adherence to hypertension diet among the elderly reported that 72.2% of elderly hypertension patients at Pajang Community Health Center had insufficient knowledge regarding hypertension management [8].

The rapid growth of smartphone use has created opportunities for delivering health education through digital media [9]. E-booklets offer several advantages, including easy accessibility, flexible distribution, attractive visual presentation, and the ability to provide more comprehensive information compared with conventional leaflets [10]. Digital educational media can therefore serve as an effective tool for disseminating health information.

The developed DASH Diet e-booklet differs from previously available health education media in several important ways, particularly in terms of format, content contextualization, and educational approach. Unlike conventional printed leaflets or static booklets, this e-booklet is designed as a digital learning medium that can be accessed through smartphones and other electronic devices, making it more flexible and suitable for patients in primary health care settings. Furthermore, the content is developed using a health literacy-based approach, ensuring that information is presented in simple language, clear visuals, and user-friendly explanations adapted to patients' educational levels. Importantly, the material is also contextualized to local dietary patterns, integrating DASH diet principles with commonly consumed Indonesian foods, which enhances relevance and practical applicability in daily life.

In addition to being informative, this e-booklet is designed to support self-management and behavioral change, which is a key requirement in hypertension control. Compared to leaflets that are often limited in content and quickly discarded, or earlier digital booklets that tend to be static and less structured, this e-booklet offers a more systematic, engaging, and reusable learning resource. It includes practical features such as portion guidance, sodium intake simplification, visual food guides, and daily dietary checklists, which strengthen patients' ability to implement dietary recommendations consistently. Therefore, this e-booklet is considered more effective in supporting patient education in primary health care because it combines accessibility, clarity, and practical application in a single learning medium.

Preliminary observations conducted at Lubuk Buaya Public Health Center indicated that hypertension education primarily relied on printed leaflets. Health workers reported several limitations, including limited information capacity, dense text presentation, and low visual attractiveness, which reduced patients' interest in reading educational materials. Consequently, there is a need to develop a more innovative and engaging educational medium. Therefore, this study aimed to develop and evaluate the validity and practicality of a DASH Diet e-booklet for hypertensive patients in the working area of Lubuk Buaya Public Health Center, Padang

## 2. METHODOLOGY

A This study employed a Research and Development (R&D) design using the ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation stages [11].

The research was conducted in the working area of Lubuk Buaya Public Health Center, Padang, from April 2025 to March 2026. The product developed in this study was a DASH Diet e-booklet intended as an educational medium for hypertensive patients.

Product validation involved four expert validators consisting of two material experts and two media experts. Practicality testing was conducted among 15 hypertensive patients selected through purposive sampling based on predetermined inclusion criteria [12]. The relatively small sample size used in this study, consisting of 2 expert validators and 15 hypertensive patients, is justified by the nature of this research as a Research and Development (R&D) study at the preliminary stage of product development. At this stage, the main objective is not to generalize findings to a broader population, but to assess the initial feasibility of the developed product, evaluate content and media validity, and examine the practicality of the e-booklet for end users. Early-stage product trials in R&D studies may appropriately involve small groups of approximately 10–20 participants, particularly in limited field testing or small group trials. Therefore, the use of 15 respondents in this study is considered adequate to obtain initial feedback on usability and practicality before progressing to larger-scale implementation. Consequently, the small sample size should not be viewed as a limitation, but rather as a methodological characteristic aligned with the preliminary development phase within the ADDIE model,

especially during the development and limited implementation stage. Respondents were required to be able to communicate effectively, read and write, operate a smartphone, and be willing to participate in the study.

Data collection was carried out using validation questionnaires, practicality questionnaires, and pre-test and post-test instruments. Validation data were used to assess the appropriateness of content and media design, while practicality data were used to evaluate ease of use, attractiveness, and comprehensibility of the developed product [11], [13], [14]. This study is positioned at the preliminary product development and limited field testing stage, where the developed e-booklet is still in its initial prototype form and continuously refined based on expert judgment. At this stage, practical testing is conducted only on a small and limited group of participants, and the study has not yet reached large-scale effectiveness testing. This approach aligns with the ADDIE development model, particularly the Development, Implementation (limited trial), and Evaluation stages, which emphasize iterative improvement before broader application. The research instrument used is a closed-ended questionnaire presented in a checklist format, where respondents are required to select predefined responses without open-ended items, using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scale is applied in both the media validity and practicality tests. In terms of validity, the study applies content validity through expert judgment involving media and nutrition experts, where evaluation and revision are prioritized over statistical testing, while empirical validity using correlation-based statistical analysis is not conducted due to the preliminary nature of the study, which focuses on expert validation and initial practicality assessment rather than large-scale inferential analysis.

Data analysis was conducted using descriptive percentage analysis. The validity and practicality of the product were assessed by comparing the obtained scores with the maximum possible scores and converting them into percentage values. The results were then interpreted based on predetermined criteria for validity and practicality. In addition, pre-test and post-test data were used to assess changes in respondents' knowledge before and after using the developed educational media. Differences between pre-test and post-test scores were analyzed to identify changes in knowledge following the intervention [15], [16], [17]. The analysis of pre-test and post-test differences was conducted using a paired sample t-test for normally distributed data, the Wilcoxon signed-rank test for non-normally distributed data, and the normalized gain (N-Gain) to measure the level of improvement. This study was approved by the Health Research Ethics Committee of Universitas Perintis Indonesia (Protocol No. 25-09-1786). All participants provided informed consent prior to data collection.

### 3. RESULTS

#### 3.1 Analysis Stage

The characteristics of the respondents in this study can be seen in Table 1.

**Tabel 1. The characteristics of the respondents**

No	Karakteristik	n	p
1	Jenis Kelamin		
	Laki-laki	6	40,0%
	Perempuan	9	60,0%
	<b>Total</b>	15	100,0%
2	Umur		
	35-45 tahun	4	26,7%
	46-55 tahun	8	53,3%
	> 55 tahun	3	20,0%
	<b>Total</b>	15	100,0%
3	Pendidikan		
	SD	0	0,0%
	SMP	2	13,3%
	SMA	7	46,7%
	PT	6	40,0%
	<b>Total</b>	15	100,0%

According to Table 4.1, 60% of the respondents were female, 53.3% were aged 46–55 years, and 46.7% had a Senior High School level of education.

The analysis stage identified several limitations of the educational media currently used for hypertension counseling at Lubuk Buaya Public Health Center. Existing leaflets provided limited space for information delivery, contained excessive text, and lacked attractive visual elements. These limitations reduced patients' interest in reading and hindered effective health education.

Based on these findings, an e-booklet was selected as an alternative educational medium because it allows more comprehensive information delivery, supports visual presentation, and can be distributed easily through smartphones. This is consistent with previous studies which

reported that booklets provide sufficient space to present more comprehensive information. In addition, e-booklets contain a greater number of pages. Booklets can therefore offer a more detailed and comprehensive overview of dietary management for patients with hypertension [18]

### 3.2 Design Stage

The design stage involved preparing educational content and designing the e-booklet layout. The content covered basic information about hypertension, classification, complications, risk factors, DASH diet principles, recommended food choices, sample menus, food exchange lists, warning signs for high-sodium foods, and practical dietary tips.

The e-booklet was developed using Canva Premium. Green, yellow, and red color schemes were selected to enhance readability and emphasize important information. Illustrations and visual elements were incorporated to improve user engagement and understanding. The color selection in this e-booklet was based on the meaning and psychological function of colors in health education media. Green was used as it is associated with health, balance, and freshness, and it can create a calming effect for readers. Red was applied as a warning sign to draw attention to limitations in the consumption of certain food ingredients for individuals with hypertension, while yellow was used to emphasize key points so that important information is more easily recognized and remembered. This combination of colors reflects careful consideration to enhance readability, reader comfort, and the effectiveness of health message delivery [19].

### 3.3 Development Stage

The development stage focused on producing the prototype and conducting product validation. The DASH Diet e-booklet was developed based on the results of the analysis and design stages. The developed product was validated by two material experts and two media experts. The validation results are presented in Table 1.

**Table 2.** Validity Test Results of the DASH Diet E - Booklet

	Validator	Percentage (%)	Category
1.	Material Experts	79.00	Valid
2.	Media Experts	75.00	Valid

Based on Table 1, the developed DASH Diet e-booklet met the validity criteria according to both material and media experts. The material experts suggested several revisions, including improving sentence structure, replacing inappropriate terminology, and clarifying dietary recommendations. Meanwhile, the media experts recommended improving color contrast, increasing text readability, adjusting illustrations, and enhancing visual consistency throughout the e-booklet. The suggested revisions were incorporated before proceeding to the implementation stage.

### 3.4 Implementation Stage

The implementation stage was conducted to assess the practicality of the developed DASH Diet e-booklet. The practicality test involved 15 hypertensive patients in the working area of Lubuk Buaya Public Health Center [20]. Respondents were asked to access and read the e-booklet using their smartphones

and subsequently complete the practicality questionnaire. The results of the practicality assessment are presented in Table 2.

**Table 3.** Practicality Test Results of the DASH Diet E-Booklet

	<b>Assessment Aspect</b>	<b>Percentage (%)</b>	<b>Category</b>
1.	Ease of Understanding	80.44	Practical
2.	Ease of Use	82.22	Very Practical
3.	Attractiveness	88.67	Very Practical
	<b>Assessment Aspect</b>	<b>Percentage (%)</b>	<b>Category</b>
	<b>Average</b>	<b>84.27</b>	<b>Very Practical</b>

Based on Table 2, the developed DASH Diet e-booklet was categorized as very practical. The highest score was obtained in the attractiveness aspect, indicating that respondents perceived the e-booklet as visually appealing and engaging. In addition, the scores for ease of understanding and ease of use suggest that the information presented in the e-booklet was accessible and easy for respondents to comprehend.

To further describe respondents' knowledge after using the developed e-booklet, pre-test and post-test evaluations were conducted. The average pre-test score was 58%, indicating a moderate level of knowledge. Following exposure to the e-booklet, the average post-test score increased to 82%, indicating a good level of knowledge. This represented an increase of 24% percentage points in respondents' knowledge regarding DASH dietary management.

#### Evaluation Stage

The evaluation stage was conducted to refine the product based on feedback from both content and media experts, ensuring that the developed DASH diet e-booklet is suitable for the subsequent practicality testing phase. The evaluation covered content accuracy, language use, and media design aspects. The following table presents the detailed revisions made based on expert validation.

**Table 4.** Product Revisions Based on Expert Validation

<b>No.</b>	<b>Section</b>	<b>Validator Findings</b>	<b>Revision Performed</b>
1	Hypertension risk factors (modifiable factors)	Inaccurate terminology in the dietary explanation	Replaced with "high-sodium foods"
2	Animal protein recommendations	Lack of specificity in examples	Clarified as "lean meat/skinless poultry"
3	Unhealthy food examples	Examples were too general and unclear	Revised into more specific examples, such as fast food, instant food, and preserved food
4	Terminology	The use of "salt" was considered less precise	Replaced with "sodium"
5	Color contrast	Poor readability due to high contrast	Adjusted to a softer color scheme
6	Font size	Text was too small in some sections	Increased the font size
7	Animation alignment	Animation was not fully aligned with the content	Revised for better consistency

The following figure illustrates one example of the product design after revision based on expert feedback.



**Figure 1.** Comparison of E-Booklet Design Before and After Revision

The findings indicate that the developed e-booklet successfully met validity and practicality requirements. The increase in respondents' knowledge also suggests that the e-booklet has potential as an effective educational medium for supporting hypertension management in primary healthcare settings.

Based on expert validation, several revisions were implemented to improve the quality and usability of the e-booklet. First, terminology related to dietary sodium was revised, replacing the term "salt" with "sodium" to ensure scientific accuracy and consistency with dietary guidelines. Second, dietary recommendations for animal protein were refined by adding clearer and more specific examples of healthy food choices. Third, examples of unhealthy foods were improved by providing more concrete and contextually relevant illustrations, such as fast food and processed foods, to enhance patient understanding. In addition, improvements were made in visual design aspects, including color contrast, font size, and alignment of animations and layout elements to increase readability and user engagement. The revised design demonstrated improved clarity, consistency, and overall visual communication, indicating that the e-booklet is more suitable as an educational medium for hypertensive patients in primary health care settings.

#### 4. CONCLUSIONS

The DASH Diet e-booklet was successfully developed using the ADDIE model through five stages: Analysis, Design, Development, Implementation, and Evaluation.

The developed e-booklet achieved a validity score of 79% from material experts and 75% from media experts, indicating that the product is valid for use as an educational medium. Practicality testing among hypertensive patients resulted in a score of 84.27%, categorized as very practical. Furthermore, respondents' knowledge increased from 58% before intervention to 82% after intervention, representing a 24% improvement. Therefore, the DASH Diet e-booklet can be considered a valid and highly practical educational medium for hypertensive patients and has the potential to support nutrition education activities in primary healthcare settings.

#### REFERENCES

- [1] WHO, "Hypertentions," WHO. 2023
- [2] Kementerian Kesehatan RI, "Laporan RISKESDAS," 2018.
- [3] Kementerian Kesehatan RI, "Laporan Provinsi Sumatera Barat RISKESDAS," 2018.
- [4] D. H. Zaenurrohman and R. D. Rachmayanti, "Relationship Between Knowledge and Hypertension History with Blood Pressure Control in Elderly," *J. Berk. Epidemiol.*, vol. 5, no. 2, p. 174, 2017, doi: 10.20473/jbe.v5i22017.174-184.
- [5] A. Wulandari, W. Kurdanti, and I. Setiyobroto, "Pemberian pesan Dietary Approaches to Stop Hypertensions-like diet melalui whatsapp untuk memperbaiki kepatuhan diet dan tekanan darah pasien hipertensi," *J. Gizi Klin. Indones.*, vol. 19, no. 3, p. 104, 2023, doi: 10.22146/ijcn.57687.

- [6] S. P. Juraschek, M. Woodward, F. M. Sacks, V. J. Carey, E. R. Miller, and L. J. Appel, "Time Course of Change in Blood Pressure from Sodium Reduction and the DASH Diet," *Hypertension*, vol. 70, no. 5, pp. 923–929, 2017, doi: 10.1161/HYPERTENSIONAHA.117.10017.
- [7] N. S. Martini, I. Maria, and N. S. Mawaddah, "Hubungan Tingkat Pengetahuan Dengan Kepatuhan Diet Hipertensi Di Puskesmas Astambul," *J. Keperawatan Suaka Insa.*, vol. 4, no. 2, pp. 114–119, 2019, doi: 10.51143/jksi.v4i2.189.
- [8] P. Wulandari and K. Kartinah, "Tingkat pengetahuan dan kepatuhan menjalankan diet hipertensi pada lansia," *Holistik J. Kesehatan.*, vol. 18, no. 2, pp. 194–201, 2024, doi: 10.33024/hjk.v18i2.260.
- [9] Y. Puspa, "Pengguna Smartphone diperkirakan Mencapai 89% Populasi pada 2025,"
- [10] Databoks.
- [11] W. Anggraini, C. F. Agustina, W. Sari, E. Muhammad, and K. Kunci, "Analisis Manfaat E-Booklet Dalam Mengedukasi Masyarakat Tentang Hipertensi Di Rumkitban JS / 00 . 08 Bintaro Jakarta Selatan Analysis the Benefits of E-Booklets in Educating the Public About Hypertension in Rumkitban JS / 00 . 08 Bintaro South Jakarta," vol. 1, no. 8, 2023.
- [12] T. Rusmayana, *Model Pembelajaran ADDIE Integrasi Pedati Di SMK PGRI Karisma Bangsa*, vol. 11, no. 1. Bandung: Penerbit Widina Bhakti Persada, 2021. [Online]. Available: [http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484\\_SISTEM\\_PEMBETUNGAN\\_TERPUSAT\\_STRATEGI\\_MELESTARI](http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI)
- [13] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*, Cetakan ke. Bandung: Alfabeta, 2019.
- [14] N. W. Amy and Anangga, "Kelayakan Aspek Materi, Bahasa dan Media Pada Pengembangan Buku Ajar Statistika Untuk Pendidikan Olahraga Di IKIP Budi Utomo Malang," *Lap. Penelit. unp Kendiri*, 2019.
- [15] H. F. Milala, Endryansyah, Joko, and A. I. Agung, "Keefektifan dan Kepraktisan Media Pembelajaran Menggunakan Adobe Flash Player".
- [16] Muliati, "Pengembangan Media Pembelajaran Interaktif dengan Model Flipped Classroom Berbantuan Software Swish MAX4," *Institut Agama Islam Negeri Palopo*, 2023.
- [17] K. P. Sari, Maysara, and M. A. Marhadi, "Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Creative Problem Solving untuk Meningkatkan Hasil Belajar Peserta Didik pada Materi Koloid," vol. 12, pp. 117–122, 2023.
- [18] Notoatmodjo, "Buku Pengetahuan dan Tingkat Pengetahuan," vol. 53, no. 9, 2020.
- [19] K. Rozalinda and F. M. Adinda, "Optimalisasi Media Leaflet dan Booklet dalam Strategi Manajemen Pendidikan," vol. 1, no. 1, pp. 15–21, 2025.
- [20] W. Handayani, R. Ulum, and N. Khofia, "Psikologi Warna Dalam Kehidupan Sehari Hari : Pengaruh Warna Terhadap Emosi, Persepsi, dan Perilaku Konsumen," *PSIKIS J. Ilmu Psikiatri dan Psikol.*, 2025.
- [21] N. Fauziah, K. Khatimah, and N. Khairunnufus, "Kepraktisan Media Flashcard Berbasis Kontekstual Pada Pembelajaran Aksara Bima Kelas Tinggi di SDN Rabakodo," *Semin. Nas. Hum.*, vol. 4, 2025.

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