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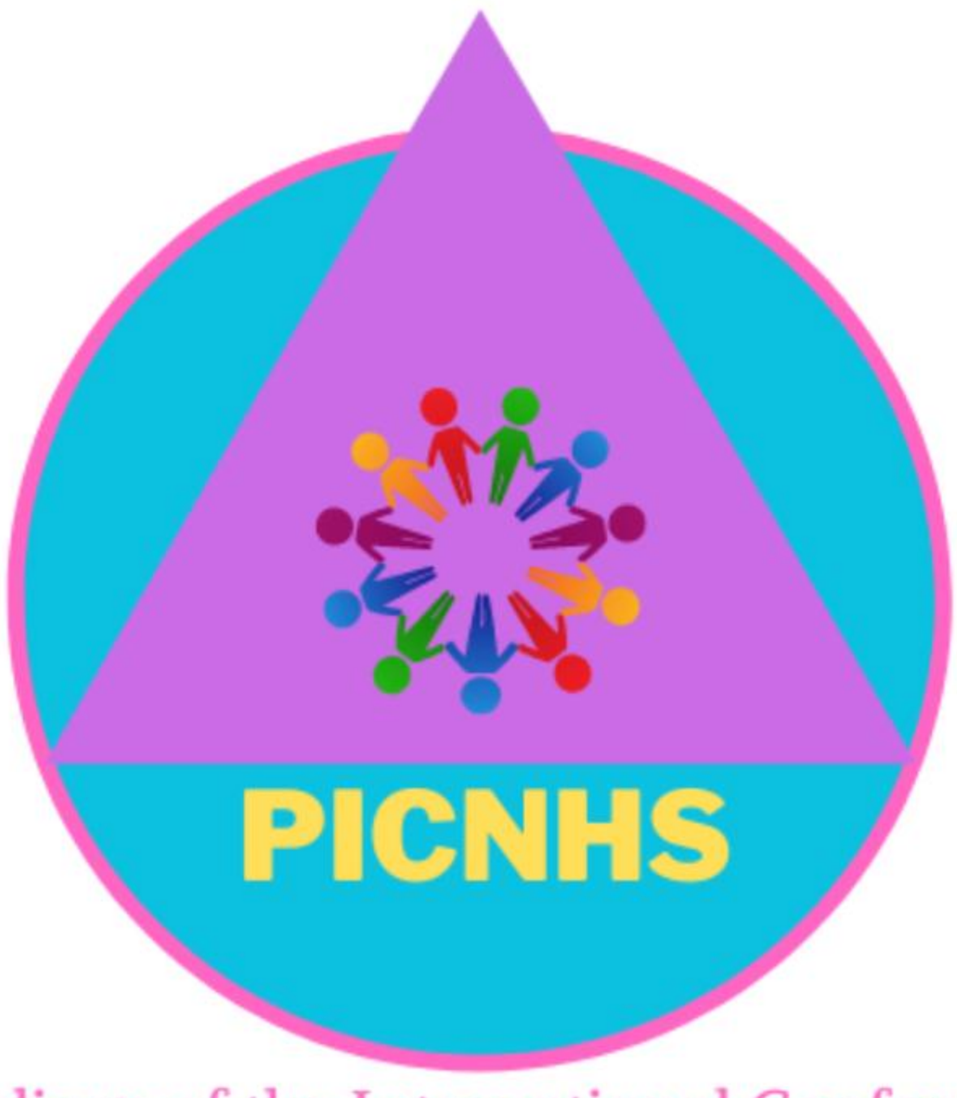

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PHYSICAL ACTIVITY, BODY MASS INDEX, AND SMARTPHONE ADDICTION: A CROSS-SECTIONAL STUDY AMONG ADOLESCENTS

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ABSTRACT

Smartphone addiction has become a growing public health concern among adolescents. Excessive smartphone use has been associated with physical inactivity, mental health problems, and unhealthy lifestyle behaviors that may contribute to abnormal body mass index (BMI). This study aimed to examine the association between physical activity level, body mass index, and smartphone addiction among adolescents. A cross-sectional study was conducted among 102 adolescents, 15–17 years old in Surakarta, Indonesia. Data were collected using a structured questionnaire including demographic characteristics, the Smartphone Addiction Scale–Short Version (SAS-SV), and the International Physical Activity Questionnaire (IPAQ). BMI was calculated based on measured height and weight. The prevalence of smartphone addiction was 52.9%. Most participants had normal BMI (52.0%), while 28.4% were obese. Low physical activity levels were observed in 42.2% of respondents. Chi-square analysis indicated a borderline association between physical activity level and smartphone addiction ($p = 0.054$), suggesting a tendency for lower physical activity to be associated with higher smartphone addiction. No significant association was found between BMI and smartphone addiction ($p = 0.084$), nor between physical activity level and BMI ($p = 0.359$). Smartphone addiction was highly prevalent among adolescents. Although physical activity showed a potential association with smartphone addiction, BMI was not significantly correlation to either smartphone addiction or physical activity. These findings showed that the importance of promoting regular physical activity as part of preventive strategies against smartphone addiction among adolescents.

Keywords: adolescent; addiction; BMI; physical activity; smartphone

INTRODUCTION

Smartphone addiction has become a growing public health concern among adolescents. (Abi-Jaoude et al., 2020; Daryabeygi-Khotbehsara et al., 2021) . Prevalence of smartphone addiction among adolescents were 16.9% in Switzerland (Haug et al., 2015), 10% in United Kingdom (Lopez-Fernandez et al., 2014), 37,1% in Malaysia (Wei Lee et al., 2023), 35.6% in South Korea (Lee & Lee, 2017) and 33,1% in India (Soni et al., 2017). Excessive smartphone use has been associated with physical inactivity, mental health problems, and unhealthy lifestyle behaviors that may contribute to abnormal body mass index (BMI). (Daryabeygi-Khotbehsara et al., 2021; Ma et al., 2025; Nagata et al., 2023).

Particularly among adolescent, poor digital device use is acknowledged as a significant concern. (Guertler et al., 2024; Kuss & Griffiths, 2017) Global estimations show that nearly 25% of people suffer from smartphone addiction, 17.42% from social media addiction, and 14.22% from Internet addiction. (Meng et al., 2022) Excessive smartphone use can also disrupt physical activity. unctions such as calling, sending and receiving text messages, updating social networking sites, and browsing the Internet, have historically been defined as sedentary behaviors. (Lepp et al., 2013; Rosenberg et al., 2010)

Such inactive behavior correlates with various health problems including obesity or metabolic syndrome because it results in low levels of energy expenditure. (Das et al., 2024) Specifically, high Internet and computer use, considered as sedentary behaviors, are associated with higher body mass index and lower physical activity levels. (Godoy-Cumillaf et al., 2023; Yuniarti et al., 2024) High frequency users of smartphones can impede physical activity and promote sedentary behaviors, such as watching television and using computers, resulting in the reduction of cardiorespiratory fitness. (Lepp et al., 2013) However, the relationship between smartphone use and physical activity is obscure (Kumban et al., 2025; Nagata et al., 2023; Zhang et al., 2024)

Physical activity as an effective modality to reduce and mitigate the phenomenon of smartphone addiction. (Chen et al., 2022) Physical activity serves as a means for individuals to achieve fitness and health and improve physical and mental well-being. Physical activity improves physical fitness, enhances overall health, and maintains bodily functions . The World Health Organization (WHO) recommends a minimum of 150 minutes per week of moderate-to-vigorous physical activity to prevent chronic diseases. Furthermore, the WHO recommends engaging in 75 minutes of vigorous-intensity exercise weekly, as regular physical activity offers significant benefits for physical and mental health. (WHO, 2020) Existing studies have shown that exercise serves as an effective intervention for the treatment of smartphone addiction, with longer intervention durations yielding better outcomes. (Geng & Liu, 2025; Liu et al., 2022) Systematic physical activity (PA) can significantly reduce smartphone addiction. (Godoy-Cumillaf et al., 2023; Zhang et al., 2024) Recent research has shown that physical activity acts as an effective negative predictor of smartphone addiction, with self-control mediating the relationship between the two. (Guo et al., 2022) Regular physical activity is suggested as a viable strategy for preventing MPA, and moderate evidence supports its effectiveness in reducing addictive behaviors among college students.

METHOD

One hundred and two adolescent in Surakarta were recruited as the subjects for this study. Participants (9 males and 93 females) aged 15 to 27 have been studying in SMK Farmasi Nasional. This study collected data through a structured questionnaire consisting of general characteristics. All questionnaires were in the self-report format. Lastly, smartphone addiction, body composition and physical activity were measured. Participants were excluded if they refused to participate in the study. The design of the study included a one month period, during which time spent using the smartphone was automatically registered from their smartphone device, and participants filled out questionnaires on screen use and physical activity.

Measure of Smartphone Addiction

The SAS-SV is a well-validated specific questionnaire to identify the level of the smartphone addiction risk and to distinguish the high-risk group in adolescent. The questionnaire includes 10 questions describing daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse and tolerance. For each item, participants expressed their opinion on a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). It identifies the different range for males and females. Males are addicted to scores higher than 31, with high risk of addiction with scores between 22 and 31 and females are addicted to scores higher than 33, with high risk of addiction on scores between 22 and 33.

Measures of Physical Activity and Body Composition

The Indonesian version of the IPAQ was used to subjectively measure physical activity and sedentary behavior. (Dharmansyah & Budiana, 2021) The Indonesian version of the IPAQ has a satisfactory criterion validity. A total of 7 question items in the IPAQ were valid. The Kaiser-Meyer-Olkin value was 0.910, and Bartlett's test of sphericity was X2 = 573,434 (df=28, p<0.000). This validated questionnaire measures participation in vigorous- and moderate-intensity physical activity and sedentary behavior over the past seven days, and using published values, physical activity data from the questionnaire were transformed into energy expenditure estimates as metabolic equivalent tasks (METs). Outcome measures from the IPAQ were (1) total physical activity expressed as MET-minutes per day and minutes reported in (2) vigorous-intensity, (3) moderate-intensity activity, and (4) in sitting per day. To objectively measure the number of steps, the activity trackers in the participant's smartphone, described above, were used.

Body mass index (BMI) was used as an indicator of nutritional status and was calculated based on direct measurements of body weight and height. Body weight was measured using a calibrated digital scale, with participants wearing light clothing and no footwear. Height was measured using a stadiometer with participants standing in an upright position and barefoot. BMI was calculated by dividing body weight in kilograms by the square of height in meters (kg/m²). The resulting BMI values were then categorized according to standard classification criteria to determine underweight, normal weight, and obesity status. BMI was classified into underweight (<18.5 kg/m²), normal (18.5-22.9 kg/m²), overweight (23–24.9 kg/m²), and obese (≥25 kg/m²)(Madden & Smith, 2016)

RESULT AND DISCUSSION

A total of 102 adolescents participated in this study. The mean Physical Activity Questionnaire (PAQ) score was 2551.04 ± 3671.57. The Smartphone Addiction Scale (SAS) score was 33.40 ± 10.34, suggesting heterogeneous patterns of smartphone use behavior within respondent.

Table 1.
Respondent Characteristic

Variabel	Frequency	Percent
Gender		
Men	9	8.8
Women	93	91.2
Smartphone Addiction		
Yes	54	52.9
No	48	47.1
Physical Activity		
Low	43	42.2
Moderate	34	33.3
High	25	24.5
Body Mass Index		
Underweight	20	19.6
Normal	53	52.0
Obesity	29	28.4

The sample was predominantly female (91.2%), with male participants accounting for 8.8%. Regarding body mass index (BMI), more than half of the respondents were classified as having a normal BMI (52.0%), while 28.4% were categorized as obese and 19.6% as underweight. Based on physical activity categories, 42.2% of adolescents exhibited low physical activity levels, 33.3%

moderate levels, and only 24.5% high physical activity levels. Concerning smartphone addiction status, 52.9% of respondents were classified as having smartphone addiction. The findings of this study showed that adolescents reported an average smartphone use of approximately 8–10 hours per day, indicating daily engagement with digital devices. This level of smartphone use reflects extensive exposure across routine activities, including communication, learning, and entertainment, and illustrates a high intensity of screen-based behavior within respondent

Table 2.
Smartphone Addiction and Physical Activity Score

	PAQ	SAS SV
Mean	2551.04	33.402
Std. Deviation	3671.57	10.3419

The Chi-square analysis showed a minimally significant correlation between high activity levels and smartphone addiction. The Pearson Chi–square test showed *p-value* was 0.054, which suggests that there may be 'direct correlation' between lower physical activity and higher smartphone use. The research showed that the correlation between body mass index and smartphone addiction, but found no significant that appears to be genuine. The Pearson Chi-square test showed *p-value* was 0.084. The Chi-square test that no significant the relationship between physical activity level and body mass index. The Pearson Chi–square was a *p-value* of 0.359. Overall, the results indicate that while physical activity may be a factor in smartphone addiction, there is no significant between body mass index and either behavior or exercise in this group.

The study showed that low physical activity and smartphone addiction were prevalent among adolescents, with more than half of participants reporting smartphone addiction and nearly half engaging in low levels of physical activity. This pattern reflects a growing public health concern, as adolescence is a critical developmental period during which lifestyle behaviors are formed and can persist into adulthood.The high proportion of adolescents with low levels of physical activity aligns with previous research showing that increased smartphone use is associated with sedentary behavior and reduced engagement in physical movement. (Nambirajan et al., 2025) Excessive smartphone use often displaces time that could otherwise be devoted to physical activity, thus contributing to lower energy expenditure. (Kim et al., 2015).

Furthermore, the distribution of BMI categories, with nearly one-third of participants classified as obese, underscores the potential role of a sedentary lifestyle in influencing weight-related outcomes among adolescents. Body mass index (BMI) serves not only as an indicator of nutritional status but also as a proxy for long-term behavioral patterns associated with physical inactivity and energy imbalance. (Tiruneh, n.d.) The low levels of physical activity and high BMI observed in this study showed that lifestyle behaviors associated with smartphone use may indirectly contribute to poor weight status.

The relatively high prevalence of smartphone addiction (52.9%) was consistent with previous studies reporting increased rates of problematic smartphone use among adolescents. Adolescents are particularly vulnerable to smartphone addiction due to ongoing neurodevelopmental processes, including immature impulse control and heightened sensitivity to reward-related stimuli. (Tymofiyeva et al., 2020) Excessive smartphone use can exacerbate sedentary behavior, disrupt daily routines, and reinforce unhealthy lifestyle habits. (Goyal & Rakhra, 2024; WHO, 2020; Wong et al., n.d.)

Overall, these findings highlight the interconnected nature of physical activity, BMI, and smartphone addiction among adolescents. Although the cross-sectional design of this study does not allow for causal conclusions, the observed patterns emphasize the need for integrated public health strategies that address digital behaviors alongside physical activity promotion and weight management. Interventions targeting smartphone addiction in adolescents may benefit from incorporating components that encourage active lifestyles and healthy behavioral routines. From a public health perspective, the results of this study provide important evidence from a developing country context, where rapid digitalization and lifestyle transitions are occurring. This study contributes to the limited literature examining the combined associations between physical activity, BMI, and smartphone addiction among adolescents and underscores the importance of a multidimensional approach to adolescent health promotion.

CONCLUSION

This study showed smartphone addiction is prevalent among adolescents, with over half of the participants classified as smartphone addicts. Most adolescents also demonstrated low levels of physical activity, highlighting a concerning pattern of sedentary behavior in this population. The data indicate a potential association between physical activity levels and smartphone addiction, suggesting that lower physical activity may be associated with a higher likelihood of smartphone addiction. However, this association was not significant. Body mass index was not significantly associated with either smartphone addiction or physical activity levels in this study. These results suggest that smartphone addiction among adolescents may be more closely related to behavioral factors, such as physical activity, than simply weight status.

Overall, these findings underscore the importance of promoting an active lifestyle alongside healthy digital behaviors as part of adolescent health interventions. Further studies using larger samples and longitudinal designs are needed to further elucidate the complex relationships between physical activity, body mass index, and smartphone addiction, and to inform evidence-based public health strategies.

REFERENCES

Abi-Jaoude, E., Naylor, K. T., & Pignatiello, A. (2020). Smartphones, social media use and youth mental health. *Canadian Medical Association Journal*, *192*(6), E136–E141. https://doi.org/10.1503/cmaj.190434

Chen, H., Wang, C., Lu, T., Tao, B., Gao, Y., & Yan, J. (2022). The Relationship between Physical Activity and College Students' Mobile Phone Addiction: The Chain-Based Mediating Role of Psychological Capital and Social Adaptation. *International Journal of Environmental Research and Public Health*, *19*(15), 9286. https://doi.org/10.3390/ijerph19159286

Daryabeygi-Khotbehsara, R., Shariful Islam, S. M., Dunstan, D., McVicar, J., Abdelrazek, M., & Maddison, R. (2021). Smartphone-Based Interventions to Reduce Sedentary Behavior and Promote Physical Activity Using Integrated Dynamic Models: Systematic Review. *Journal of Medical Internet Research*, *23*(9), e26315. https://doi.org/10.2196/26315

Das, P., Saraswathy, K. N., & Chaudhary, V. (2024). Prevalence of Smartphone Addiction and its Relationship with Obesity among Young Adults: A Cross-sectional Study from Delhi, India. *Indian Journal of Community Medicine*, *49*(3), 544–548. https://doi.org/10.4103/ijcm.ijcm_288_23

Dharmansyah, D., & Budiana, D. (2021). Indonesian Adaptation of The International Physical Activity Questionnaire (IPAQ): Psychometric Properties. *JURNAL PENDIDIKAN KEPERAWATAN INDONESIA*, *7*(2), 159–163. https://doi.org/10.17509/jpki.v7i2.39351

Geng, Z., & Liu, R. (2025). The impact of smartphone addiction and negative emotions on parent–child relationships among elementary school students. *Frontiers in Psychiatry*, *16*. https://doi.org/10.3389/fpsyt.2025.1582741

Godoy-Cumillaf, A., Fuentes-Merino, P., Farías-Valenzuela, C., Duclos-Bastías, D., Giakoni-Ramírez, F., Bruneau-Chávez, J., & Merellano-Navarro, E. (2023). The Association between Sedentary Behavior, Physical Activity, and Physical Fitness with Body Mass Index and Sleep Time in Chilean Girls and Boys: A Cross-Sectional Study. *Children*, *10*(6), 981. https://doi.org/10.3390/children10060981

Goyal, J., & Rakhra, G. (2024). Sedentarism and Chronic Health Problems. *Korean Journal of Family Medicine*, *45*(5), 239–257. https://doi.org/10.4082/kjfm.24.0099

Guertler, D., Bläsing, D., Moehring, A., Meyer, C., Brandt, D., Schmidt, H., Rehbein, F., Neumann, M., Dreißigacker, A., Bischof, A., Bischof, G., Sürig, S., Hohls, L., Hagspiel, M., Wurm, S., Haug, S., & Rumpf, H.-J. (2024). App-Based Addiction Prevention at German Vocational Schools: Implementation and Reach for a Cluster-Randomized Controlled Trial. *Prevention Science*, *25*(5), 849–860. https://doi.org/10.1007/s11121-024-01702-w

Guo, K., Ma, Q., Yao, S., Liu, C., Hui, Z., Jiang, J., & Lin, X. (2022). The Relationship Between Physical Exercise and Mobile Phone Addiction Tendency of University Students in China: A Moderated Mediation Model. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.730886

Haug, S., Castro, R. P., Kwon, M., Filler, A., Kowatsch, T., & Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *Journal of Behavioral Addictions*, *4*(4), 299–307. https://doi.org/10.1556/2006.4.2015.037

Kim, S.-E., Kim, J.-W., & Jee, Y.-S. (2015). Relationship between smartphone addiction and physical activity in Chinese international students in Korea. *Journal of Behavioral Addictions*, *4*(3), 200–205. https://doi.org/10.1556/2006.4.2015.028

Kumban, W., Cetthakrikul, S., & Santiworakul, A. (2025). Smartphone Addiction, Screen Time, and Physical Activity of Different Academic Majors and Study Levels in University Students. *International Journal of Environmental Research and Public Health*, *22*(2), 237. https://doi.org/10.3390/ijerph22020237

Kuss, D., & Griffiths, M. (2017). Social Networking Sites and Addiction: Ten Lessons Learned. *International Journal of Environmental Research and Public Health*, *14*(3), 311. https://doi.org/10.3390/ijerph14030311

Lee, C., & Lee, S.-J. (2017). Prevalence and predictors of smartphone addiction proneness among Korean adolescents. *Children and Youth Services Review*, *77*, 10–17. https://doi.org/10.1016/j.childyouth.2017.04.002

Lepp, A., Barkley, J. E., Sanders, G. J., Rebold, M., & Gates, P. (2013). The Relationship Between Cell Phone Use, Physical and Sedentary Activity, and Cardiorespiratory Fitness in a Sample of U.S. College Students. *International Journal of Behavioral Nutrition and Physical Activity*, *10*. https://doi.org/10.1186/1479-5868-10-79

Liu, H., Zhou, Z., Huang, L., Zhu, E., Yu, L., & Zhang, M. (2022). Prevalence of smartphone addiction and its effects on subhealth and insomnia: a cross-sectional study among medical students. *BMC Psychiatry*, *22*(1), 305. https://doi.org/10.1186/s12888-022-03956-6

Lopez-Fernandez, O., Honrubia-Serrano, L., Freixa-Blanxart, M., & Gibson, W. (2014). Prevalence of Problematic Mobile Phone Use in British Adolescents. *Cyberpsychology, Behavior, and Social Networking*, *17*(2), 91–98. https://doi.org/10.1089/cyber.2012.0260

Ma, R., Min, K., Meng, Z., Yang, J., Zhang, H., & Li, Q. (2025). The mediating effects of smartphone addiction in the association between mental disorders and eating disorders: findings from a nationwide survey among Chinese youth. *BMC Public Health*, *25*(1). https://doi.org/10.1186/s12889-025-23608-0

Madden, A. M., & Smith, S. (2016). Body composition and morphological assessment of nutritional status in adults: a review of anthropometric variables. *Journal of Human Nutrition and Dietetics*, *29*(1), 7–25. https://doi.org/10.1111/jhn.12278

Meng, S.-Q., Cheng, J.-L., Li, Y.-Y., Yang, X.-Q., Zheng, J.-W., Chang, X.-W., Shi, Y., Chen, Y., Lu, L., Sun, Y., Bao, Y.-P., & Shi, J. (2022). Global prevalence of digital addiction in general population: A systematic review and meta-analysis. *Clinical Psychology Review*, *92*, 102128. https://doi.org/10.1016/j.cpr.2022.102128

Nagata, J. M., Smith, N., Alsamman, S., Lee, C. M., Dooley, E. E., Kiss, O., Ganson, K. T., Wing, D., Baker, F. C., & Gabriel, K. P. (2023). Association of Physical Activity and Screen Time With Body Mass Index Among US Adolescents. *JAMA Network Open*, *6*(2), e2255466. https://doi.org/10.1001/jamanetworkopen.2022.55466

Nambirajan, M. K., Vidusha, K., Kailasam, J. G., Kannan, S., Govindan, D., Ganesh, K., U, S., Priyan, S., & Krishnamoorthy, Y. (2025). Association between smartphone addiction and sedentary behaviour amongst children, adolescents and young adults: A Systematic Review and meta-analysis. *Journal of Psychiatric Research*, *184*, 128–139. https://doi.org/10.1016/j.jpsychires.2025.02.049

Rosenberg, D. E., Norman, G. J., Wagner, N., Patrick, K., Calfas, K. J., & Sallis, J. F. (2010). Reliability and Validity of the Sedentary Behavior Questionnaire (SBQ) for Adults. *Journal of Physical Activity and Health*, *7*(6), 697–705. https://doi.org/10.1123/jpah.7.6.697

Soni, R., Upadhyay, R., & Jain, M. (2017). Prevalence of smart phone addiction, sleep quality and associated behaviour problems in adolescents. *International Journal of Research in Medical Sciences*, *5*(2), 515. https://doi.org/10.18203/2320-6012.ijrms20170142

Tiruneh, G. (n.d.). *The Relationship between Physical Activity and Body Mass Index: Issues in Model Specification*.

Tymofiyeva, O., Yuan, J. P., Kidambi, R., Huang, C.-Y., Henje, E., Rubinstein, M. L., Jariwala, N., Max, J. E., Yang, T. T., & Xu, D. (2020). Neural Correlates of Smartphone Dependence in Adolescents. *Frontiers in Human Neuroscience*, *14*, 564629. https://doi.org/10.3389/fnhum.2020.564629

Wei Lee, K., Mooi Ching, S., Ali, N., Yau Ooi, C., Kamal Hj Sidek, S., Amat, A., Yatim, Y., Yahaya, Z., Shamsuddin, N., Ibrahim, I., Abdul Majid, F., Suhana Othman, F., Suhaila Zakaria, N., Abidin, A., Hazlin Talib, N., & Sivaratnam, D. (2023). Prevalence and Factors Associated with Smartphone Addiction among Adolescents–A Nationwide Study in Malaysia. *International Journal of Mental Health Promotion*, *25*(2), 237–247. https://doi.org/10.32604/ijmhp.2023.013407

WHO. (2020). *WHO Guideline On Physical Activity And Sedentary Behavior*.

Wong, S. L., Leatherdale, S. T., & Cdc, for. (n.d.). *Association Between Sedentary Behavior, Physical Activity, and Obesity: Inactivity Among Active Kids*. Retrieved http://www.cdc.gov/pcd/issues/2009/jan/07_0242.htm.Accessed[date].

Yuniarti, T., Musta'in, Adriani, R. B., Widiyanto, A., Atmojo, J. T., & Putri, S. I. (2024). The Correlation between Physical Activity, Sedentary Behavior, and Body Mass Index among

College Students in Surakarta, Indonesia: A Cross-sectional Study. *Asian Journal of Social Health and Behavior*, *7*(3), 134–139. https://doi.org/10.4103/shb.shb_18_24

Zhang, R., Jiang, Q., Cheng, M., & Rhim, Y.-T. (2024). The effect of smartphone addiction on adolescent health: the moderating effect of leisure physical activities. *Psicologia: Reflexão e Crítica*, *37*(1), 23. https://doi.org/10.1186/s41155-024-00308-z

THE EFFECT OF STRUCTURED MATERNAL ENGAGEMENT ON ARI PREVENTION

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ABSTRACT

Acute respiratory infection (ARI) remains a major cause of morbidity and mortality among under-five children in India. Despite being preventable through simple home-based measures, repeated hospital visits indicate gaps in maternal knowledge and practices. Objective to evaluate the effectiveness of structured maternal engagement strategies on knowledge and home-based practices regarding prevention of acute respiratory infection among mothers of under-five children. A true experimental pre-test post-test control group design was adopted in paediatric units of selected hospitals in Dehradun, Uttarakhand. A total of 290 mothers were selected using purposive sampling. Structured knowledge questionnaire and practice checklist were used. The experimental group received structured maternal engagement strategies, while the control group received routine care. Data were analysed using descriptive and inferential statistics. Post-test knowledge and practice scores significantly improved in the experimental group ($p < 0.05$). Significant differences were observed between experimental and control groups. Structured maternal engagement strategies are effective in improving maternal knowledge and preventive practices regarding ARI.

Keywords: acute respiratory infection; maternal engagement; under-five child; home care practice; child morbidity; paediatric nursing

INTRODUCTION

Acute respiratory infection is one of the leading causes of morbidity and mortality among under-five children globally. In India, respiratory infections including pneumonia account for a significant proportion of child deaths. According to NFHS-5 (2019–21), 2.8% of children under five experienced symptoms of ARI within two weeks preceding the survey. Respiratory infections contribute to nearly 13–16% of under-five mortality in India. In hilly regions such as Uttarakhand, climatic variations, cold temperatures, overcrowding, poor ventilation, and indoor air pollution increase vulnerability. Mothers are the primary caregivers and play a crucial role in prevention and early recognition of danger signs. However, studies indicate gaps in maternal knowledge regarding warning signs, hygiene practices, and appropriate health-seeking behaviour. Structured maternal engagement strategies delivered by nurses may systematically improve maternal awareness and caregiving behaviour. Hence, this experimental study was undertaken.

METHOD

True experimental pre-test post-test control group design. Paediatric units of selected hospitals, Dehradun, Uttarakhand. 290 mothers of under-five children. Sampling Technique non-probability purposive sampling. Structured maternal engagement strategies included planned teaching sessions, demonstrations on hygiene and ventilation, education on danger signs, interactive discussions, and printed materials. Data were analysed using descriptive statistics (mean, SD, frequency, percentage) and inferential statistics (paired t-test, independent t-test, chi-square). Significance level was set at $p < 0.05$.

RESULT AND DISCUSSION

The experimental group showed significant improvement in post-test knowledge and practice scores compared to pre-test scores ($p < 0.05$). The control group did not show significant improvement. Between-group comparison revealed statistically significant differences favouring the experimental group.

Table 1.
Characteristics Respondent

Characteristics	f	%
Age 20–25 years	110	37.9
Age 26–30 years	120	41.4
Age >30 years	60	20.7
Primary education	85	29.3
Secondary education	140	48.3

The findings revealed that structured maternal engagement strategies significantly improved maternal knowledge and preventive practices. The results are consistent with previous interventional studies demonstrating improvement in maternal awareness following structured education programmes. Systematic nurse-led engagement appears more effective than routine advice.

CONCLUSION

Structured maternal engagement strategies significantly improved maternal knowledge and home-based preventive practices regarding ARI. The intervention is feasible, cost-effective, and suitable for integration into paediatric hospital settings.

REFERENCES

Black, R. E., et al. (2010). Global causes of child mortality. Lancet, 375(9730), 1969–1987.

Walker, C. L. F., et al. (2013). Global burden of childhood pneumonia. Lancet, 381(9875), 1405–1416.

World Health Organization. (2022). Acute respiratory infections in children.

UNICEF. (2021). Pneumonia and diarrhoea progress report.

Gupta, P., et al. (2018). Maternal knowledge and ARI prevention. Indian Journal of Public Health.

Black, R. E., Cousens, S., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G., ... & Child Health Epidemiology Reference Group. (2010). Global, regional, and national causes of child mortality in 2008: A systematic analysis. Lancet, 375(9730), 1969–1987. https://doi.org/10.1016/S0140-6736(10)60549-1

Walker, C. L. F., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z. A., ... & Black, R. E. (2013). Global burden of childhood pneumonia and diarrhoea. Lancet, 381(9875), 1405–1416. https://doi.org/10.1016/S0140-6736(13)60222-6

Sonego, M., Pellegrin, M. C., Becker, G., & Lazzerini, M. (2015). Risk factors for mortality from acute lower respiratory infections in children under five years: A systematic review and meta-analysis. Bulletin of the World Health Organization, 93(5), 345–354. https://doi.org/10.2471/BLT.14.139949

Gupta, P., Murali, M. V., Seth, A., Aneja, S., & Puri, R. K. (2018). Maternal knowledge and practices regarding acute respiratory infections in children. Indian Journal of Public Health, 62(3), 182–188. https://doi.org/10.4103/ijph.IJPH_212_17

Kallander, K., Nsungwa-Sabiiti, J., Peterson, S. (2008). Symptom overlap for malaria and pneumonia in children: Policy implications for home management. Tropical Medicine & International Health, 13(6), 1–9. https://doi.org/10.1111/j.1365-3156.2008.02076.x

National Family Health Survey (NFHS-5). (2021). India fact sheet 2019–21. International Institute for Population Sciences.

World Health Organization. (2022). Pneumonia in children. WHO Factsheet. https://www.who.int/news-room/fact-sheets/detail/pneumonia

UNICEF. (2021). Pneumonia and diarrhoea progress report 2021. United Nations Children's Fund.

ANALYSIS OF RISK FACTORS ASSOCIATED WITH DENGUE HEMORRHAGIC FEVER INCIDENCE

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) remains a major public health problem in tropical and subtropical regions, including Indonesia. The incidence of DHF is influenced by multiple risk factors, such as environmental conditions, vector density, population behaviour, and socio-demographic characteristics. Rapid urbanisation and population mobility in Bandar Lampung City may contribute to increased transmission risk. This study aimed to analyse risk factors associated with the incidence of Dengue Hemorrhagic Fever in Bandar Lampung City in 2025. A quantitative analytic study with a case–control design was conducted involving DHF cases and non-DHF controls in Bandar Lampung City. Samples were selected using an appropriate sampling technique based on inclusion and exclusion criteria. Data were collected through structured questionnaires, observation sheets, and secondary data from health records. Data analysis included univariate analysis, bivariate analysis using the chi-square test, and multivariate analysis using logistic regression to identify dominant risk factors. The results showed that several factors were significantly associated with DHF incidence, including environmental sanitation, presence of mosquito breeding sites, larval density, water storage practices, and household preventive behaviours ($p<0.05$). Multivariate analysis identified the presence of mosquito breeding sites as the most dominant risk factor for DHF incidence. The results showed that several factors were significantly associated with DHF incidence, including environmental sanitation, presence of mosquito breeding sites, larval density, water storage practices, and household preventive behaviours ($p<0.05$). Multivariate analysis identified the presence of mosquito breeding sites as the most dominant risk factor for DHF incidence.

Keywords: dengue haemorrhagic fever; risk factor; mosquito breeding site; vector control; urban health

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) remains one of the most significant vector-borne diseases affecting tropical and subtropical regions worldwide. The disease is caused by four serotypes of the dengue virus (DENV-1 to DENV-4) and is transmitted primarily by Aedes aegypti and Aedes albopictus mosquitoes, which thrive in urban and peri-urban environments (WHO, 2023; Guzman et al., 2016). Dengue infection may range from asymptomatic or mild febrile illness to severe manifestations, including plasma leakage, bleeding, and shock, which can result in death if not managed appropriately. According to the World Health Organization, the global incidence of dengue has increased more than eight-fold over the last two decades, with an estimated 390 million infections occurring annually (WHO, 2023). This increase is attributed to rapid urbanisation, population growth, increased human mobility, climate variability, and inadequate environmental sanitation, all of which facilitate mosquito breeding and virus transmission (Messina et al., 2019; Brady et al., 2014). Dengue continues to pose a substantial public health burden due to its high morbidity, economic impact, and pressure on healthcare systems, particularly in low- and middle-income countries.

Indonesia is among the countries with the highest dengue burden in Southeast Asia and consistently reports a large number of DHF cases each year. Dengue transmission occurs throughout the year, with marked seasonal peaks during the rainy season, when environmental conditions favour

mosquito proliferation (Kemenkes RI, 2023; Shepard et al., 2016). Urban areas with high population density, inadequate waste management, and inconsistent water supply systems are particularly vulnerable to dengue outbreaks (Bhatt et al., 2013). Bandar Lampung City, as a rapidly growing urban centre in Sumatra, exhibits several characteristics that increase the risk of dengue transmission, including dense settlements, population mobility, and heterogeneous environmental sanitation conditions. Despite the implementation of routine vector control programmes, such as larval source reduction and fogging, DHF outbreaks continue to occur, indicating that existing control measures may not adequately address underlying risk factors.

The occurrence of DHF is influenced by a complex interaction of environmental, behavioural, and socio-demographic factors. Environmental factors, such as the presence of mosquito breeding sites, uncovered water storage containers, housing conditions, and ineffective waste management, play a critical role in determining vector density and transmission dynamics (Focks & Alexander, 2006; Bowman et al., 2016). High larval indices have been consistently associated with increased risk of DHF transmission at the household and community levels. Behavioural factors also contribute significantly to dengue prevention and control. Community participation in vector control activities, regular implementation of the 3M Plus strategy (draining, covering, recycling, and additional preventive actions), use of mosquito repellents, and routine larval monitoring are essential to reducing mosquito breeding and interrupting transmission (Erlanger et al., 2008; Al-Delaimy et al., 2014). Lack of sustained preventive behaviour has been shown to increase vulnerability to dengue infection, even in areas with ongoing control programmes.

Previous studies have demonstrated that inadequate environmental sanitation, high larval density, poor water storage practices, and limited household preventive behaviours are strongly associated with increased DHF incidence (Siqueira et al., 2012; Bowman et al., 2016). However, the relative contribution of these risk factors may vary across regions due to differences in ecological conditions, urban infrastructure, socio-economic status, and community behaviour. Therefore, local epidemiological evidence is essential to identify context-specific risk factors and to inform targeted and effective intervention strategies. In Bandar Lampung City, DHF remains a persistent public health concern despite continuous prevention efforts by local health authorities. Empirical data analysing specific environmental and behavioural risk factors associated with DHF incidence in this area remain limited. Understanding these factors is crucial for strengthening evidence-based dengue prevention and control programmes. Therefore, this study aimed to analyse risk factors associated with the incidence of Dengue Hemorrhagic Fever in Bandar Lampung City in 2025.

METHOD

This study employed a quantitative analytic design using a case–control approach. The study was conducted in Bandar Lampung City in 2025. The case group consisted of individuals diagnosed with Dengue Hemorrhagic Fever based on clinical and laboratory confirmation recorded in health facility surveillance data. The control group comprised individuals without a history of DHF who resided in the same area. Samples were selected using an appropriate sampling technique based on predefined inclusion and exclusion criteria. Data collection was conducted through structured questionnaires, direct observation, and secondary data review from health records. Variables assessed included environmental sanitation, presence of mosquito breeding sites, water storage practices, larval density, household preventive behaviours, and selected socio-demographic characteristics.

The dependent variable was the incidence of Dengue Hemorrhagic Fever, while independent variables included environmental and behavioural risk factors. Data analysis consisted of univariate analysis to describe variable distributions, bivariate analysis using the chi-square test to identify associations, and multivariate logistic regression analysis to determine dominant risk factors. Statistical significance was set at $p<0.05$. Ethical approval was obtained prior to data collection. All participants provided informed consent, and confidentiality of respondent information was maintained throughout the study.

RESULT AND DISCUSSION

The study included confirmed Dengue Hemorrhagic Fever (DHF) cases and matched controls residing in Bandar Lampung City. Cases and controls were comparable in terms of basic demographic characteristics, ensuring the validity of comparisons between groups.

Univariate Analysis

Univariate analysis demonstrated clear differences in environmental and behavioural characteristics between DHF cases and controls. A higher proportion of DHF cases were found to live in environments with poor sanitation conditions, including unmanaged solid waste and stagnant water around the household. The presence of uncovered water containers, such as water storage drums, buckets, and discarded containers, was more frequently observed among DHF cases than controls. Larval inspection results indicated that larval indices were higher in households of DHF cases, suggesting increased vector density. Similar patterns have been reported in previous dengue studies, where elevated larval indices were associated with higher transmission risk (Focks & Alexander, 2006; Bowman et al., 2016). Preventive behaviours at the household level, such as routine container cleaning and participation in community vector control activities, were less frequently reported among DHF cases.

Bivariate Analysis

Bivariate analysis using the chi-square test revealed statistically significant associations between DHF incidence and several risk factors. The presence of mosquito breeding sites showed a strong association with DHF incidence ($p<0.05$), indicating that households with positive larval findings were significantly more likely to report DHF cases. Inadequate water storage practices, particularly uncovered or rarely cleaned containers, were also significantly associated with DHF incidence ($p<0.05$). Poor environmental sanitation, including ineffective waste management and presence of stagnant water in the surrounding environment, was significantly related to DHF incidence. In addition, lack of regular household-level vector control activities, such as source reduction and participation in the 3M Plus programme, was associated with a higher likelihood of DHF occurrence. These findings are consistent with previous epidemiological studies demonstrating the role of environmental and behavioural factors in dengue transmission (Erlanger et al., 2008; Siqueira et al., 2012).

Multivariate Analysis

Multivariate logistic regression analysis was conducted to identify dominant risk factors after controlling for potential confounding variables. The analysis identified the presence of mosquito breeding sites as the most dominant risk factor associated with DHF incidence. Households with identified breeding sites had a substantially higher risk of DHF compared to households without breeding sites. Poor water storage practices and inadequate household preventive behaviours also remained significantly associated with DHF incidence in the adjusted model. These results indicate

that environmental conditions and daily household practices independently contribute to dengue transmission risk. Similar findings have been reported in studies conducted in other urban settings, where breeding site presence and water management practices were key predictors of DHF incidence (Bhatt et al., 2013; Messina et al., 2019). Overall, the results highlight that environmental risk factors, particularly mosquito breeding sites, play a central role in DHF transmission in Bandar Lampung City, even after accounting for other contributing factors.

The findings of this study indicate that environmental and behavioural factors play a critical role in the incidence of Dengue Hemorrhagic Fever (DHF) in Bandar Lampung City. The presence of mosquito breeding sites emerged as the most influential risk factor, highlighting the central role of environmental management in dengue prevention. Stagnant water in household containers provides optimal breeding conditions for *Aedes aegypti* and *Aedes albopictus*, leading to increased vector density and a higher probability of virus transmission (Focks & Alexander, 2006; Bowman et al., 2016; WHO, 2023). This finding is consistent with numerous epidemiological studies demonstrating that the presence of positive larval habitats is a strong predictor of DHF incidence in urban settings (Bhatt et al., 2013; Messina et al., 2019). High larval density has been shown to correlate with increased adult mosquito populations, which directly influences transmission intensity and outbreak potential (Brady et al., 2014; Kraemer et al., 2015). Therefore, effective elimination of breeding sites remains a cornerstone of dengue prevention strategies.

Poor water storage practices were also significantly associated with DHF incidence. Uncovered or infrequently cleaned water containers facilitate mosquito breeding and contribute to sustained transmission cycles. Similar findings have been reported in studies conducted in Southeast Asia and other dengue-endemic regions, where domestic water storage practices were identified as major determinants of household-level dengue risk (Erlanger et al., 2008; Siqueira et al., 2012; Toledo et al., 2017). In urban areas with inconsistent water supply, residents often rely on water storage containers, which, if poorly managed, become persistent breeding sites for *Aedes* mosquitoes.

Preventive behaviours, including participation in source reduction activities and routine implementation of the 3M Plus strategy, were shown to reduce DHF risk. Households with low engagement in preventive practices were more vulnerable to dengue transmission. These findings align with previous research emphasising that behavioural factors and community participation are essential components of successful dengue control programmes (Al-Delaimy et al., 2014; Caprara et al., 2015). Behavioural interventions that promote regular container cleaning, waste management, and larval monitoring have been shown to significantly reduce larval indices and dengue incidence. The results of this study further support the ecological model of dengue transmission, which recognises the interaction between environmental conditions, human behaviour, vector ecology, and socio-demographic factors (Reiner et al., 2016; WHO, 2023). Dengue transmission is not solely determined by vector presence but is influenced by complex interactions between environmental sanitation, human practices, and population dynamics. Urbanisation, population density, and human mobility further amplify these interactions, increasing the risk of dengue outbreaks in urban centres such as Bandar Lampung City (Gubler, 2011; Messina et al., 2019).

Integrated vector management (IVM) is therefore essential to reduce DHF incidence in urban areas. IVM combines environmental management, biological and chemical control, community participation, and surveillance-based decision-making to achieve sustainable dengue control

(WHO, 2012; Bowman et al., 2016). Strengthening community engagement and intersectoral collaboration is crucial to ensure long-term effectiveness of vector control interventions.

Overall, the findings of this study highlight the importance of addressing environmental and behavioural determinants of DHF through comprehensive, evidence-based strategies. Strengthening environmental sanitation, improving household water management practices, and promoting sustained community participation are critical to reducing dengue transmission. These results provide valuable local evidence to support targeted dengue prevention and control programmes in Bandar Lampung City and other similar urban settings.

CONCLUSION

The incidence of Dengue Hemorrhagic Fever in Bandar Lampung City is significantly associated with environmental and behavioural risk factors, particularly the presence of mosquito breeding sites, poor water storage practices, and inadequate household preventive behaviours. The presence of mosquito breeding sites is identified as the most dominant risk factor. Strengthening environmental sanitation, enhancing vector control measures, and promoting sustainable community-based preventive behaviours are essential to reduce DHF transmission. These findings provide important evidence to support targeted dengue prevention programmes in Bandar Lampung City.

REFERENCES

Al-Delaimy, A. K., Al-Mekhlafi, H. M., Nasr, N. A., Sady, H., Atroosh, W. M., Al-Areeqi, M. A., Anuar, T. S., & Mahmud, R. (2014). Epidemiology of dengue fever in Yemen: A systematic review. Parasites & Vectors, 7, 239. https://doi.org/10.1186/1756-3305-7-239

Bhatt, S., Gething, P. W., Brady, O. J., Messina, J. P., Farlow, A. W., Moyes, C. L., Drake, J. M., Brownstein, J. S., Hoen, A. G., Sankoh, O., Myers, M. F., George, D. B., Jaenisch, T., Wint, G. R. W., Simmons, C. P., Scott, T. W., Farrar, J. J., & Hay, S. I. (2013). The global distribution and burden of dengue. Nature, 496(7446), 504–507.
https://doi.org/10.1038/nature12060

Bowman, L. R., Donegan, S., & McCall, P. J. (2016). Is dengue vector control deficient in effectiveness or evidence? Systematic review and meta-analysis. PLoS Neglected Tropical Diseases, 10(3), e0004551.
https://doi.org/10.1371/journal.pntd.0004551

Brady, O. J., Gething, P. W., Bhatt, S., Messina, J. P., Brownstein, J. S., Hoen, A. G., Moyes, C. L., Farlow, A. W., Scott, T. W., & Hay, S. I. (2014). Refining the global spatial limits of dengue virus transmission by evidence-based consensus. PLoS Neglected Tropical Diseases, 6(8), e1760.
https://doi.org/10.1371/journal.pntd.0001760

Caprara, A., Lima, J. W. O., Marinho, A. C. P., Calvasina, P. G., Sommerfeld, J., & Kroeger, A. (2015). Irregular water supply, household usage and dengue: A bio-social study in the Brazilian Northeast. Cadernos de Saúde Pública, 25(Suppl 1), S125–S136.
https://doi.org/10.1590/S0102-311X2009001300012

Erlanger, T. E., Keiser, J., & Utzinger, J. (2008). Effect of dengue vector control interventions on entomological parameters in developing countries: A systematic review and meta-analysis. Medical and Veterinary Entomology, 22(3), 203–221.
https://doi.org/10.1111/j.1365-2915.2008.00740.x

Focks, D. A., & Alexander, N. (2006). Multicountry study of Aedes aegypti pupal productivity survey methodology. Bulletin of the World Health Organization, 84(10), 781–788.
https://doi.org/10.2471/BLT.05.026559
Gubler, D. J. (2011). Dengue, urbanization and globalization: The unholy trinity of the 21st century. Tropical Medicine and Health, 39(4 Suppl), 3–11.
https://doi.org/10.2149/tmh.2011-S05
Guzman, M. G., Harris, E., & Dengue. (2016). Dengue. The Lancet, 385(9966), 453–465.
https://doi.org/10.1016/S0140-6736(14)60572-9
Kementerian Kesehatan Republik Indonesia. (2023). Profil kesehatan Indonesia. Kementerian Kesehatan RI.
Kraemer, M. U. G., Sinka, M. E., Duda, K. A., Mylne, A. Q. N., Shearer, F. M., Barker, C. M., Moore, C. G., Carvalho, R. G., Coelho, G. E., Van Bortel, W., Hendrickx, G., Schaffner, F., Elyazar, I. R. F., Teng, H. J., Brady, O. J., Messina, J. P., Pigott, D. M., Scott, T. W., Smith, D. L., … Hay, S. I. (2015). The global distribution of the arbovirus vectors Aedes aegypti and Aedes albopictus. eLife, 4, e08347.
https://doi.org/10.7554/eLife.08347
Messina, J. P., Brady, O. J., Golding, N., Kraemer, M. U. G., Wint, G. R. W., Ray, S. E., Pigott, D. M., Shearer, F. M., Johnson, K., Earl, L., Marczak, L. B., Shirude, S., Davis Weaver, N., Gilbert, M., Velayudhan, R., Jones, K. E., Jaenisch, T., Scott, T. W., Reiner, R. C., & Hay, S. I. (2019). The current and future global distribution and population at risk of dengue. Nature Microbiology, 4(9), 1508–1515.
https://doi.org/10.1038/s41564-019-0476-8
Reiner, R. C., Stoddard, S. T., Scott, T. W., & Smith, D. L. (2016). Estimating the impact of vector control interventions on dengue transmission. PLoS Neglected Tropical Diseases, 10(2), e0004582.
https://doi.org/10.1371/journal.pntd.0004582
Shepard, D. S., Undurraga, E. A., & Halasa, Y. A. (2016). Economic and disease burden of dengue in Southeast Asia. PLoS Neglected Tropical Diseases, 7(2), e2055.
https://doi.org/10.1371/journal.pntd.0002055
Siqueira, J. B., Martelli, C. M. T., Coelho, G. E., Simplicio, A. C. R., & Hatch, D. L. (2012). Dengue and dengue hemorrhagic fever, Brazil, 1981–2002. Emerging Infectious Diseases, 11(1), 48–53.
https://doi.org/10.3201/eid1101.031091
Toledo, M. E., Vanlerberghe, V., Baly, A., Ceballos, E., Valdes, L., Searret, M., Boelaert, M., & Van der Stuyft, P. (2017). Towards active community participation in dengue vector control: Results from action research in Havana, Cuba. Transactions of the Royal Society of Tropical Medicine and Hygiene, 101(1), 56–63.
https://doi.org/10.1016/j.trstmh.2006.05.006
World Health Organization. (2012). Handbook for integrated vector management. WHO.
World Health Organization. (2023). Dengue and severe dengue. WHO.

NANOEMULSION AROMATHERAPY CUPPING REDUCES ANXIETY IN HYPERTENSION PATIENTS

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ABSTRACT

Hypertension is a chronic condition that is often accompanied by psychological issues, such as anxiety, which can affect blood pressure control and the quality of life of patients. Various complementary therapies have been developed to help reduce anxiety, including cupping therapy and nanoemulsion aromatherapy. This study aims to analyse the effect of nanoemulsion aromatherapy cupping on anxiety levels in hypertension patients and compare it with cupping therapy. This study employed a quasi-experimental design with a pretest-posttest control group. The sample consisted of 30 hypertension patients, divided into two groups: cupping therapy and nanoemulsion aromatherapy cupping, with 15 respondents in each group. Anxiety levels were measured before and after the intervention using an anxiety questionnaire. Data analysis was performed using paired t-tests to examine the difference in anxiety within each group and an independent t-test to compare the reduction in anxiety between the two groups. The results showed a significant reduction in anxiety levels in both the cupping therapy group ($p = 0.002$) and the nanoemulsion aromatherapy cupping group ($p = 0.000$). However, the independent t-test revealed no significant difference in anxiety reduction between the two groups ($p = 0.215$). Both cupping therapy and nanoemulsion aromatherapy cupping were effective in reducing anxiety levels in hypertension patients, with no significant difference in effectiveness between the two therapies. Nanoemulsion aromatherapy cupping has the potential to be a complementary therapy in managing anxiety in hypertension patients.

Keywords: anxiety; cupping therapy; hypertension; nanoemulsion aromatherapy

INTRODUCTION

Hypertension is one of the cardiovascular diseases affecting many individuals worldwide and is often referred to as the "silent killer" because it can develop without clear symptoms, yet has a significant impact on long-term health and can be life-threatening. According to the Indonesian Ministry of Health data in 2018, the prevalence of hypertension increased by 8.2% compared to the previous year. In the Special Region of Yogyakarta (DIY), the prevalence of hypertension reached 34.1%, and in Bantul Regency, it was 29.89% (Bantul District Health Office, 2019). Hypertension not only affects physical health but is also closely related to psychological issues, particularly anxiety. Anxiety in hypertension patients can exacerbate their condition, as it can increase stress hormones such as cortisol, which contributes to elevated blood pressure (Sherwood, 2014)

Anxiety in hypertension patients is an uncontrolled worry, characterized by feelings of tension and fear, accompanied by physiological changes such as increased heart rate, breathing, and blood pressure. Anxiety in hypertension patients can stimulate the secretion of stress hormones like cortisol, leading to further increases in blood pressure (Stuart, 2019). Therefore, proper management of anxiety is crucial in hypertension management to avoid worsening the patient's condition.

Hypertension therapy typically uses pharmacological and non-pharmacological approaches to address anxiety. One increasingly popular non-pharmacological therapy is wet cupping. Cupping

is a treatment method where capillary blood is drawn through suction, followed by light needling and re-suctioning (Al-Bedah et al., 2019; Aris Setyawan, 2022; Siregar et al., 2021). Cupping therapy can stimulate the secretion of β-endorphin hormones, providing analgesic and anxiolytic (anti-anxiety) effects (Benli & Sunay, n.d.). Previous research has shown that cupping therapy can reduce anxiety in hypertension patients (Setyawan et al., 2020).

However, although cupping is effective, the absorption of active compounds from essential oils used in aromatherapy therapy may be limited by the skin's permeability. Innovation in active compound delivery is necessary to enhance the effectiveness of aromatherapy. One innovative solution is the use of nanoemulsion, a drug delivery system based on nanoparticles that can improve the stability and bioavailability of essential oils. Nanoemulsion can dissolve lipophilic compounds that are difficult to dissolve in water, enabling better penetration through the skin and improving the therapeutic effects of aromatherapy (Al-Hussaniy et al., 2023)

Cupping can enhance transdermal permeability by breaking down the lipid structure between cells in the stratum corneum, while nanoemulsion aromatherapy therapy can improve the penetration effectiveness of essential oils. This study aims to explore the effect of combining nanoemulsion aromatherapy cupping in reducing anxiety in hypertension patients. It is expected that the combination of cupping therapy and nanoemulsion aromatherapy can provide synergistic benefits, offering a safer and more effective complementary therapy alternative in managing anxiety in hypertension patients.

METHOD

This study used a quasi-experimental design with a pretest-posttest control group design approach. The research was conducted at Rumah Sehat Holistik Islami and Integrative Care (RSH In Care) Yogyakarta, with subjects being hypertension patients who met the inclusion and exclusion criteria. Sampling was performed using simple random sampling, with 30 respondents. The respondents were divided into two groups: the intervention group and the control group, each consisting of 15 participants. The intervention group received cupping therapy combined with nanoemulsion aromatherapy, while the control group received cupping therapy without nanoemulsion aromatherapy.

The intervention consisted of two parts. First, cupping therapy was performed using the Cupping–Puncture–Cupping (CPC) method at the Al-Kaahil, Azh-Zahrul A'la, and Al-Akhda'ain points. This procedure was carried out by trained professionals following sterile procedure standards to ensure safety and reduce the risk of infection. Afterward, the intervention group received the application of nanoemulsion aromatherapy containing essential oils of *Lavandula angustifolia* (lavender), *Mentha piperita* (peppermint), and *Zingiber officinale* (ginger). The nanoemulsion aromatherapy was topically applied to the designated points after the cupping therapy to enhance the penetration of active compounds into the skin and improve therapeutic effects.

Pretest data collection was performed 5-10 minutes before the intervention. The intervention was conducted once for each respondent, with a duration of 15-30 minutes per participant. Posttest data collection was performed 15-20 minutes after the intervention was given. The dependent variable in this study was anxiety level, measured using the Zung-Self Anxiety Rating Scale (ZSAS) before and after the intervention. The data obtained from the ZSAS questionnaire were analyzed to see the difference in anxiety levels before and after the intervention within each group using paired

sample t-test. To compare changes in anxiety between the intervention and control groups, an independent sample t-test was used, with a significance level of $p < 0.05$.

RESULT AND DISCUSSION

Respondent Characteristics

The descriptive analysis of 30 respondents, categorized by antihypertensive drug use and age group, is presented in Table 1. The analysis showed that the majority of respondents did not take antihypertensive medications, with 20 people (66.7%) not using medication, while 10 respondents (33.3%) took antihypertensive drugs. In terms of age categories, most respondents were in the 46–55 years age range, comprising 22 people (73.3%). Respondents aged 36–45 years and 56–65 years each numbered 4 (13.3%). In terms of gender, the majority of respondents were female, totaling 18 people (60%), while males accounted for 12 people (40%).

Table 1.
Respondent characteristics (n= 30)

Characteristic	f	%
Age (Years)		
26 – 35 Years	-	-
36 – 45 Years	4	13.3
46 – 55 Years	22	73.3
56 – 65 Years	4	13.3
Gender		
Female	18	60
Male	12	40
Antihypertensive Medication		
Yes	10	33.3
No	20	66.7

Based on the results of the study, most respondents were in the 46-55 age range. This finding aligns with the theory stating that the risk of hypertension increases with age due to physiological changes in the cardiovascular system, such as reduced arterial elasticity, increased arterial stiffness, and higher peripheral vascular resistance, which directly affect blood pressure (Kapuku, 2022; Labarthe, 2012). The dominance of respondents in this age range indicates that late adulthood is a critical period for blood pressure regulation disorders. In this phase, the adaptability of blood vessels to hemodynamic changes begins to decline, making individuals more vulnerable to increased blood pressure and cardiovascular complications. This condition explains why both pharmacological and non-pharmacological nursing interventions are crucial for this age group.

The age distribution of respondents in this study is also consistent with epidemiological data showing that the prevalence of hypertension significantly increases in late adulthood and the elderly. Data from Riskesdas and the Ministry of Health of the Republic of Indonesia show that those over the age of 45 have a higher prevalence of hypertension compared to the productive age group, making this group a priority for hypertension prevention and control interventions (Bantul District Health Office, 2019; Ministry of Health Republic of Indonesia., 2018).

The high prevalence of hypertension in this age group is influenced not only by biological factors but also by lifestyle factors such as low physical activity, high sodium intake, and increased stress exposure. Therefore, hypertension control strategies for this age group should combine medical and complementary nursing approaches focusing on both the physiological and psychological improvement of the patient.

In this study, the majority of respondents were female (60%), while 40% were male. The high number of women in this sample may be related to hormonal factors affecting blood pressure

regulation in women, particularly after menopause, which often leads to increased blood pressure. The decrease in estrogen levels after menopause can affect the elasticity of blood vessels and increase vascular resistance, contributing to elevated blood pressure (Kapuku, 2022). Additionally, women are more vulnerable to psychological conditions such as anxiety, which is related to hypertension. Previous studies have shown that women tend to be more susceptible to anxiety, which can exacerbate their hypertension (Sherwood, 2014). Therefore, a psychological approach is essential in managing hypertension in female patients, with complementary therapies such as aromatherapy or relaxation therapy offering an alternative to help reduce anxiety and improve the quality of life.

Effectiveness of Cupping and Nanoemulsion Aromatherapy Cupping in Reducing Anxiety in Hypertension Patients

Table 2 shows the results of the normality test using the Shapiro-Wilk test, where the p-value for both groups was > 0.05, indicating that the data in this study followed a normal distribution. Thus, subsequent statistical testing will use parametric tests (Paired T-test).

Table 2.
Normality Test Results Using Shapiro-Wilk Test (n=30)

Group	*Shaphiro-Wilk*		
	Statistic	Df	Sig.
Intervention	.149	15	.190
Control	.965	15	.774

Table 3 shows significant differences in anxiety levels before and after the intervention in both groups. In the control group, which received cupping therapy, the average anxiety score decreased by 9.467, with a p-value of 0.002 ($p < 0.05$), indicating that cupping therapy was effective in reducing anxiety in hypertension patients. On the other hand, in the intervention group, which received a combination of cupping and nanoemulsion aromatherapy cupping, the average anxiety score decreased by 13.400, with a p-value of 0.000 ($p < 0.05$). This also shows that the combination therapy of cupping and nanoemulsion aromatherapy was effective in reducing anxiety in hypertension patients.Thus, both therapies, cupping and the combination of cupping with nanoemulsion aromatherapy, significantly impacted the reduction of anxiety in hypertension patients.

Table 3
Paired T-test Results for Control and Intervention Groups

Group	Mean Pre ± SD	Mean Post ± SD	ΔMean	t	df	P Value
Control (cupping)	43.20 ± 8.334	33.73 ± 5.946	9,467	3.835	14	0.002
Intervention (nanoemulsion aromatherapy cupping)	45,20 ± 7.849	31,80 ± 6.428	13,400	7.160	14	0.000

Table 4 shows the results of the independent t-test used to compare the changes in anxiety between the control group (cupping) and the intervention group (nanoemulsion aromatherapy cupping). The results of the test showed a p-value of 0.215 ($p > 0.05$), meaning there was no significant difference between the two groups in terms of the change in anxiety scores. Although the intervention group showed a larger reduction in anxiety, this difference was not statistically significant.

Table 4
Independent T-test Results for Control and Intervention Groups

Group	Mean ± SD	ΔMean	t	df	P Value
Control (cupping)	9,47 ± 9,56	-3.933	1,270	28	0,215
Intervention (nanoemulsion aromatherapy cupping)	13,40 ± 7,25				

In this study, the effectiveness of cupping and nanoemulsion aromatherapy cupping therapy in reducing anxiety in hypertension patients was analyzed using the Zung-Self Anxiety Rating Scale (ZSAS) before and after the intervention. The results of the study show that both therapies were effective in reducing anxiety levels in hypertension patients, both in the control group receiving cupping therapy and in the intervention group receiving the combination of cupping and nanoemulsion aromatherapy.

In the control group, which received only cupping therapy, there was a reduction in the average anxiety score by 9.47, indicating that cupping therapy can have a positive effect in reducing anxiety in hypertension patients. Cupping therapy is known to stimulate the secretion of β-endorphin hormones, which have an anti-anxiety effect, and also promote physical and psychological relaxation in patients (Ahmedi, 2014; Benli & Sunay, n.d.)Previous research by Setyawan (2020) also supports this finding, where cupping therapy was proven to be effective in reducing anxiety in hypertension patients, with significant results observed in post-therapy anxiety levels. According to the researcher, this may occur because cupping therapy not only functions as physical relaxation but also stimulates the nervous system to release endorphins, which have the ability to relieve anxiety and improve patients' psychological well-being.

In the intervention group, which received the combination of cupping and nanoemulsion aromatherapy cupping, the average anxiety score decreased by a larger amount, 13.40. Nanoemulsion aromatherapy, which involves using essential oils such as lavender, peppermint, and ginger, works to calm the nervous system and provide a deeper relaxation effect through topical application formulated in nanoemulsions. The essential oils used in aromatherapy contain bioactive compounds that can selectively bind with specific targets in the body, affecting physiological processes (Koyama & Heinbockel, 2020). Aromatherapy using essential oils (EO) has also been shown to have various therapeutic uses, including relieving depression (Setyawan et al., n.d., 2022), pain (Reyes et al., 2020) and hypertension (Mohamadinasab et al., 2019).

According to a systematic review by Alves-Silva et al. (2021), several essential oils, such as lavender, ginger, and peppermint, have antihypertensive effects. Ginger oil, especially the active compound 6-gingerol, also shows significant therapeutic potential in alleviating anxiety. Research conducted by Song et al. (2024) showed that transdermal patches containing ginger oil could reduce PTSD and anxiety symptoms by decreasing levels of TNF-α and IL-6 (pro-inflammatory cytokines) in the brain while increasing BDNF (brain-derived neurotrophic factor) and melatonin. This indicates that ginger oil can provide neuroprotective effects, reduce inflammation, and address psychological disorders, including anxiety. The use of nanoemulsions allows better penetration of essential oils through the skin, as nanoemulsions have very small particles (usually between 50–500 nm), making it easier for essential oils to pass through the skin barrier (stratum corneum), which was previously difficult to penetrate with conventional aromatherapy. Nanoemulsion improves the bioavailability of essential oils, enhances the effectiveness of aromatherapy, and extends the duration of therapeutic effects experienced by patients (Al-Hussaniy et al., 2023; Wilson et al., 2022).

CONCLUSION

This study shows that both conventional cupping therapy and cupping therapy combined with nanoemulsion aromatherapy are effective in reducing anxiety in hypertension patients. Although the intervention group that received the combination of cupping and nanoemulsion aromatherapy showed a larger reduction in anxiety compared to the control group, the statistical test did not show a significant difference between the two therapies ($p = 0.215$). Thus, both therapies have similar effectiveness in relieving anxiety and can be considered safe and effective alternative therapies to help hypertension patients manage their anxiety. Cupping therapy, both independently and with the addition of nanoemulsion aromatherapy, can be an important part of a holistic approach to hypertension management, considering the often overlooked psychological aspects in conventional medical care. The results of this study support the use of complementary therapies as part of hypertension management, especially in relieving anxiety related to this condition. An approach that combines cupping therapy with other non-pharmacological therapies, such as aromatherapy, can improve the overall quality of life for hypertension patients.

REFERENCES

Ahmedi, M., & Siddiqui, M. R. (2014). *The value of wet cupping as a therapy in modern medicine-An Islamic Perspective*.

Al-Bedah, A. M. N., Elsubai, I. S., Qureshi, N. A., Aboushanab, T. S., Ali, G. I. M., El-Olemy, A. T., Khalil, A. A. H., Khalil, M. K. M., & Alqaed, M. S. (2019). The medical perspective of cupping therapy: Effects and mechanisms of action. In *Journal of Traditional and Complementary Medicine* (Vol. 9, Issue 2, pp. 90–97). National Taiwan University. https://doi.org/10.1016/j.jtcme.2018.03.003

Al-Hussaniy, H. A., Almajidi, Y. Q., Oraibi, A. I., & Alkarawi, A. H. (2023). Nanoemulsions as medicinal components in insoluble medicines. In *Pharmacia* (Vol. 70, Issue 3, pp. 537–547). Pensoft Publishers. https://doi.org/10.3897/pharmacia.70.e107131

Alves-Silva, J. M., Zuzarte, M., Girão, H., & Salgueiro, L. (2021). The Role of Essential Oils and Their Main Compounds in the Management of Cardiovascular Disease Risk Factors. *Molecules*, *26*(12), 3506. https://doi.org/10.3390/molecules26123506

Aris Setyawan. (2022). *cupping for nursing : tinjauan syariyah dan ilmiah (1st ed.)*. cendekia muslim.

Aris Setyawan, A., & Kintoko, K. (2024). Potential Applications and Active Substances of Lavender Essential Oil as An Anti-Hypertension: Narrative Literature Review. *Indonesian Journal of Global Health Research*, *6*(4), 2343–2352.

Bantul District Health Office. (2019). *Bantul District Health Office*. Bantul District health profile.

Benli, A. R., & Sunay, D. (n.d.). The effect of wet cupping therapy on a patient diagnosed with panic attacks: a case report. *Asian J Clin Case Rep Trad Alt Med*, *1*(2), 27–31. https://doi.org/10.22040/AJTCAM.2018.87184

Dieterle, T. (2015). Nebenwirkungen und Interaktionen häufig eingesetzter kardiologischer Medikamente. *Therapeutische Umschau*, *72*(11/12), 701–710. https://doi.org/10.1024/0040-5930/a000740

Ghosh, R., Alajbegovic, A., & Gomes, A. V. (2015). NSAIDs and Cardiovascular Diseases: Role of Reactive Oxygen Species. *Oxidative Medicine and Cellular Longevity*, *2015*(4), 1–25. https://doi.org/10.1155/2015/536962

Kapuku, G. K. . & K. W. J. (2022). *Classification of cardiovascular diseases: Epidemiology, diagnosis, and treatment. Handbook of Cardiovascular Behavioral Medicine*.

Koyama, S., & Heinbockel, T. (2020). The Effects of Essential Oils and Terpenes in Relation to Their Routes of Intake and Application. *International Journal of Molecular Sciences*, *21*(5), 1558. https://doi.org/10.3390/ijms21051558

Labarthe, D. R. (2012). From Cardiovascular Disease to Cardiovascular Health. *Circulation: Cardiovascular Quality and Outcomes*, *5*(6). https://doi.org/10.1161/CIRCOUTCOMES.111.964726

Ministry of Health Republic of Indonesia. (2018). *Report on the results of Basic Health Research (Riskesdas) 2018.*

Mohamadinasab, S., Ravari, A., Mirzaei, T., & Sayadi, A. (2019). The Effect of Aromatherapy with Essential Rose Oils on Blood Pressure in Hypertensive Patients. *Journal of Medicinal Plants*, *4*(72), 202–214. https://doi.org/10.29252/jmp.4.72.202

Reyes, M. C. G. M., Reyes, M. C. G. M., Ribay, K. G. L., & Paragas, E. D. (2020). Effects of sweet orange aromatherapy on pain and anxiety during needle insertion among patients undergoing hemodialysis: A quasi-experimental study. *Nursing Forum*, *55*(3), 425–432. https://doi.org/10.1111/nuf.12447

Setyawan, A., Hasnah, K., Surya, S., Yogyakarta, G., Keperawatan, A., & Surakarta, I. H. (2020). EFEKTIVITAS WET CUPPING THERAPY TERHADAP KECEMASAN PADA PASIEN HIPERTENSI. In *Jurnal Kesehatan Kusuma Husada-Juli*.

Setyawan, A., Syahruramdhani, S., & Setyaningrum, N. (2022). The Effect of Aromatherapy on Anxiety in Patients Undergoing Hemodialysis during COVID-19 Pandemic. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*, *7*(S2). https://doi.org/10.30604/jika.v7iS2.1440

Shakeel, F., & Ramadan, W. (2010). Transdermal delivery of anticancer drug caffeine from water-in-oil nanoemulsions. *Colloids and Surfaces B: Biointerfaces*, *75*(1), 356–362. https://doi.org/10.1016/j.colsurfb.2009.09.010

Sinclair, J., Du, X., Shadwell, G., Dillon, S., Butters, B., & Bottoms, L. (2025). Effects of peppermint (Mentha piperita L.) oil in cardiometabolic outcomes in participants with pre and stage 1 hypertension: Protocol for a placebo randomized controlled trial. *PLOS One*, *20*(5), e0321986. https://doi.org/10.1371/journal.pone.0321986

Siregar, R., Setyawan, A., & Syahruramdhani, S. (2021). A model to standardize safety and quality of care for cupping therapy. *Journal of Integrative Medicine*, *19*(4), 327–332. https://doi.org/10.1016/j.joim.2021.01.011

Song, X., Zhang, Y., Tang, Z., Dai, J., Wu, Y., Huang, G., Niu, H., Wang, Y., Jin, X., & Du, L. (2024). Ginger oil-loaded transdermal adhesive patch treats post-traumatic stress disorder.

Journal of Traditional Chinese Medical Sciences, *11*(3), 316–329. https://doi.org/10.1016/j.jtcms.2024.05.003

Stuart, G. W. (2019). *Pocket guide to psychiatric nursing*.

Wilson, R. J., Li, Y., Yang, G., & Zhao, C.-X. (2022). Nanoemulsions for drug delivery. *Particuology*, *64*, 85–97. https://doi.org/10.1016/j.partic.2021.05.009

Zhang, Q. (2018). Global situation and WHO strategy on traditional medicine. *Traditional Medicine and Modern Medicine*, *01*(01), 11–13. https://doi.org/10.1142/s257590001820001x

RESPIRATORY HEALTH RISKS DUE TO EXPOSURE TO SECONDHAND SMOKE IN PREGNANT WOMEN AND THEIR IMPACT ON PREGNANCY OUTCOMES: A LITERATURE REVIEW

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ABSTRACT

Exposure to secondhand smoke (SHS) during pregnancy is a significant public health concern, particularly within households, as it can adversely affect maternal respiratory health and pregnancy outcomes. Objective to review the current evidence regarding SHS exposure in pregnant women, its impact on respiratory health, and pregnancy outcomes. A literature review was conducted on national and international journals published between 2018 and 2024. Studies were extracted based on their characteristics, sources of SHS, effects on maternal respiration, and pregnancy outcomes. Five Indonesian journals and five international journals were selected to represent both national and global contexts. The analysis indicated that households are the primary source of SHS exposure, particularly from husbands or other family members who smoke. This exposure leads to maternal respiratory disturbances, such as cough, shortness of breath, increased carbon monoxide levels, and reduced oxygen saturation. Adverse pregnancy outcomes include low birth weight, shorter body length, smaller head circumference, preterm birth, and maternal complications such as placental abruption. Similar findings have been reported internationally, highlighting the cumulative nature and significant risks of SHS exposure for both mother and fetus. \ SHS exposure during pregnancy negatively affects maternal respiratory health and pregnancy outcomes. Health interventions should target all family members, particularly active smokers in the household, to reduce exposure and maternal–fetal complications.

Keywords: pregnancy outcomes; pregnant women; respiratory health; secondhand smoke; SHS

INTRODUCTION

Maternal health is a primary determinant of pregnancy outcomes and fetal growth and development. During pregnancy, oxygen demand increases in response to fetal growth and physiological changes in the maternal cardiovascular and respiratory systems. This condition requires optimal pulmonary function to ensure adequate oxygen supply for both the mother and the fetus. However, exposure to secondhand smoke (SHS) remains a significant public health concern, particularly among pregnant women. The World Health Organization reported in the WHO Report on the Global Tobacco Epidemic 2023 that tobacco use continues to affect millions of people worldwide, with approximately 5.2 million of them being women (Mahmoodabad et al. 2019). In Indonesia, the high prevalence of male smokers, exceeding 60%, places most pregnant women at risk of becoming passive smokers(WHO, Kemenkes RI, and Brin 2024).

Pregnant women may also experience various respiratory disorders, such as asthma. Asthma is one of the most frequently diagnosed respiratory conditions during pregnancy, affecting up to 13% of pregnant women (Monitoring asthma in pregnancy A discussion paper Monitoring asthma in pregnancy n.d.) In Nusa Tenggara Timur, infectious diseases were the most prevalent health problems in 2018, with the highest incidence related to respiratory and pulmonary infections, including acute respiratory infections, rhinopharyngitis, and acute pneumonia. The number of pneumonia cases increased from 225 in 2017 to 189 in 2018, while tuberculosis cases in 2018 reached 645, comprising 374 males and 271 females (“Health Profile,” 2018). Cigarette smoke

contains more than 7,000 harmful chemical substances, including nicotine, carbon monoxide, and fine particulate matter, which can reduce lung capacity and impair oxygen exchange. Chronic exposure to these substances may lead to respiratory dysfunction in pregnant women and result in fetal hypoxia. Carbon monoxide in cigarette smoke has a much higher affinity for hemoglobin than oxygen, forming carboxyhemoglobin that directly reduces oxygen delivery to maternal tissues and the placenta (Palmeri and Gupta 2025) (Palmeri and Gupta 2025).

Exposure to secondhand smoke during pregnancy has been associated with various adverse maternal and neonatal outcomes, including an increased risk of preterm birth, low birth weight (Mojibyan et al. 2013), and impaired fetal growth characterized by reduced birth weight and body size. Furthermore, children exposed to tobacco smoke during both prenatal and postnatal periods have a higher risk of developing respiratory disorders, including asthma and other respiratory complications. Although numerous studies have examined the impact of secondhand smoke exposure on pregnancy outcomes, research specifically focusing on its effects on maternal respiratory health remains limited, particularly in developing countries, including Indonesia. Therefore, a comprehensive evidence-based study through a literature review is needed to analyze the impact of SHS exposure on maternal respiratory health and pregnancy outcomes. This evidence is essential for strengthening promotive and preventive interventions in maternal healthcare services.

METHOD

This study employed a descriptive literature review design. Data were obtained from Google Scholar, SINTA, ScienceDirect, and PubMed using the keywords “secondhand smoke,” “pregnant women,” “lung health,” “pregnancy outcomes,” and “tobacco smoke exposure” combined with Boolean operators (AND, OR). The inclusion criteria were scientific articles published between 2018 and 2024, discussing secondhand smoke exposure among pregnant women, available in full-text format, and published in reputable journals. The exclusion criteria included opinion or editorial articles, publications without full-text access, and studies that were not relevant to the research topic

RESULT AND DISCUSSION

Table 1.
Exposure to Secondhand Smoke Among Pregnant Women and Its Maternal and Neonatal Health Impacts (2018–2025)

No	Author (year)	Country	Journal	Study Design	Sample	Source of Smoke Exposure	Outcome	Main Findings
1	Magister Aziza N. et al. (2024)	Indonesia	Jurnal Kesehatan Perintis	Case-control	102 ibu hamil	Exposure to cigarette smoke at home	Low Birth Weiight	SHS exposure among pregnant women significantly increases the risk of delivering a low birth weight infant (OR=3.429). (Upertis Journal)
2	Ismar A. et al. (2021)	Indonesia	Jurnal Ilmiah Ilmu Keperawatan Indonesia	Cross-sectional	50 pregnant women	Exposure to cigarette smoke at home	Birth weight	There is a significant association between exposure to cigarette smoke and low birth weight (<2500 g) in infants. (UIMA Journal)
3	Anisa U.S. et al. (2023)	Indonesia	Health Information:	Tinjauan pustaka	Literature review	SHS exposure	espiratory risk & low	SHS exposure affects lung development and increases

No	Author (year)	Country	Journal	Study Design	Sample	Source of Smoke Exposure	Outcome	Main Findings
			Jurnal Penelitian				birth weight (LBW)	the risk of low birth weight in infants.
4	Mudyawati et al. (2018)	Indonesia	Medika Alkhairaat: Jurnal Penelitian Kedokteran dan Kesehatan	Deskriptif	42 pregnant women	Exposure to cigarette smoke	regnant women's knowledge	pregnant women's knowledge about the dangers of cigarette smoke during pregnancy remains low, which may influence behaviors related to SHS exposure.(J(FK UNISA Journal)
5	Oktaviana M.P. et al. (2025)	Indonesia	Jurnal Penelitian Perawat Profesional	Case-control	34 pregnant women	Exposure to cigarette smoke	Chronic energy deficiency (CED)	Exposure to cigarette smoke is associated with chronic energy deficiency in pregnant women, indicating an additional risk to maternal nutritional status.(Global Health Science Journal)
6	Hein Nyi Maung et al. (2023)	Myanmar	Asia Pacific J Public Health	Cross-sectional	407 pregnant women	Home & public places	Prevalence of SHS exposure	65.4% of pregnant women were exposed to SHS, associated with household rules and public visits.
7	Stevens et al. (2024)	Mesir	BMC Women's Health	Cross-sectional	407 pregnant women	Home (husband smoking)	Prevalence of SHS exposure & attitudes	8% of pregnant women were exposed; exposure was associated with a lack of understanding of SHS hazards.
8	Prince et al. (2021)	India	Indian J Community Med	Retrospective cohort	208 pregnant women	Homeh	Low birth weight (LBW), length & head circumference	regnant women exposed to SHS were at risk of delivering infants with low birth weight, reduced length, and smaller head circumference.
9	Karumai-Mori et al. (2025)	Jepang	BMJ Open	Prospective cohort	82,000 pregnant women	Home & surrounding environment	Placental abruption	SHS exposure significantly increases the risk of placental abruption.
10	Wang et al. (2024)	China	Tobacco Induced Diseases	Cohort	350 ibu hamil	Home	Preterm birth, low birth weight (LBW), intrauterine growth restriction (IUGR)	SHS exposure is associated with preterm birth and low birth weight.

Based on the review of the 10 analyzed articles, most studies were conducted in Indonesia, with additional studies from Myanmar, Egypt, India, Japan, and China. The study designs varied, including case-control, cross-sectional, cohort, descriptive, and literature review, with sample sizes ranging from 34 to more than 80,000 pregnant women. Overall, all studies indicated that the home environment is the primary source of cigarette smoke exposure among pregnant women, mainly due to the smoking habits of husbands or other family members. This exposure occurs continuously, thereby increasing the risk of long-term exposure to toxic substances from tobacco smoke.

CONCLUSION

Exposure to secondhand smoke (SHS) during pregnancy remains a significant public health concern, particularly within domestic environments. National studies have consistently identified the home as the primary setting for SHS exposure, with smoking by husbands or other family members serving as the main contributors. Aziza et al. (2024) found that pregnant women exposed to SHS at home were at a significantly increased risk of delivering infants with low birth weight (OR = 3.429).(Aziza et al. 2025). Similar findings were reported by Ismar A. et al. (2021), who demonstrated a significant association between exposure to tobacco smoke and birth weight below 2,500 g. Furthermore, a literature review by Anisa U.S. et al. (2023) concluded that SHS exposure can impair respiratory system development and increase the risk of low birth weight..(Agustin et al. 2021)

SHS exposure also affects the health of pregnant women. A study by Oktaviana M.P. et al. (2025) demonstrated an association between exposure to tobacco smoke and the occurrence of chronic energy deficiency (CED), which can further compromise maternal nutritional status.(Putri et al. 2025). Mudyawati et al. (2020) found that pregnant women's knowledge about the dangers of tobacco smoke remains low, which may potentially influence their exposure to SHS.(Mudyawati et al. 2020). SHS exposure also contributes to impaired oxygenation and respiratory function in pregnant women by increasing carboxyhemoglobin levels, reducing oxygen-carrying capacity, and exacerbating respiratory complaints.(Salmasi et al. 2010),(Salmasi et al. 2010)

This phenomenon is not limited to Indonesia but is also observed internationally. A cross-sectional study in Myanmar reported that 65.4% of pregnant women were exposed to SHS at home or in public spaces. In Egypt (Hein Nyi Maung, Kyaw Thet Aung, and Nguyen Thi Thuy Hanh 2023), Stevens et al. (2024) This phenomenon is not limited to Indonesia but is also observed internationally. A cross-sectional study in Myanmar reported that 65.4% of pregnant women were exposed to SHS at home or in public spaces. In Egypt, 38% of pregnant women were exposed to SHS from their husbands at home. Similar findings were reported in India, where SHS exposure at home was associated with an increased risk of delivering infants with low birth weight, shorter length, and smaller head circumference.(Prince et al. 2021)A prospective study in Japan also indicated that SHS exposure increases the risk of placental complications, such as placental abruption. Karumai-Mori et al. (2025), while a study in China reported an increased risk of preterm birth, low birth weight, and intrauterine growth restriction (IUGR) due to SHS exposure at home.(Karumai-Mori et al. 2025).

Overall, the evidence indicates that SHS exposure at home imposes an additional burden on the respiratory system, nutritional status, and overall health of pregnant women, while also increasing the risk of adverse pregnancy outcomes. Therefore, preventive interventions should target not only pregnant women but also family members, particularly active smokers within the household, through health education and the implementation of smoke-free homes (Hermaliana et al. 2025) A family- and community-based approach is crucial for effectively reducing SHS exposure and creating a healthy home environment for both pregnant women and their fetuses.

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REFERENCES

Agustin, Ismar, Sri Endriyani, Rehana, and Tri Utari. 2021. "Relationship of Exposure Cigarette Smoke in Pregnant Mothers to The Newbornweight." JURNAL ILMIAH ILMU KEPERAWATAN INDONESIA 11(04).

Aziza, Neri et al. 2025. "Analisis Case Control: Paparan Asap Rokok Ibu Hamil Terhadap Kejadian Berat Badan Lahir Rendah." https://jurnal.upertis.ac.id/index.php/JKP/article/view/1151/487.

Hein Nyi Maung, MPH, MBBS Kyaw Thet Aung, and PhD Nguyen Thi Thuy Hanh. 2023. "Prevalence of Secondhand Smoke and Its Associated Factors Among Pregnant Women Attending Antenatal Care at a Hospital in Yangon Region, Myanmar." Asia Pacific Journal of Public Health 35(5).

Hermaliana, Hermaliana, Suhrawardi Suhrawardi, Hapisah Hapisah, and Isnaniah Isnaniah. 2025. "Analis Hubungan Paparan Asap Rokok (Perokok Pasif) Dengan Kejadian Anemia Pada Ibu Hamil Di Wilayah Kerja Puskesmas Lontar Kecamatan Pulau Laut Barat Kabupaten Kotabaru Tahun 2024." Jurnal Penelitian Multidisiplin Bangsa 1(8).

Karumai-Mori, Hikaru et al. 2025. "Impact of Maternal Smoking and Secondhand Smoke Exposure during Singleton Pregnancy on Placental Abruption: Analysis of a Prospective Cohort Study (the Japan Environment and Children's Study)." BMJ open 15(3): e089499.

Mahmoodabad, Seyed Saeed Mazloomy et al. 2019. "Exposure to Secondhand Smoke in Iranian Pregnant Women at Home and the Related Factors." Tobacco prevention & cessation 5: 7.

Mojibyan, Mahdiyeh et al. 2013. "Exposure to Second-Hand Smoke During Pregnancy and Preterm Delivery." International journal of high risk behaviors & addiction 1(4): 149–53.

Monitoring Asthma in Pregnancy A Discussion Paper Monitoring Asthma in Pregnancy.

Mudyawati, Kamaruddin, Andi Asriany, Kasmawati, and Nurhidayat Triananinsi. 2020. "KAJIAN Pengetahuan Ibu Hamil Tentang Bahaya Asap Rokok Pada Kehamilan Di Puskesmas Herlang Kabupaten Bulukumba." Urnal Penelitian Kedokteran Dan Kesehatan 2(2).

Palmeri, Renata, and Vikas Gupta. 2025. "Carboxyhemoglobin Toxicity." : 1–9.

Prince, Priya Mary, Marciya Umman, Farah Naaz Fathima, and Avita Rose Johnson. 2021. "Secondhand Smoke Exposure during Pregnancy and Its Effect on Birth Outcomes: Evidence from a Retrospective Cohort Study in a Tertiary Care Hospital in Bengaluru." Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine 46(1): 102–6.

Putri, Oktaviana Manda, Friska Oktaviana, Poppy Farasari, and Siti Suciati. 2025. "Hubungan Paparan Asap Rokok Terhadap Kekurangan Energi Kronis (KEK) Pada Wanita Hamil." Pl 7(3).

Salmasi, Giselle, Rosheen Grady, Jennifer Jones, and Sarah D McDonald. 2010. "Environmental Tobacco Smoke Exposure and Perinatal Outcomes: A Systematic Review and Meta-Analyses." Acta obstetricia et gynecologica Scandinavica 89(4): 423–41.

WHO, Kemenkes RI, and Brin. 2024. WHO Menerbitkan Laporan Global Adult Tobacco Survey Indonesia 2021. https://www.who.int/indonesia/id/news/detail/22-08-2024-ministry-of-health-and-who-release-global-adult-tobacco-survey-indonesia-report-2021?utm_source=chatgpt.com.

INVESTIGATION OF FOOD POISONING OUTBREAK

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ABSTRACT

Food poisoning outbreaks remain a major public health problem, particularly in settings involving mass food preparation and distribution. On 14 January 2026, a suspected food poisoning outbreak was reported in the working area of Ngadirojo Primary Health Center, Wonogiri Regency, following the implementation of the Free Nutritious Meal Program (MBG). This investigation aimed to describe the outbreak by person, place, and time, and to identify the suspected source of exposure and contributing risk factors. A field epidemiological investigation with a descriptive observational design and cross-sectional approach was conducted. A case was defined as any individual who developed symptoms of food poisoning, including nausea, vomiting, diarrhea, abdominal pain, dizziness, or fever after consuming MBG meals on 13 January 2026. Data were collected through active case finding, structured questionnaires, medical record review, environmental health inspections, and laboratory examination of food samples. Descriptive analysis included calculation of the attack rate (AR), case fatality rate (CFR), and construction of an epidemic curve. A total of 604 cases were identified among 3,976 beneficiaries, yielding an attack rate of 15.2% and a CFR of 0%. The majority of cases occurred among junior high school students (49.5%) and males (56.5%). The incubation period ranged from 30 minutes to 36 hours 30 minutes, with a mean of approximately 14 hours 30 minutes. The epidemic curve demonstrated a common-source outbreak with a point-source pattern. Laboratory examinations identified contamination with Escherichia coli and Salmonella spp. in raw vegetables and fresh fruit. Environmental health inspections revealed multiple hygiene and sanitation deficiencies. This investigation confirmed a food poisoning outbreak associated with contaminated MBG food items, most likely caused by Escherichia coli with possible co-contamination by Salmonella spp. Strengthening food hygiene and sanitation practices in mass food provision programs is essential to prevent similar outbreaks.

Keywords: bacterial contamination; free nutritious meal program; food poisoning; outbreak investigation

INTRODUCTION

An outbreak is defined as a condition characterized by a significant increase in morbidity or mortality in a specific area and time period, which may potentially develop into a widespread epidemic if not addressed promptly. Outbreaks may be caused by infectious diseases as well as poisoning events, including food poisoning, which often occur rapidly and involve a large number of people within a short period of time. Therefore, any suspected outbreak requires immediate response through a systematic epidemiological investigation to confirm the occurrence of an outbreak, describe the magnitude of the problem, and identify the source of exposure and risk factors contributing to the event (Ministry of Health of the Republic of Indonesia, 2011; World Health Organization, 2017). Food poisoning remains a major global public health problem. The World Health Organization reports that foodborne diseases cause hundreds of millions of cases of illness each year worldwide, with a greater burden of disease in developing countries due to limitations in food safety systems and public health surveillance (World Health Organization, 2015, 2016). Low- and middle-income countries face additional challenges in food safety control,

including limited infrastructure, regulatory oversight, and human resource capacity, which increase the risk of foodborne diseases (Grace et al., 2024).

In Indonesia, food poisoning continues to be frequently reported and often occurs in the form of outbreaks, both in the general community and in educational institutions, including programs such as the Free Nutritious Meal initiative. Several incidents have demonstrated that mass food preparation and distribution constitute a key contributing factor to the high number of cases occurring within a short period of time (Hamidah et al., 2025; Iskandar et al., 2024). Large-scale food preparation carries a high risk of food poisoning, as errors at any stage of food handling or processing can simultaneously affect a large number of people (Newell et al., 2010).

The Free Nutritious Meal Program (MBG) is a government initiative aimed at improving nutritional status and public health, particularly among school-aged children. The program involves large-scale food production and distribution, making food safety a highly critical component. When hygiene and sanitation principles are not consistently applied, mass food provision programs may become a potential source of food poisoning outbreaks (Iskandar et al., 2025). Failures in the implementation of food hygiene and sanitation, particularly in the handling of fresh food ingredients that do not undergo reheating, increase the risk of microbiological contamination. Unsafe food handling practices, including inadequate hand hygiene, equipment cleanliness, and food preparation environments, have long been identified as major risk factors for foodborne diseases (Ehuwa et al., 2021; Gemeda et al., 2025; Heredia & García, 2018).

Although most food poisoning–related illnesses are self-limiting and resolve without specific treatment, under certain circumstances, they may progress to severe disease and even result in fatal outcomes. More serious impacts are disproportionately observed among vulnerable populations, including children, pregnant women, older adults, and individuals with compromised immune systems (Tood et al., 2014). In addition, severe foodborne illnesses in children may result in impaired physical growth and cognitive development, leading to long-term adverse effects on quality of life (Lee & Yoon, 2021; World Health Organization, 2016). Nutrition is a fundamental human requirement essential for sustaining life. However, the consumption of certain foods may instead trigger health disorders and even lead to fatal outcomes, manifested by symptoms such as diarrhea, nausea, vomiting, headache, abdominal cramps, and other related complaints. Along with increasing globalization and the growing intensity of cross-border food trade, outbreaks of foodborne diseases in recent years have shown a worsening trend worldwide. Although each country implements different regulations to ensure food safety and prevent disease, the incidence of foodborne illnesses continues to rise. Regardless of a country's economic status, foods of animal origin remain a major source of pathogenic bacterial infections, including Escherichia coli, Salmonella, Listeria monocytogenes, Campylobacter, and Staphylococcus aureus (Gupta & Chaudhary, 2022; Heredia & García, 2018).

On 14 January 2026, the Wonogiri District Health Office received a report from Ngadirojo Primary Health Center regarding health complaints among beneficiaries of the Free Nutritious Meal Program. Initial information was obtained after several students, particularly from Dayawangsa Vocational High School, presented to Ngadirojo Primary Health Center with complaints of diarrhea, dizziness, fever, abdominal pain, nausea, and vomiting between 08:00 and 12:00 Western Indonesia Time on the same day. Based on the epidemiological investigation, it was identified that on 13 January 2026, the Ngadirojo SPPG began distributing the MBG menu to schools and

community health posts (posyandu) between 06:30 and 10:00 WIB, with most beneficiaries consuming the meals between 09:00 and 11:00 WIB. At approximately 13:00 WIB, some students began to experience early symptoms, including abdominal pain, nausea, and vomiting, after consuming the MBG meals. Complaints continued to increase over time, with a rise in cases observed during the afternoon to evening hours, consistent with an average incubation period of approximately 15 hours. In response to these reports, the surveillance officers of Ngadirojo Primary Health Center notified the surveillance team of the Wonogiri District Health Office at 12:15 WIB on 14 January 2026, indicating a suspected food poisoning outbreak. During the investigation and data collection process, which was conducted using a self-administered questionnaire via Google Forms, a total of 604 individuals were identified as having experienced clinical symptoms, including diarrhea, dizziness, fever, abdominal pain, nausea, and vomiting. Subsequently, epidemiological investigations and environmental health inspections were carried out to characterize the outbreak and to identify the source and causative agent of the suspected food poisoning event.

Foodborne diseases represent a significant public health problem; however, they are largely preventable and treatable. Therefore, identifying the source of contamination is a critical component of outbreak investigations to ensure that foodborne disease events can be effectively prevented and appropriately managed (Tao et al., 2023). Therefore, an epidemiological investigation is required to confirm the occurrence of an outbreak and to establish a preliminary case definition. The investigation should be conducted as promptly as possible to prevent further case accumulation. Key activities include verification of reported information, collection of available laboratory results, case identification, and detailed case interviews, as well as appropriate collection of clinical specimens and food samples (World Health Organization, 2017).

METHOD AND DISCUSSION

This investigation employed a descriptive observational design with a cross-sectional approach in response to a suspected food poisoning outbreak associated with the Free Nutritious Meal Program in the working area of Ngadirojo Primary Health Center. Meals were distributed by SPPG Ngadirojo, Foundation X, on 13 January 2026 to 3,976 beneficiaries from schools and community health posts (posyandu). A case was defined as any individual who developed one or more symptoms of food poisoning, including nausea, vomiting, diarrhea, abdominal pain, dizziness, fever, or weakness after consuming the meal on the same date, and all individuals meeting the case definition were included.

The investigation commenced with outbreak confirmation through field visits to affected schools and posyandu, followed by the collection of suspected food samples for laboratory analysis at the Wonogiri District Health Office, which are commonly observed in food poisoning cases. Laboratory, in accordance with national and international outbreak response guidelines. Epidemiological data were collected cross-sectionally after the event without a comparison group, a method commonly used in outbreak investigations to describe event magnitude and characteristics (Tao et al., 2023). Data sources included active case finding, self-administered online questionnaires (Google Forms) completed by beneficiaries or their parents/guardians, and review of health service records at Ngadirojo Primary Health Center. An environmental health inspection was conducted through direct observation of food hygiene and sanitation practices at the Ngadirojo Nutrition Service Unit (SPPG) as part of the outbreak investigation. Data analysis followed a descriptive field epidemiology approach, including analysis by person, place, and time,

symptom distribution, calculation of attack rate (AR) and case fatality rate (CFR), and construction of an epidemic curve to describe the outbreak pattern and incubation period (Centers for Disease Control and Prevention, 2022).

RESULT

Based on administrative records from the SPPG, a total of 3,976 beneficiaries received the Free Nutritious Meal (MBG) on 13 January 2026, which was distributed by SPPG Foundation X to several schools and community health posts (posyandu). Of these, 604 individuals were identified as having clinical symptoms consistent with food poisoning. The attack rate for this incident was 15.2%, and no deaths were reported (case fatality rate = 0%). The distribution of clinical symptoms identified during the food poisoning outbreak investigation is presented in Table 1 below:

Table 1.
Distribution of Clinical Symptoms (n=604)

Clinical Symptoms	f	%
Abdominal pain	331	54,80
Vomiting	302	50,00
Dizziness	282	46,69
Nausea	280	46,35
Diarrhea	266	44,04
Fever	14	2,32

Based on the table 1, the most frequently reported clinical symptom of food poisoning was abdominal pain, affecting 331 individuals (54.80%), followed by vomiting in 302 individuals (50.00%), dizziness in 282 individuals (46.69%), nausea in 280 individuals (46.35%), and diarrhea in 266 individuals (44.04%). Fever was reported in a smaller proportion of cases, affecting 14 individuals (2.32%). These findings indicate that most students experienced disturbances of the lower gastrointestinal system, which are commonly observed in food poisoning cases and are likely associated with bacterial contamination of the consumed food. The epidemic curve of this food poisoning outbreak is presented as follows:

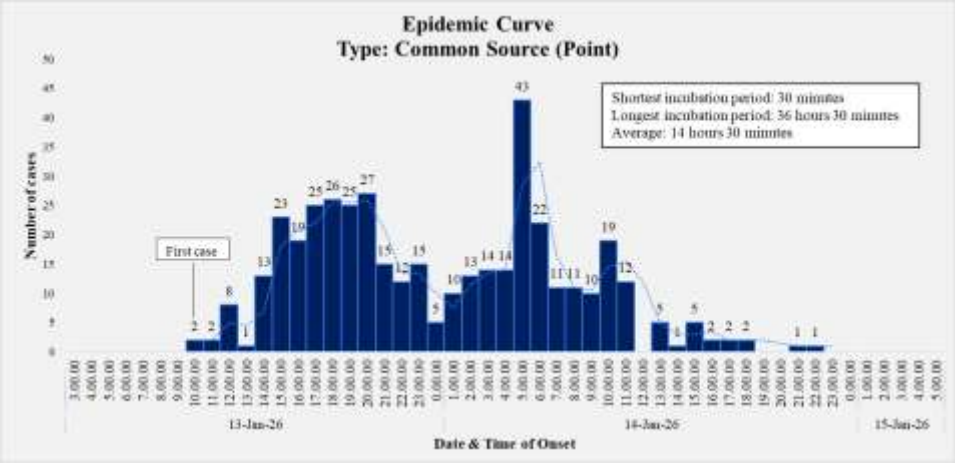

Figure 1. Epidemic Curve

The shortest incubation period observed in this outbreak was 30 minutes, while the longest incubation period reached 36 hours and 30 minutes, with a mean incubation period of 14 hours and 30 minutes. The majority of cases occurred within an incubation period of approximately 14–16 hours after exposure, as indicated by the highest concentration of cases during this time interval. Based on the epidemic curve shown in the figure above, the outbreak exhibited a common-source

pattern. A common-source outbreak occurs when individuals are exposed to the same source, either over a brief or a defined period. In this event, the outbreak was classified as a point-source outbreak, characterized by a relatively short exposure period in which all cases occurred within a single incubation period. This pattern is consistent with food poisoning resulting from a single exposure to a contaminated food source (Scallan et al., 2011; Yang et al., 2025).

The distribution of cases by sex is presented in the following table:

Table 2.
Distribution of Cases by Sex (n=604)

Sex	f	%
Male	341	56,46
Female	263	43,54

Based on the demographic characteristics of the investigation, suspected food poisoning cases were more frequent among males (56.46%) than females (43.54%).

Table 3.
Distribution of Cases by Location

School/Posyandu	f	%
Kindergarten & Early Childhood Education	2	0,33
Kindergarten	3	0,50
Primary School	181	29,97
Junior High School	299	49,50
Senior High School	97	16,06
Posyandu	22	3,64

The distribution of cases by location showed that the majority of cases originated from the junior high school level, with 299 cases (49.50%).

Identification of Risk Factors for a Food Poisoning Outbreak
Attack Rate

Table 4.
Attack Rate of Food Poisoning

$$\text{Attack Rate} = \frac{\text{Number of Food Poisoning Cases}}{\text{Total Population}} \times 100\% = \frac{604}{3976} \times 100\% = 15{,}20\ \%$$

Based on the table above, the attack rate of food poisoning was 15.20%, as 604 individuals developed symptoms out of a total of 3,976 MBG beneficiaries. However, this estimate should be interpreted with caution, as it does not account for individuals who did not report symptoms or did not complete the questionnaire, nor does it fully reflect the actual number of individuals who consumed the meals, which may differ from the registered number of beneficiaries.

Case Fatality Rate (CFR)

Table 5.
Case Fatality Rate of Food Poisoning

$$\text{Case Fatality Rate} = \frac{\text{Number of Deaths}}{\text{Total Number of Cases}} \times 100\% = \frac{0}{604} \times 100\% = 0\ \%$$

Based on the table 5, the case fatality rate (CFR) was 0%, as no deaths were reported among the 604 food poisoning cases.

Table 6.
Distribution of Food Poisoning Cases by Suspected Food Items

Food Item	Consumed (N)	Not Consumed /Did Not Respond (N)
Rice	355	75
Fried Chicken	358	73
Tempe Goreng	182	247
Vegetables	157	178
Mixed Fruit	253	447

The table 6 shows that the most frequently consumed food items among the cases were fried chicken, rice, and mixed fruit.

Table 7.
Characteristics of Suspected Pathogens and Differential Diagnosis of Food Poisoning

No	Microorganism	Incubation Period	Mean Incubation	Signs and Symptoms
1	*Escherichia coli*	5 – 48 hours, average 10-24 hours	15 Hours	Abdominal pain, nausea, vomiting, fever, chills, headache, muscle pain
2	*Salmonella sp*	6 – 72 hours average 18 – 36 hours		Abdominal cramps, diarrhea, chills, fever, nausea, vomiting, weakness
3	*Bacillus cereus (enteritis)*	8 – 16 hours average 12 hours		Nausea, abdominal cramps, watery diarrhea

Based on table 7, three pathogens were suspected as potential causes of the food poisoning outbreak, namely Escherichia coli, Salmonella spp., and Bacillus cereus (enteritis type). To confirm these suspicions, laboratory testing was required. During the initial investigation, food samples collected included rice, breaded fried chicken, chili sauce, fried tempeh, raw vegetables (sliced cucumber and tomato), and mixed cut fruit (watermelon, melon, and dragon fruit). These food samples were submitted to the Wonogiri District Health Laboratory on Wednesday, 14 January 2026. The samples were analyzed using biochemical testing methods, with test parameters focused on the identification of Escherichia coli and Salmonella spp. The laboratory examination yielded the following results:

Table 8.
Laboratory Examination Results

No	Sample Type	Result		Limit Conditions
		E. Coli	*Salmonella Sp.*	
1	Rice	Negative	Negative	Negative
2	Fried Chicken	Negative	Negative	
3	Tempe goreng	Negative	Negative	
4	Vegetables	Negative	*Positive*	
5	Dragon Fruit	Negative	*Positive*	
6	Watermelon	*Positive*	*Positive*	
7	Melon	Negative	Negative	
8	Terasi	Negative	Negative	

Based on the laboratory examination results, the food items suspected as the sources of food poisoning were watermelon, dragon fruit, and raw vegetables (lalapan), as these items tested positive for pathogenic bacteria, namely Escherichia coli and Salmonella spp. (Gupta & Chaudhary, 2022). These bacterial pathogens are known to cause gastrointestinal symptoms, including diarrhea, nausea, and vomiting, with a relatively short incubation period following consumption. These findings further support the results of the epidemiological investigation and

the questionnaire-based data collected via Google Forms, in which affected individuals reported similar clinical symptoms. The environmental health inspection, based on direct field observation, identified several non-compliances in key food hygiene and sanitation components, including waste management, environmental conditions in the portioning area, equipment functionality, thawing procedures for food ingredients, and water quality.

This investigation confirmed the occurrence of a food poisoning outbreak in the working area of Ngadirojo Primary Health Center on 13 January 2026, with an attack rate of 15.2%. This figure indicates a substantial proportion of the population at risk, as commonly observed in food poisoning incidents involving mass food provision from a single distribution source (Holst et al., 2025). The epidemic curve demonstrated a rapid increase in cases, a single dominant peak, and a gradual decline, which are characteristic features of a common-source outbreak of the point-source type. This pattern suggests that exposure occurred at a specific point in time, with the majority of cases arising within a single incubation period. Outbreaks characterized by a single major peak and a relatively uniform incubation period are typical of food poisoning events resulting from a single exposure source, as reported in previous outbreak investigations (Bennett et al., 2018).

The incubation period in this outbreak ranged from 30 minutes to 36 hours and 30 minutes, with a mean of 14 hours and 30 minutes. This short to moderate incubation period is consistent with the characteristics of foodborne diseases caused by enteric bacteria. Variations in incubation periods among individuals may be influenced by differences in exposure dose, individual health status, and the type of pathogen contaminating the food. The very short incubation period reported in a small number of cases may reflect recall bias or exposure to other food items and should therefore be interpreted with caution. The clinical presentation, predominantly characterized by abdominal pain, nausea, vomiting, dizziness, and diarrhea, further supports the suspicion of food poisoning. Laboratory findings demonstrating contamination with Escherichia coli and Salmonella spp. in raw vegetables and fresh fruit strengthen this differential diagnosis. Findings from the environmental health inspection demonstrated multiple hygiene and sanitation deficiencies during food preparation and handling, which may have contributed to the contamination of fresh food items (Ehuwa et al., 2021). These findings highlight the vulnerability of fresh food items that do not undergo reheating in mass food provision systems.

From a One Health perspective, food poisoning events are influenced by the interactions between humans, animals, and the environment. Therefore, the prevention and control of foodborne diseases require a multisectoral approach across the entire food chain (Silva et al., 2014). Findings from the environmental health inspection revealed several non-compliances in hygiene and sanitation practices during food processing and serving. Inadequate waste management, excessive room humidity, suboptimal performance of storage equipment, and water quality that had not been regularly tested may increase the risk of microbiological contamination of food. These conditions may have increased the risk of microbiological contamination, particularly in fresh food items.

Beyond clinical impacts, foodborne diseases impose a substantial public health burden, including healthcare costs and loss of productivity. Recent studies have demonstrated that foodborne illnesses exert a significant economic impact on health systems, especially during outbreaks associated with mass food provision (Grace et al., 2024; Hoffmann et al., 2025). Global changes in food systems, increasing urbanization, and large-scale food distribution have made food poisoning a persistent and evolving public health issue (Davydova et al., 2025; Sun et al., 2025).

CONCLUSION

The food poisoning outbreak that occurred on 13 January 2026 in the working area of Ngadirojo Primary Health Center was classified as a common-source outbreak with point-source exposure, associated with the consumption of the Free Nutritious Meal Program (MBG). The epidemic curve pattern, incubation period range, clinical manifestations, and laboratory findings indicate that this event was most likely caused by bacterial contamination with Escherichia coli, with potential co-contamination by Salmonella spp. in fresh food items. Strengthening the implementation of food hygiene and sanitation practices, particularly in mass food provision settings, is essential to prevent the recurrence of similar outbreaks.

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REFERENCES

Bennett, S. D., Walsh, K. A., & Gould, L. H. (2018). Foodborne disease outbreaks caused by contaminated food: Characteristics and contributing factors. *Clinical Infectious Diseases*, *67*(5). https://doi.org/10.1093/cid/ciy164

Centers for Disease Control and Prevention. (2022). *Principles of Epidemiology in Public Health Practice* (Vol. 71, Issue 1). https://doi.org/10.15585/mmwr.mm7101a1

Davydova, A., Fastl, C., Mughini-gras, L., Bai, L., Kubota, K., Hoffmann, S., Rachmawati, T., & Pires, S. M. (2025). Source attribution studies of foodborne pathogens, 2010 – 2023 : a review and collection of estimates. *Food Microbiology*, *131*, 104812. https://doi.org/10.1016/j.fm.2025.104812

Ehuwa, O., Jaiswal, A. K., & Jaiswal, S. (2021). Salmonella, Food Safety and Food Handling Practices. *Foods*, *10*(5), 1–16. https://doi.org/10.3390/foods10050907

Gemeda, N., Yazew, T., Moroda, M., & Kuyu, C. G. (2025). *Food safety practices and associated factors among food handlers in food establishments in Adama town, Central Ethiopia*. *January*, 1–13. https://doi.org/10.3389/fsufs.2024.1471429

Grace, D., Bonfoh, B., Barbara, H., Maurer, J. J., Tech, V., & States, U. (2024). *Editorial : Food safety in low- and middle-income countries*. https://doi.org/10.3389/fsufs.2024.1358897

Gupta, A. K., & Chaudhary, A. (2022). Food poisoning: Causes, its effects, and control. *I TECH MAG*, *4*(1), 4–6. https://doi.org/http://doi.org/10.26480/itechmag.04.2022.59.61

Hamidah, L., Zahraa, A., & Hanifatu, I. (2025). Risk factors and characteristics of food poisoning outbreaks in East Java, Indonesia, 2024. *6*, 4143–4155. https://doi.org/https://doi.org/10.31004/jkt.v6i1.42674

Heredia, N., & García, S. (2018). Animals as sources of food-borne pathogens : A review. *Animal Nutrition*, *4*(3), 250–255. https://doi.org/10.1016/j.aninu.2018.04.006

Hoffmann, S., White, A. E., Mcqueen, R. B., Ahn, J., Gunn-sandell, L. B., & Walter, E. J. S. (2025).

Economic Burden of Foodborne Illnesses Acquired in the United States. *22*(1). https://doi.org/10.1089/fpd.2023.0157

Holst, M. M., Wittry, B. C., Crisp, C., Torres, J., Irving, D. J., & Nicholas, D. (2025). Contributing Factors of Foodborne Illness Outbreaks — National Outbreak Reporting System, United States, 2014 – 2022. *MMWR Surveillance Summaries*, *74*(1), 1–15. https://doi.org/10.15585/mmwr.ss7401a1

Iskandar, S. I., Hertanto, D. A., Aryanto, S., & Satria, B. (2025). E. Coli-caused Foodborne Outbreak in Bantul Regency, Indonesia, 2023: A Retrospective Cohort Study. *The Open Public Health Journal*, *18*, e18749445391790. https://doi.org/10.2174/0118749445391790250428070104

Iskandar, S. I., Janah, M., Aryanto, S., Wiratama, B. S., District, B., Office, H., & Health, P. (2024). Foodborne Outbreak Investigation in Elementary School Students in Bantul, Yogyakarta, 2023. *Media Kesehatan Masyarakat Indonesia*, *20*(3), 124–132. https://doi.org/10.30597/mkmi.v20i3.2024

Lee, H., & Yoon, Y. (2021). Etiological Agents Implicated in Foodborne Illness Worldwide. *Food Science of Animal Resources*, *41*(1), 1–7. https://doi.org/https://doi.org/10.5851/kosfa.2020.e75

Ministry of Health of the Republic of Indonesia. (2011). Guidelines for the Investigation and Control of Outbreaks of Infectious Diseases and Food Poisoning.

Newell, D. G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-kane, A., Sprong, H., Opsteegh, M., Langelaar, M., Threfall, J., Scheutz, F., Giessen, J. van der, & Kruse, H. (2010). International Journal of Food Microbiology Food-borne diseases — The challenges of 20 years ago still persist, while new ones continue to emerge. *International Journal of Food Microbiology*, *139*, S3–S15. https://doi.org/10.1016/j.ijfoodmicro.2010.01.021

Scallan, E., Hoekstra, R. M., Angulo, F. J., Tauxe, R. V, Widdowson, M., Roy, S. L., Jones, J. L., & Griffi, P. M. (2011). *Foodborne Illness Acquired in the United States — Major Pathogens*. *17*(1), 7–15. https://doi.org/10.3201/eid1701.P11101

Silva, C., Calva, E., & Maloy, S. (2014). *One Health and Food-Borne Disease : Salmonella Transmission between Humans, Animals, and Plants*. https://doi.org/10.1128/microbiolspec.OH-0020-2013.Correspondence

Sun, Y., Xu, W., Wu, Y., Zhu, G., Li, P., Jia, J., Song, H., Chen, L., & Lin, Y. (2025). *Descriptive study of foodborne disease outbreaks using monitoring data from foodborne disease outbreak surveillance system (FDOSS) in Jiaxing City, China, 2013 – 2023*. https://doi.org/https://doi.org/10.1186/s12889-025-24287-7

Tao, D., Zhang, D., Hu, R., Rundensteiner, E., & Feng, H. (2023). *Epidemiological Data Mining for Assisting with Foodborne Outbreak Investigation*. *Cdc*, 1–18. https://doi.org/https://doi.org/10.3390/foods12203825

Tood, E., LLC, E. T. C., Okemis, MI, & USA. (2014). Overview of Biological Hazards and Foodborne Diseases. In *Encyclopedia of Food Safety* (Issue January). Elsevier.

https://doi.org/10.1016/B978-0-12-378612-8.00071-8

World Health Organization. (2015). *WHO estimates of the global burden of foodborne diseases*.

World Health Organization. (2016). *Burden of foodborne diseases in the WHO South-East Asia Region*.

World Health Organization. (2017). *Investigating foodborne disease outbreaks: Therefore, identifying the source of contamination is a critical component of Stage One Booklet*. World Health Organization. https://www.who.int/publications/i/item/9789240118607

Yang, Y., Xu, F., Zhou, Y., Hu, L., Lu, W., Zhang, S., Hu, H., & Huang, X. (2025). Epidemiological Characteristics of Foodborne Disease Outbreaks in a Hospital : A 5-Year Retrospective Study. *International Journal of General Medicine*, *18*. https://doi.org/10.2147/IJGM.S496799

EXPLORING THE RELATIONSHIP BETWEEN SLEEP RELATED MYTHS AMONG PREGNANT WOMEN AND STUNTING: LITERATUR REVIEW

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ABSTRACT

Stunting remains a major public health problem in Indonesia, with its incidence largely influenced by the first 1,000 days of life. Such traditions, including taboos and unsafe practices like home delivery, can increase the risk of complications for both mothers and newborns 1. Cultural beliefs and practices related to the care of pregnant and postpartum women are still widely found within communities2. In the third trimester, many pregnant women experience sleep difficulties due to physical discomfort or frequent urination at night, making daytime naps important. This study aims to examine the cultural myth of prohibiting daytime naps during pregnancy and its potential impact on maternal sleep quality, birth outcomes, and stunting prevention. The study employed a comprehensive literature review. Data were collected from Scopus, Google Scholar, and media articles, using specific inclusion and exclusion criteria to ensure relevance and quality. Findings indicate that myths discouraging daytime naps in pregnancy, particularly in Javanese culture, may exacerbate maternal sleep deprivation, affect fetal growth, and increase the risk of low birth weight a known contributor to stunting. While these cultural beliefs have been passed down through generations, they can hinder the promotion of healthy sleep practices in pregnancy. This research provides evidence to dispel unfounded cultural myths and highlights the importance of adequate maternal sleep, including daytime naps, for healthy pregnancy outcomes and stunting prevention. Continuous education from healthcare providers, community leaders, and families is essential to correct misconceptions and promote maternal well-being.

Keywords: pregnant women; sleep myths; stunting

INTRODUCTION

Cultural traditions and belief systems shape and reinforce women's behaviors throughout pregnancy and childbirth across various regions of the world (Ramulondi et al., 2021). The Javanese are one of Indonesia's largest ethnic groups, and their culture shapes daily life, including maternal care (Zulkifli et al., 2023). Many still follow traditional myths and practices during pregnancy, which can sometimes put the pregnancy at risk (Cukarso & Herbawani, 2020). A major factor contributing to Indonesia's high maternal mortality rate is limited knowledge about prenatal care, along with cultural traditions passed down through generations (Murniasih et al., 2016). Across different cultures, similar practices were observed, including structured support for mothers, designated rest periods, dietary prescriptions and restrictions, hygiene-related routines, as well as customs concerning infant care and breastfeeding(Dennis et al., 2007). Although interventions have reduced maternal and neonatal illness and death, progress remains slow, particularly in remote indigenous populations. In these communities, sociocultural beliefs strongly shape health-related behaviors during pregnancy, delivery, and the postpartum period (Felisian et al., 2023).

In Javanese society, pregnancy is often viewed as a vulnerable and risky period, surrounded by numerous traditional beliefs and practices throughout its stages (Austiyana, 2021). Pregnant women must prepare for pregnancy, especially in the first 1000 days of life(Agushybana et al., 2022). Sleep is an essential function, particularly for pregnant women, as it plays a crucial role in

maintaining maternal health during pregnancy. The quality of the next generation will be determined by the mother's condition before pregnancy and during pregnancy(Alfarisi et al., 2019).Therefore, recognizing and addressing sleep patterns during pregnancy and their impact on maternal and child health outcomes should be a public health priority(Cassidy et al., 2023). The five main factors that cause stunting are poverty, social and cultural factors, increased exposure to infectious diseases, food insecurity and community access to health services(Artika, 2018). A qualitative study exploring the experiences of Javanese women during their first pregnancy; it reports various pregnancy traditions and myths that are still practiced, including behavioral restrictions such as avoiding daytime naps (Gayatri et al., 2023). Research on myths in the Javanese tribe found that pregnant women were prohibited from napping. Pregnant women who live with their parents still follow this belief(Regina Putri & Noviani Fadilah, 2023). Sleep disturbances not only affect the physical and mental health of pregnant women but can also have consequences for fetal development. Therefore, maintaining maternal well-being during pregnancy is crucial(Karami et al., 2022). Maternal circadian preference is related to several sleep difficulties in early childhood, and it may be considered a potential risk factor for the onset of early sleeping problems. Parental circadian preference can influence a baby's or child's sleep patterns, especially in the early stages of life. If parents have sleep patterns that are irregular or different from the baby's needs, this can be a risk factor for children's sleep disorders, which in turn can impact their growth and development(Morales-Muñoz et al., 2019).

Maternal sleep duration of 9.0 to 9.9 hours is significantly associated with a reduced incidence of low birth weight and small-for-gestational-age infants, particularly among women who gain an appropriate amount of weight during pregnancy, compared to those who sleep for 6.0 to 7.9 hours. (Murata et al., 2021) Moreover, there is a significant relationship between maternal age, parity, and the incidence of anemia. Public Health Centers can enhance health promotion programs targeting mothers approaching at-risk ages and parity levels to help prevent anemia in third-trimester pregnancies.(Vionalita & Permata, 2020) Additionally, addressing maternal depression due to lack of sleep may play a crucial role in reducing stunting rates. Overall, focusing on psychosocial factors in perinatal women can have a significant impact on child growth and well-being, especially in developing countries.(Smith Fawzi et al., 2019)

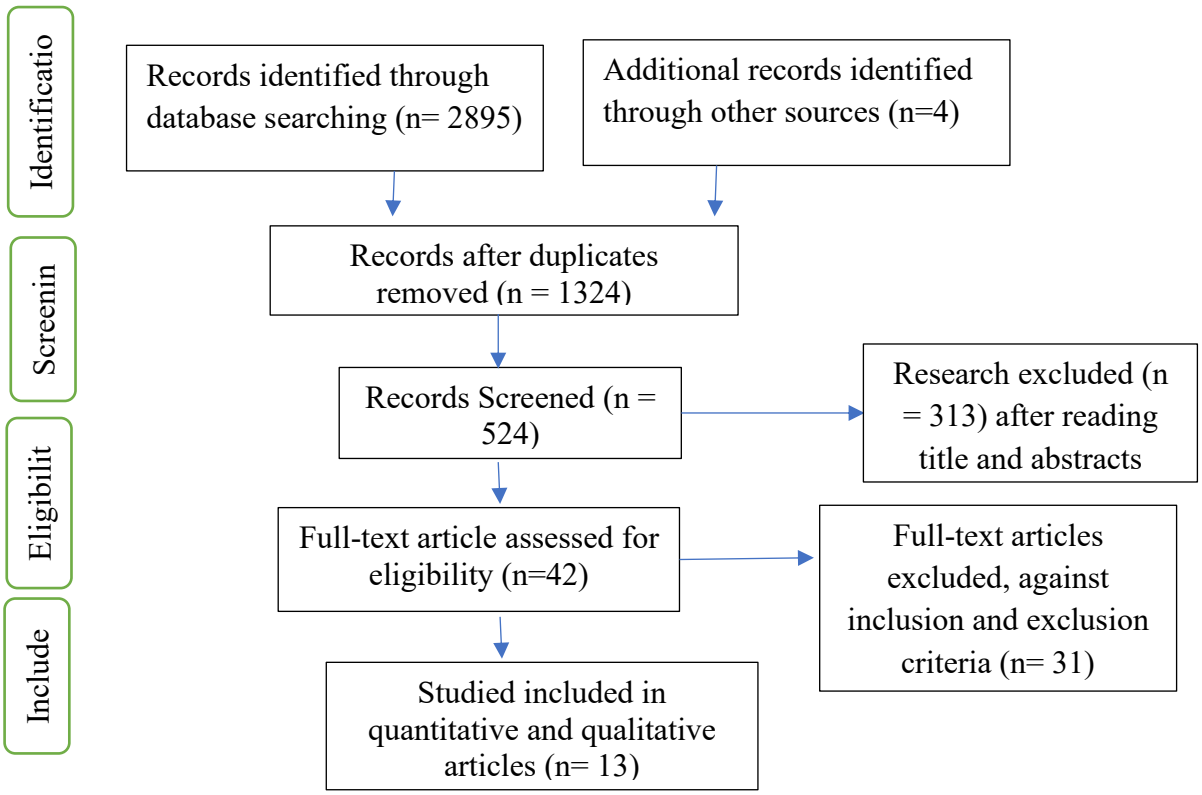
METHOD

This study employed a literature review design aimed at comprehensively examining the myth prohibiting daytime napping among pregnant women and its association with maternal sleep quality, pregnancy outcomes, and the risk of stunting in children. The literature search was conducted systematically by the authors following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure rigorous identification, screening, and selection of relevant articles. Article searches were carried out using several indexed databases, namely Google Scholar and PubMed, selected for their accessibility and relevance to maternal and child health research. The literature search utilized combinations of keywords in both English and Indonesian, including *"pregnant women"* and/or *"pregnant female"*, *"sleep quality"*, *"daytime napping"*, and *"stunting"*. These keywords were combined using Boolean operators (AND/OR) to refine and optimize search results.

The inclusion criteria comprised: (1) quantitative studies, qualitative studies, systematic reviews, and literature reviews; (2) studies addressing maternal sleep quality, daytime napping, cultural beliefs or myths related to pregnancy, and their associations with low birth weight, prematurity, or

stunting; (3) articles published within the last five years (2019–2023); and (4) publications written in English or Indonesian. The exclusion criteria included studies focusing on sleep quality among men, elderly individuals, adolescents, or non-pregnant populations, as well as articles that did not provide information relevant to the objectives of this review. The article selection process was conducted in several stages. Initially, all articles retrieved from the database searches were identified and compiled. This was followed by title and abstract screening to assess relevance to the study focus. Articles containing the three primary keywords (*pregnant women*, *sleep quality*, and *stunting*) were briefly reviewed to confirm relevance. Eligible articles were then examined in full text to evaluate content suitability and contribution to the study objectives. From an initial total of 2895 identified articles, 10 studies (including quantitative, qualitative, and literature review studies) met the inclusion criteria and were included in the final analysis after the screening and selection process. The flow of article identification, screening, eligibility assessment, and inclusion is presented in the PRISMA flow diagram (Figure 1). Data analysis was conducted using a narrative thematic approach, grouping key findings into the main theme of maternal sleep quality, with subthemes including: (1) myths and cultural beliefs related to daytime napping among pregnant women; (2) the effects of insufficient sleep on maternal and fetal health; (3) the relationship between maternal sleep and low birth weight and prematurity; and (4) the implications of maternal sleep quality for the risk of stunting.

Data Abstraction



RESULT AND DISCUSSION

Sleep disturbances are a significant global public health issue. Both insufficient and excessive sleep have been linked to negative pregnancy outcomes (R. Wang et al., 2022). Therefore, routine sleep screening is recommended for pregnant women. In today's society, with modernization, migration

and globalization, individuals may be unable to carry out the rituals or, conversely, feel pressured to carry out activities in which they no longer believe(Ramulondi et al., 2021). If pregnant women do not get sufficient quality sleep, it can negatively impact fetal health. They require approximately eight hours of sleep at night, along with additional rest during the day. The belief that pregnant women should avoid napping is a harmful myth that can be detrimental to their well-being. The myth about prohibiting naps for pregnant women is still widely believed by the public. Regular daytime napping is associated with shorter labor and a lower risk of obstetric interventions (Tsai et al., 2013). Moderate-duration napping (30–60 minutes) during pregnancy is associated with a reduced risk of low birth weight. This finding highlights the importance of healthy sleep patterns as a lifestyle factor that can support maternal and fetal health. Moderate-duration daytime napping in the late trimester is associated with a reduced risk of low birth weight (LBW)(Song et al., 2018) which subsequently increases the risk of stunting.

Throughout pregnancy, maternal estrogen and progesterone levels increase to support fetal development. These hormonal changes affect sleep quality. Poor sleep can cause the accumulation of harmful substances, including free radicals and neurotoxic waste, in the brain. It is essential to educate pregnant women about the effects of poor sleep quality, as it can lead to anemia and interfere with the production of growth hormones in the fetus, potentially contributing to stunting. Inadequate maternal sleep during pregnancy also impacts the development of the newborn's hippocampus. Ensuring sufficient rest during the first 1,000 days of life (HPK) can help prevent stunting. Daytime napping plays an important role in compensating for insufficient nighttime sleep. Studies assessing 24-hour sleep patterns have found that mothers who are not accustomed to napping are more likely to experience overall sleep deprivation and have a higher risk of preterm birth(L. Wang & Jin, 2020). Counseling about the myth of napping in pregnant women is very important considering the positive impact of sleep on pregnant women which can prevent anemia and optimize fetal development. A comprehensive solution is needed, including a cross-sector approach, women's empowerment, policies and programs that provide an understanding of the myth of prohibiting naps among pregnant women. Adequate sleep in pregnant women is very important for fetal growth and can prevent stunting, as well as targeted and sensitive interventions.

Table 1.
Analysis Article

Author (years)	Title	Types of Research	Instrumen	Sample/ Object	Result
Yulianti I (2024)	Pregnancy Through a Cultural Lens: Addressing Myths and Facts in the Beliefs of the Javanese Community in Tarakan City	Qualitative	Interview	Post Partum Women	Cultural beliefs and practices related to the care of pregnant and postpartum women are still widely found within communities.
Aynalem BY, Melesse MF, Bitewa YB (2023)	Cultural Beliefs and Traditional Practices During Pregnancy, Child Birth, and the Postpartum Period in East Gojjam Zone, Northwest Ethiopia	Qualitative	in-depth interviews and focused group discussions until	Pregnant Women	There are still cultural practices and myths related to pregnancy that may negatively affect maternal and infant health, including restrictions on daytime napping, which can increase the risk of maternal fatigue and adverse pregnancy outcomes.

Author (years)	Title	Types of Research	Instrumen	Sample/ Object	Result
Zulkifli Z, Yenni, Dila Yulinda Sari, et al. (2023)	Pregnancy Tradition Ceremony in Javanese Society	literature review	literature review	academic journals, books, conference proceedings, and other pertinent sources	Javanese traditions include certain prohibitions for pregnant women, including restrictions on daytime napping. This may hinder healthy sleep patterns that are essential for fetal growth and development.
Felisian S, Mushy SE, Tarimo EAM, et al. (2023)	Sociocultural Practices and Beliefs During Pregnancy in Manyara, Tanzania	Qualitative	In-depth interviews	Women with experienced pregnancy	Cultural practices that restrict rest for pregnant women affect both maternal and neonatal health. This condition may increase the risk of babies being born small and vulnerable to stunting.
Gayatri M, Silvani Y, Pirade RA, et al. (2023)	Javanese Women's Experiences During the First Pregnancy	Qualitative	In-depth interviews with phenomenological approach	pregnant women	The experiences of Javanese mothers show that cultural pressures regarding daytime napping still exist. Sleep deprivation is associated with fatigue, pregnancy complications, and the risk of small-for-gestational-age infants.
Wang R, Xu M, Yang W, et al. (2022)	Maternal Sleep During Pregnancy and Adverse Pregnancy Outcomes: A Systematic Review and Meta-Analysis	literature review	literature review	PubMed, Embase and the Cochrane Central Register of Controlled Trials databases	Inadequate sleep duration during pregnancy is associated with low birth weight (LBW) and preterm birth. Daytime napping helps compensate for nighttime sleep deficits.
Murata T, Kyozuka H, Fukuda T, et al. (2021)	Maternal Sleep Duration and Neonatal Birth Weight: Japan Environment and Children's Study	Quantitative	questionnaire	pregnant women	Short sleep duration (<6 hours) is associated with an increased risk of low birth weight (LBW). Daytime napping can serve as an important compensation to help reduce this risk.
Austiyana M (2021)	Tingkeban: Javanese Ritual During Pregnancy in Kalisari	Qualitative	Interview	Dukun bayi	Javanese traditional rituals include rules for pregnant women, including prohibitions on daytime napping. This may potentially reduce the fulfillment of maternal sleep needs.
Cukarso SNA, Herbawani CK (2020)	Traditional Beliefs and Practices Among Pregnant Women in Javanese Communities: A Systematic Review	Literature review	Literature review	Google Scholar with a publication period between 2010-2020. Result:	the myth of daytime napping still persists in Javanese society, potentially leading to sleep deprivation and an increased risk of pregnancy complications.
Wang L, Jin F (2020)	Association Between Maternal Sleep Duration and Quality, and the Risk of Preterm Birth: A Systematic Review and Meta-Analysis	Systematic review	Systematic review	Google Scholar with a publication period between 2010-2020	Pregnant women with short sleep duration and no daytime naps are at higher risk of preterm birth. Napping serves as a compensatory factor to help prevent prematurity.
Song L, Shen L, Li H, et al. (2018)	Afternoon Napping During Pregnancy and Low Birth Weight: The Healthy Baby Cohort Study	Quantitative	Quantitative	Pregnant women	Daytime napping of moderate duration (30–90 minutes) significantly reduces the risk of low birth weight (LBW).
Murniasih NP, Masfiah	Prenatal Care Practices from the	Qualitative	Interview	Pregnant women	Javanese culture influences prenatal care behaviors, including the

Author (years)	Title	Types of Research	Instrumen	Sample/ Object	Result
S, Hariyadi B, et al. (2016)	Perspective of Javanese Culture in Kaliori Village				prohibition of daytime napping. This may have implications for the risk of low birth weight (LBW) and stunting due to suboptimal maternal sleep quality.
Tsai SY, Lin JW, Kuo LT, et al. (2013)	Nighttime Sleep, Daytime Napping, and Labor Outcomes in Healthy Pregnant Women in Taiwan	Qualitative	Interview	Postpartum mother	Daytime napping is associated with smoother labor. Mothers without the habit of napping are at higher risk of fatigue and labor complications.

Stunting is a multifactorial phenomenon (prenatal and postnatal nutrition, infections, sanitation, breastfeeding, and socioeconomic factors), with maternal sleep being one of many factors that influence the final risk (R. Wang et al., 2022). Delivering nutrition and reproductive health education in small groups using interactive methods enhances pregnant women's knowledge, attitudes, and behaviors. This approach has the potential to be expanded and applied on a larger scale by strengthening collaboration among government agencies, non-governmental organizations, and maternal and child health service providers(Permatasari et al., 2021). Counseling material can be added about the benefits of naps for fetal development, provides useful information to dispel unfounded myths and increase public understanding of the importance of naps for pregnant women. Pregnant women are advised to have a good sleep pattern. Pregnant women are encouraged to enhance sleep quality by incorporating pregnancy exercises into their routine, like yoga(Mongi, 2022). It is recommended that apart from having regular visits during pregnancy, pregnant women should also continue to monitor their sleep-related disorders.

CONCLUSION

Sleep patterns during pregnancy play an important role in maternal and fetal health. Sleep disturbances or suboptimal sleep duration are often associated with pregnancy complications. Healthy sleep patterns during pregnancy (including adequate nighttime sleep and regular short naps) are associated with better labor outcomes (e.g., more optimal birth weight, shorter labor, and fewer interventions). Since low birth weight and prematurity increase the risk of stunting, improving maternal sleep habits represents a potential strategy for stunting prevention. The myth prohibiting pregnant women from taking daytime naps, which still persists in Indonesian society, particularly within Javanese culture, may negatively affect maternal and fetal health. In fact, various studies have shown that napping of reasonable duration contributes to healthier pregnancies, supports optimal birth weight, and may reduce the risk of stunting later in life. Therefore, continuous education from stakeholders including healthcare providers, community cadres, cultural leaders, and families is needed to correct this misconception. Such education is expected to encourage pregnant women to adopt healthy sleep patterns, including daytime napping, as part of a comprehensive effort to prevent stunting in Indonesia.

REFERENCES

Agushybana, F., Pratiwi, A., Kurnia, P. L., Nandini, N., Santoso, J., & Setyo, A. (2022). Reducing Stunting Prevalence: Causes, Impacts, and Strategies. *BIO Web of Conferences*, *54*, 1–6. https://doi.org/10.1051/bioconf/20225400009

Alfarisi, R., Nurmalasari, Y., & Nabilla, S. (2019). Status Gizi Ibu Hamil Dapat Menyebabkan Kejadian Stunting Pada Balita. *Jurnal Kebidanan Malahayati*, *5*(3), 271–278. https://doi.org/10.33024/jkm.v5i3.1404

Artika, M. F. (2018). PENGARUH STUNTING PADA TUMBUH KEMBANG ANAK. *Journal of Materials Processing Technology*, *1*(1), 1–8. http://dx.doi.org/10.1016/j.cirp.2016.06.001%0Ahttp://dx.doi.org/10.1016/j.powtec.2016.12.055%0Ahttps://doi.org/10.1016/j.ijfatigue.2019.02.006%0Ahttps://doi.org/10.1016/j.matlet.2019.04.024%0Ahttps://doi.org/10.1016/j.matlet.2019.127252%0Ahttp://dx.doi.o

Austiyana, M. (2021). Tingkeban: Javanese Ritual During Pregnancy in Kalisari, Bojonegoro, East Java. *Muqoddima Jurnal Pemikiran Dan Riset Sosiologi*, *2*(2), 159–176. https://doi.org/10.47776/mjprs.002.02.05

Aynalem, B. Y., Melesse, M. F., & Bitewa, Y. B. (2023). Cultural Beliefs and Traditional Practices During Pregnancy, Child Birth, and the Postpartum Period in East Gojjam Zone, Northwest Ethiopia: A Qualitative Study. *Women's Health Reports*, *4*(1), 415–422. https://doi.org/10.1089/whr.2023.0024

Cassidy, E. M., Bailey, C. P., Napolitano, M. A., & Vyas, A. N. (2023). Sleep duration and chronotype of pregnant women in the United States: An online cross-sectional survey study. *Preventive Medicine Reports*, *31*(November 2022), 102088. https://doi.org/10.1016/j.pmedr.2022.102088

Cukarso, S. N. A., & Herbawani, C. K. (2020). Traditional Beliefs and Practices Among Pregnant Women In Javanese Communities: A Systematic Review. *Journal of Public Health Research and Community Health Development*, *4*(1), 71. https://doi.org/10.20473/jphrecode.v4i1.20810

Dennis, C. L., Fung, K., Grigoriadis, S., Robinson, G. E., Romans, S., & Ross, L. (2007). Traditional postpartum practices and rituals: A qualitative systematic review. *Women's Health*, *3*(4), 487–502. https://doi.org/10.2217/17455057.3.4.487

Felisian, S., Mushy, S. E., Tarimo, E. A. M., & Kibusi, S. M. (2023). Sociocultural practices and beliefs during pregnancy, childbirth, and postpartum among indigenous pastoralist women of reproductive age in Manyara, Tanzania: a descriptive qualitative study. *BMC Women's Health*, *23*(1), 1–8. https://doi.org/10.1186/s12905-023-02277-4

Gayatri, M., Silvani, Y., Pirade, R. A., Akingbade, O., Harjo, I. W. W., & Hastuti, N. R. (2023). Javanese Women's Experiences during the First Pregnancy. *Iranian Journal of Nursing and Midwifery Research*, *28*(6), 735–739. https://doi.org/10.4103/ijnmr.ijnmr_413_20

Karami, M., Chaleshgar, M., Salari, N., Akbari, H., & Mohammadi, M. (2022). Global Prevalence of Anemia in Pregnant Women: A Comprehensive Systematic Review and Meta-Analysis. *Maternal and Child Health Journal*, *26*(7), 1473–1487. https://doi.org/10.1007/s10995-022-03450-1

Mongi, T. (2022). Pengaruh senam hamil terhadap kualitas tidur pada ibu hamil trimester II dan III di Puskesmas Kema Minahasa Utara. *J Kedokt Kom Tropik. 2022;10(2):441-448* *, *10*(2), 441–448.

Morales-Muñoz, I., Partonen, T., Saarenpää-Heikkilä, O., Kylliäinen, A., Pölkki, P., Porkka-Heiskanen, T., Paunio, T., & Paavonen, E. J. (2019). The role of parental circadian preference in the onset of sleep difficulties in early childhood. *Sleep Medicine*, *54*, 223–230. https://doi.org/10.1016/j.sleep.2018.10.039

Murata, T., Kyozuka, H., Fukuda, T., Yasuda, S., Yamaguchi, A., Morokuma, S., Sato, A., Ogata, Y., Shinoki, K., Hosoya, M., Yasumura, S., Hashimoto, K., Nishigori, H., Fujimori, K., Kamijima, M., Yamazaki, S., Ohya, Y., Kishi, R., Yaegashi, N., … Katoh, T. (2021). Maternal sleep duration and neonatal birth weight: the Japan Environment and Children's Study. *BMC Pregnancy and Childbirth*, *21*(1), 1–9. https://doi.org/10.1186/s12884-021-03670-3

Murniasih, N. P., Masfiah, S., Hariyadi, B., Kesehatan, J., Fakultas, M., Kesehatan, I.-I., &

Soedirman, U. J. (2016). *Perilaku Perawatan Kehamilan Dalam Perspektif Budaya Jawa Di Desa Kaliori Kecamatan Kalibagor Prenatal Care Behavior in Javanese Culture Perspective in Kaliori Village, District of Kalibagor*. 56–66.

Permatasari, T. A. E., Rizqiya, F., Kusumaningati, W., Suryaalamsah, I. I., & Hermiwahyoeni, Z. (2021). The effect of nutrition and reproductive health education of pregnant women in Indonesia using quasi experimental study. *BMC Pregnancy and Childbirth*, *21*(1), 1–15. https://doi.org/10.1186/s12884-021-03676-x

Ramulondi, M., de Wet, H., & Ntuli, N. R. (2021). Traditional food taboos and practices during pregnancy, postpartum recovery, and infant care of Zulu women in northern KwaZulu-Natal. *Journal of Ethnobiology and Ethnomedicine*, *17*(1), 1–19. https://doi.org/10.1186/s13002-021-00451-2

Regina Putri, N., & Noviani Fadilah, L. (2023). Asuhan Kebidanan Komprehensif Pada Ny.E Di Puskesmas Malangbong Kabupaten Garut. *Jurnal Kesehatan Siliwangi*, *4*(1), 553–565. https://doi.org/10.34011/jks.v4i1.1515

Smith Fawzi, M. C., Andrews, K. G., Fink, G., Danaei, G., McCoy, D. C., Sudfeld, C. R., Peet, E. D., Cho, J., Liu, Y., Finlay, J. E., Ezzati, M., Kaaya, S. F., & Fawzi, W. W. (2019). Lifetime economic impact of the burden of childhood stunting attributable to maternal psychosocial risk factors in 137 low/middle-income countries. *BMJ Global Health*, *4*(1), 1–11. https://doi.org/10.1136/bmjgh-2018-001144

Song, L., Shen, L., Li, H., Liu, B., Zheng, X., Zhang, L., Xu, S., & Wang, Y. (2018). Afternoon napping during pregnancy and low birth weight: the Healthy Baby Cohort study. *Sleep Medicine*, *48*, 35–41. https://doi.org/10.1016/j.sleep.2018.03.029

Tsai, S. Y., Lin, J. W., Kuo, L. T., Lee, C. N., & Landis, C. A. (2013). Nighttime sleep, daytime napping, and labor outcomes in healthy pregnant women in Taiwan. *Research in Nursing and Health*, *36*(6), 612–622. https://doi.org/10.1002/nur.21568

Vionalita, G., & Permata, N. T. (2020). *The Relationship Between Age of Pregnant Women and Parity With the Incidence of Anemia in Third Semester Pregnant Women*. *30*(Ichd), 125–128. https://doi.org/10.2991/ahsr.k.201125.021

Wang, L., & Jin, F. (2020). Association between maternal sleep duration and quality, and the risk of preterm birth: A systematic review and meta-Analysis of observational studies. *BMC Pregnancy and Childbirth*, *20*(1), 1–13. https://doi.org/10.1186/s12884-020-2814-5

Wang, R., Xu, M., Yang, W., Xie, G., Yang, L., Shang, L., Zhang, B., Guo, L., Yue, J., Zeng, L., & Chung, M. C. (2022). Maternal sleep during pregnancy and adverse pregnancy outcomes: A systematic review and meta-analysis. *Journal of Diabetes Investigation*, *13*(7), 1262–1276. https://doi.org/10.1111/jdi.13770

Yulianti, I. (2024). Kehamilan Dalam Lensa Budaya Menyikapi Mitos Dan Fakta Menurut Kepercayaan Masyarakat Suku Jawa di Kota Tarakan. *Jurnal Peduli Masyarakat*, *6*(2), 450.

Zulkifli, Z., Yenni, Dila Yulinda Sari, Angeline Rachel, & Elland Sasihade. (2023). Pregnancy Tradition Ceremony in Javanese Society. *Indonesian Journal of Medical Anthropology*, *4*(1), 19–23. https://doi.org/10.32734/ijma.v4i1.11594

THE RELATIONSHIP BETWEEN KNOWLEDGE OF HEALTHY FOOD AND FOOD ADDITIVES AND ATTITUDES AND BEHAVIORS TOWARD SAFE FOOD SELECTION AMONG SCHOOL ADOLESCENTS

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ABSTRACT

Food safety is a critical public health issue among adolescents, particularly in school environments where exposure to processed foods and snacks containing food additives is high. Limited awareness and understanding of healthy foods and food additives may influence adolescents' attitudes and behaviors in food selection. This study aimed to analyze the relationship between knowledge of healthy food and food additives with attitudes and behaviors related to safe food selection among school adolescents. This quantitative study employed a cross-sectional design involving tenth-grade students at SMA X Pekanbaru. Data were collected using a structured questionnaire consisting of 21 items covering knowledge, attitudes, and self-reported behaviors related to healthy food and food additives. Data were analyzed using univariate analysis to describe respondents' characteristics and levels of knowledge, attitudes, and behaviors, as well as bivariate analysis to examine the relationships between variables using appropriate statistical tests. The results indicated that most respondents had a good level of knowledge regarding healthy foods and food additives. However, good knowledge was not consistently accompanied by positive attitudes and healthy food selection behaviors. A significant relationship was found between knowledge level and both attitudes and behaviors toward safe food selection. These findings suggest that knowledge plays an important role in shaping adolescents' attitudes and behavioral tendencies related to food safety. Continuous and context-based nutrition education is therefore necessary to support sustainable behavioral change.

Keywords: adolescents; attitude; behavior; food additives; food safety; knowledge

INTRODUCTION

Safe food is an essential aspect of maintaining and improving adolescents' health status, particularly in the school environment where exposure to ready-to-eat snacks containing various food additives is high (BPOM, 2020). Adolescence is a transitional period characterized by rapid physical growth, cognitive development, and the formation of dietary habits that tend to persist into adulthood (Sawyer et al., 2012). Choosing unsafe and unhealthy foods during this phase may increase the risk of health problems, both in the short and long term.

The school environment offers a wide variety of snacks that are appealing in terms of taste, color, and price; however, food safety aspects are often overlooked. Many school snacks contain food additives such as artificial colorings, preservatives, artificial sweeteners, and flavor enhancers. Although food additives are permitted within certain regulatory limits, excessive and inappropriate consumption may lead to negative health effects, including digestive disorders, allergic reactions, behavioral problems, and an increased risk of non-communicable diseases (WHO, 2015; European Food Safety Authority, 2019). Previous studies have shown that most adolescents still have a low level of knowledge regarding food safety and the health risks associated with excessive additive consumption (Suhartini et al., 2019).

Knowledge about healthy foods and food additives plays a crucial role in shaping adolescents' attitudes and behaviors in selecting safe foods. The Knowledge–Attitude–Behavior (KAB) model explains that knowledge is the initial factor influencing attitudes, which subsequently shape individual behavior (Glanz et al., 2015). Several studies indicate that adolescents with higher levels of nutrition and food safety knowledge are more likely to demonstrate positive attitudes toward healthy foods and exhibit safer food selection behaviors (Wardle et al., 2000; Contento, 2016). Some studies report that adolescents' understanding of food additives remains limited, particularly in identifying potentially harmful additives and interpreting food label information (Laska et al., 2015). Low food literacy contributes to indifferent attitudes toward food safety and unhealthy snacking behaviors in school settings. Additionally, peer influence, taste preferences, and the lack of systematic nutrition education in schools further reinforce adolescents' tendency to choose unsafe foods (Story et al., 2009).

Although food safety issues among adolescents are receiving increasing attention, research examining the relationship between knowledge of healthy foods and food additives, and attitudes and behaviors related to safe food selection among school adolescents, remains limited, especially in Indonesia. Most previous studies have focused primarily on general nutrition knowledge without integrating food additives as an important component of food safety (Suhartini et al., 2019; BPOM, 2020). This study aimed to analyze the relationship between knowledge of healthy food and food additives with attitudes and behaviors related to safe food selection among school adolescents.

METHOD

This study employed a quantitative analytical design with a cross-sectional approach to examine the relationship between knowledge of healthy food and food additives and adolescents' attitudes and behaviors toward safe food selection. The study was conducted among school adolescents in Senior High School X at Pekanbaru City, Riau, Indonesia. Data collection was carried out during the academic year 2025-2026. The study population consisted of adolescents enrolled in secondary school. The inclusion criteria were students aged 12–18 years who were present at the time of data collection and willing to participate in the study. Students who were absent or did not complete the questionnaire were excluded.

The sample size was determined using proportion formula, with a confidence level of 95%. A total sampling technique was used to select participants. Data were collected using a structured, self-administered questionnaire consisting of 21 multiple-choice questions divided into three domains:

1. Knowledge (17 items): assessing understanding of healthy food definitions, criteria and benefits of healthy food, definitions and purposes of food additives, and examples of permitted and prohibited additives.
2. Attitude (2 items): assessing respondents' tendencies in food selection and their attitudes toward foods containing additives.
3. Behavior (2 items): assessing responses and tendencies in selecting healthy foods after receiving information about healthy food and food additives.

The knowledge section was scored as 1 for correct answers and 0 for incorrect answers. Knowledge levels were categorized into good, moderate, and poor based on predetermined cut-off points. Attitude and behavior responses were categorized into positive/negative and safe/unsafe tendencies, respectively. Prior to data collection, permission was obtained from the school authorities. Participants were informed about the study objectives and procedures, and written

informed consent was obtained from students and/or their parents or guardians. The questionnaire was distributed and completed during school hours under researcher supervision. Data were analyzed using SPSS version XXIII]. Descriptive statistics were used to summarize respondent characteristics and variable distributions. The relationship between knowledge level and attitudes, as well as between knowledge level and behavior toward safe food selection, was analyzed using the Fisher's exact test was applied. A p-value of <0.05 was considered statistically significant.

RESULT AND DISCUSSION

This study involved 408 school adolescents who met the inclusion criteria. Based on gender distribution, the majority of respondents were female, totaling 239 individuals (58.60%), while 167 respondents were male (41.4%). The respondents were aged between 14 and 18 years. The majority were 15 years old, comprising 209 individuals (51.2%), followed by those aged 16 years, totaling 176 individuals (43.1%). These characteristics indicate that the study participants were predominantly in the middle adolescence phase, a critical period for the development of mindset, attitudes, and behaviors related to food selection. The relatively diverse composition of respondents based on age and grade level provides a representative overview of the condition of school adolescents in this study.

Table 1.
Respondent characteristics (n= 408)

Respondent characteristics	f	%
Age		
14 years old	7	1.7
15 years old	209	51.2
16 years old	176	43.1
17 years old	15	3.7
18 years old	1	0.2
Gender		
Male	169	41.47
Female	239	58.67
Weight		
<40	38	9.3
40-50	202	49.5
51-60	126	30.9
>60	42	10.3

Respondents' Knowledge Level on Healthy Eating Concepts and Food Additives

The results of the descriptive analysis indicated that the majority of respondents had a good level of knowledge regarding the concepts of healthy food and food additives. Respondents were generally able to accurately explain the definition of healthy food, identify the benefits of consuming healthy food for overall health, and distinguish between permitted and prohibited food additives. These findings suggest that, cognitively, most adolescents possess adequate basic understanding of balanced nutrition principles and food safety. This level of knowledge serves as an initial foundation for developing awareness of the importance of selecting safe and healthy foods within the school environment.

Attitudes and Behaviors Toward Safe Food Selection

Although the respondents' level of knowledge was generally good, the findings revealed that not all respondents demonstrated attitudes and behaviors consistent with their understanding. Some respondents still tended to choose foods based on taste, price, and convenience rather than

considering food safety and nutritional value. This indicates a gap between cognitive aspects (knowledge) and actual behavioral implementation. In other words, good knowledge does not automatically translate into consistent decision-making regarding safe food selection.

Table 2.
Results of the test on the relationship between knowledge and attitudes and behavior in choosing safe food among school adolescents.

	Positive Attitudes and Behavior	Negative Attitudes and Behavior	Total	P value
Knowledge of Healthy Eating Concepts	326	7	333	
Lack of Knowledge of Healthy Eating Concepts	58	17	75	0.00

The results of the bivariate analysis showed a statistically significant relationship between knowledge level and attitudes and behaviors toward safe food selection among school adolescents. Respondents with higher levels of knowledge tended to exhibit more positive attitudes toward healthy foods and were more selective in choosing foods. Conversely, respondents with lower knowledge levels were less likely to consider safety and health aspects when selecting foods. That knowledge plays an important role in shaping adolescents' attitudes and behaviors toward food safety, although it is not the sole determinant in the food choice decision making process. The findings of this study indicate that most school adolescents possess a good level of knowledge regarding healthy eating concepts and food additives. Respondents were generally able to accurately identify the definition and benefits of healthy food, as well as distinguish between permitted and prohibited food additives. This suggests that, cognitively, adolescents have been exposed to adequate nutrition and food safety information.

Recent global evidence supports this finding. The World Health Organization (2022) emphasizes that strengthening nutrition literacy among adolescents is a key strategy in preventing diet-related non-communicable diseases. Increased access to school-based nutrition education and digital health information has contributed to improved awareness of healthy eating practices. Similarly, UNICEF (2023) reports that adolescents today have greater exposure to health and nutrition information compared to previous generations, although behavioral translation remains inconsistent. Despite the generally good knowledge observed in this study, not all respondents demonstrated positive attitudes and safe food selection behaviors. A proportion of adolescents continued to prioritize taste, affordability, and convenience over nutritional value and food safety. This gap between knowledge and behavior is consistent with contemporary health behavior frameworks, which recognize that knowledge alone is insufficient to drive sustained behavior change. A systematic review published in *Nutrients* (2022) found that although nutrition knowledge among adolescents was positively associated with healthier dietary patterns, environmental factors such as food availability, peer influence, and marketing exposure significantly moderated this relationship. Furthermore, a 2023 study in *Frontiers in Nutrition* reported that adolescents' food choices are strongly influenced by sensory preferences and social contexts, even when awareness of health risks is present.

The bivariate analysis in this study demonstrated a statistically significant relationship between knowledge levels and attitudes and behaviors toward safe food selection. Adolescents with higher knowledge levels were more likely to exhibit positive attitudes and selective food choice behaviors. This finding aligns with recent empirical evidence indicating that nutrition literacy plays a

foundational role in shaping adolescents' dietary decision-making processes, although supportive environmental and policy-level interventions are necessary to strengthen behavioral outcomes. The present study reinforces the importance of integrating nutrition education with structural and environmental strategies within school settings. Strengthening food labeling literacy, regulating the availability of ultra-processed snacks in schools, and implementing peer-led health promotion programs may help bridge the gap between knowledge and actual behavior.

CONCLUSION

These findings suggest that knowledge plays a significant role in shaping adolescents' attitudes and behavioral tendencies toward safe food selection. However, knowledge alone is not sufficient to ensure consistent healthy behavior. Therefore, continuous and context-based nutrition education is necessary to promote sustainable behavioral change among school adolescents.

REFERENCES

Badan Pengawas Obat dan Makanan Republik Indonesia. (2020). *Pangan aman untuk anak sekolah*. BPOM RI.

Contento, I. R. (2016). *Nutrition education: Linking research, theory, and practice* (3rd ed.). Jones & Bartlett Learning.

European Food Safety Authority. (2019). *Food additives and safety assessment*. EFSA Journal.

Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health behavior: Theory, research, and practice* (5th ed.). Jossey-Bass.

Laska, M. N., Hearst, M. O., Forsyth, A., Pasch, K. E., & Lytle, L. (2015). Neighbourhood food environments: Are they associated with adolescent dietary intake, food purchases and weight status? *Public Health Nutrition*, 13(11), 1757–1763.

Nakamura, Y., Yamasaki, S., Okada, N., Ando, S., Nishida, A., Kasai, K., & Koike, S. (2024). Macronutrient intake is associated with intelligence and neural development in adolescents. *Frontiers in Nutrition, 11*, 1349738. https://doi.org/10.3389/fnut.2024.1349738

Nor, N. M., Rusli, S. F. M., & Asmawi, U. M. (2023). *Awareness, Knowledge, and Practices towards Reading Snack Food Labels among Malaysian Adolescents*. Jurnal Gizi dan Pangan, 18(1), 61–70.

Sains & Public Health. (2025). *The impact of educational interventions on food label comprehension and food choices among adolescents: a scoping review*. BMC Public Health, 25, 2682.

Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S. J., Dick, B., Ezeh, A. C., & Patton, G. C. (2012). Adolescence: A foundation for future health. *The Lancet*, 379(9826), 1630–1640.

Srimiati, M., & Ratnayani, R. (2025). *Digital education on knowledge of ultra-processed foods in Grade XI adolescents*. Jurnal Abmas Negeri (JAGRI).

Story, M., Neumark-Sztainer, D., & French, S. (2009). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association*, 102(3), S40–S51.

Suhartini, E., Suryani, D., & Indrawati, V. (2019). Hubungan pengetahuan keamanan pangan dengan perilaku memilih jajanan pada siswa sekolah menengah. *Jurnal Gizi dan Kesehatan*, 11(2), 85–94.

UNICEF. (2023). *The state of the world's children 2023: For every child, nutrition*. United Nations Children's Fund.

Vaitkeviciute, R., Ball, L. E., & Harris, N. (2022). The relationship between food literacy and dietary intake in adolescents: A systematic review. *Nutrients, 14*(3), 567. https://doi.org/10.3390/nu14030567

Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite*, 34(3), 269–275.

World Health Organization. (2015). *Food safety and foodborne diseases*. WHO Press.

World Health Organization. (2022). *Adolescent nutrition: A review of the situation in selected South-East Asian countries*. WHO Regional Office.

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PORTABLE X-RAY AS A STRATEGY FOR THE PREVENTION AND CONTROL OF PULMONARY TUBERCULOSIS: A SYSTEMATIC REVIEW

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ABSTRACT

Pulmonary tuberculosis (TB) remains a global public health problem with high morbidity and mortality rates, particularly in developing countries. Indonesia has the second-highest number of cases in the world, with East Nusa Tenggara (NTT) as one of the provinces with the highest number of cases nationally. Early detection is a key component of TB prevention and control strategies, but limited access to conventional radiology facilities is a major obstacle, particularly in remote areas such as NTT. The use of portable X-ray technology is considered a potential innovation to expand screening coverage and accelerate the diagnosis of pulmonary TB. This study aims to systematically analyze the role and effectiveness of portable X-ray use as a strategy for preventing and controlling pulmonary tuberculosis. The method used was a systematic review by examining scientific articles published in electronic databases such as PubMed, Scopus, and Google Scholar within a specific publication year. Inclusion criteria included studies discussing the use of portable X-rays in the screening, early diagnosis, and control of pulmonary tuberculosis in the general population and high-risk groups. The article selection process followed the PRISMA guidelines. The review results show that the use of portable X-ray significantly increases access to pulmonary TB screening, especially in areas with limited health infrastructure. Several studies report relatively high sensitivity and specificity in detecting lung abnormalities suggestive of TB, especially when combined with Computer-Aided Detection (CAD) technology. Furthermore, the implementation of portable X-ray has proven effective in supporting mass screening activities, active case detection, and accelerating referrals for further bacteriological examination. Challenges identified include the need for operator training, the initial cost of equipment procurement, and radiation safety aspects. Portable X-ray is an effective and innovative strategy for preventing and controlling pulmonary tuberculosis, particularly in improving early detection and reaching populations with limited access to healthcare. Integrating this technology into the national TB program requires radiation safety regulations, increased healthcare worker capacity, and ongoing policy support.

Keywords: prevention; portable X-ray; pulmonary tuberculosis; screening; systematic review; TB control

INTRODUCTION

Tuberculosis (TB) remains a major public health threat worldwide, with millions of new cases and deaths occurring annually. This is ironic, despite the extensive programs and budgets dedicated to diagnosing and treating TB. The emergence of drug-resistant TB strains further complicates efforts to control the disease. Furthermore, TB causes long-term complications that lead to side effects and loss of productivity (Sholichah et al., 2020). As a developing country, Indonesia has the second-highest number of TB cases in the world after India, with 1.02 million cases (Mason et al., 2017). Indonesia has a high TB burden, with a mortality rate of 40 per 100,000 and new cases of 395 per 100,000. East Nusa Tenggara (NTT) Province contributes to the number of TB cases in Indonesia, with 20,599 sufferers, with 57.7% taking medication regularly (Ministry of Health of the Republic of Indonesia, 2024). The bacterium Mycobacterium tuberculosis is the cause of tuberculosis (TB). Besides affecting the lungs, this bacterium can also affect other parts of the body, such as the bones or lymph nodes. Complications of TB can include lung damage, leading to chronic respiratory problems or even death if left untreated. Factors contributing to the spread of TB include economic factors or poverty, malnutrition, overcrowded living conditions, a

weakened immune system due to HIV/AIDS, tobacco use, and exposure to air pollution (Eneogu et al., 2025).

The high number of TB cases in Indonesia is caused by a combination of low awareness of treatment, discontinuation of treatment (risk of drug-resistant TB), and environmental factors such as population density, poverty, and poor nutrition. Furthermore, delayed diagnosis, high comorbidities (such as HIV/diabetes), and high population mobility facilitate the spread of the disease. The complexity of the TB problem indicates the need for continuous efforts to prevent and control its transmission. Early TB detection services are crucial for breaking the chain of transmission because one active person can infect 10-15 people per year, preventing permanent lung damage, and avoiding drug-resistant TB (Drug-Resistant TB). This phenomenon is a major focus because TB is an infectious disease whose symptoms are often ignored, even though early detection increases the cure rate (Dakum et al, 2024).

Early detection is a key component in prevention and control strategies, breaking the chain of transmission, and reducing morbidity and mortality from this disease. TB often develops slowly and does not always cause severe symptoms in the early stages. As a result, many sufferers only realize they have the disease when their condition is already severe and they have the potential to transmit the germs to others around them. Through early detection, sufferers can receive prompt treatment, significantly increasing the chances of recovery. Starting treatment early also prevents serious complications, such as permanent lung damage, decreased immunity, and the emergence of drug-resistant TB (DR-TB). Furthermore, early detection reduces the risk of transmission within families, schools, workplaces, and the wider community (Harahap et al, 2022).

According to the World Health Organization, one person with untreated TB can transmit the disease to 10–15 people each year. This demonstrates that detecting cases as early as possible not only protects individuals but also communities. In Indonesia, the Ministry of Health emphasizes the importance of active screening in high-risk groups such as household contacts of TB patients, people with diabetes, smokers, and people with vulnerable socioeconomic conditions. Early detection also supports the efficiency of the healthcare system. The cost of treatment in the early stages is much lower than the cost of treating patients with severe or drug-resistant TB. Thus, early detection impacts not only health but also the social and economic aspects of the community (Paskaria, et al, 2024).

Limited access to conventional radiology facilities is a major obstacle, particularly in remote areas such as East Nusa Tenggara (NTT). The use of portable X-ray technology is considered a potential innovation to expand screening coverage and accelerate the diagnosis of pulmonary TB. The use of portable X-ray technology is a strategic solution to overcome limited access to conventional radiology facilities in remote areas, such as NTT. Limited facilities, difficult geography, and limited radiographers are the main obstacles to early TB detection in these areas. Portable X-ray is an important innovation in the early detection of pulmonary tuberculosis (TB), particularly in remote areas and high-risk populations. With this technology, examinations can be performed directly in the community without having to wait for patients to come to the hospital, thereby minimizing the barriers of distance, cost, and time (Paulis et al, 2025).

Early detection through portable X-rays allows for faster detection of TB cases, prompt initiation

of treatment, and suppression of community transmission. This aligns with World Health Organization (WHO) recommendations emphasizing the importance of active community-based screening for TB control. Therefore, portable X-rays serve not only as a diagnostic tool but also as a preventive and promotive strategy to strengthen health systems, accelerate TB elimination, and sustainably improve public health. This study aims to systematically analyze the role and effectiveness of portable X-rays as a strategy for preventing and controlling pulmonary tuberculosis.

METHOD

The method used was a systematic review, examining scientific articles published in electronic databases such as PubMed, Scopus, and Google Scholar within a specific publication year. Inclusion criteria included studies addressing the use of portable X-rays in the screening, early diagnosis, and control of pulmonary TB in the general population and high-risk groups. The article selection process followed the PRISMA guidelines.

RESULT AND DISCUSSION

After conducting a search for scientific articles through Google Scholar, PubMed, and ScienceDirect, 3 articles were found that met the inclusion criteria from a review of 24,840 published clinical and research articles, including the following.

Table 1.
Characteristics of the Analyzed Articles

Author's Name	Title	Research Objectives	Design and Method	Findings
Patrick Dakum et al	Implementation of Portable Digital Chest X-ray Machine for Tuberculosis Contact Tracing in Oyo and Osun States, Nigeria: A Formative Assessment	This presents a formative assessment of the implementation of mobile PDX machines for contact tracing in Oyo and Osun states, Nigeria.	A descriptive qualitative study in eight local government areas, and 24 focus group discussions and 30 key informant interviews were conducted using a four-stage sampling technique to select participants. Validated transcribed notes were entered and analyzed using Nvivo. Respondents ranged in age from 17 to 85 years, with a mean age of 42.08 ± 14.9 years, and 4.0% had a postgraduate degree.	The use of X-ray for screening at the community level is considered the best method, given the convenience of proximity to TB contacts and reduced concerns about transportation costs to health facilities. Furthermore, community TB screening is conducted concurrently with screening for other health conditions such as high blood pressure and diabetes. Portable X-ray detection can be implemented at the community level to allow more TB contacts living with the index patient to be screened without distance and transportation constraints.
Josef Yayan et al	Early detection of tuberculosis: a systematic review	Analyzing the findings of several published studies on the topic of early tuberculosis detection.	Electronic databases, including PubMed, Embase, and Google Scholar, were searched using a combination of keywords and Medical Subject Headings ("early tuberculosis detection"). Additional search terms were also used to ensure comprehensive coverage of the literature.	X-rays are used for automated tuberculosis detection. Interferon gamma release assays, routine passive and active case detection, portable X-rays and nucleic acid amplification testing, and highly sensitive enzyme-linked immunosorbent assays (ELISAs) play a crucial role in improving tuberculosis detection.
Mawaddah Harahap et al	Classification of Tuberculosis Based on Lung X-Ray Image with Data Science Approach Using Convolutional Neural Network, 2022	Tuberculosis Classification Based on Lung X-ray Images with a Data Science Approach Using Convolutional Neural Networks.	This study was experimental, analyzing the efficiency and accuracy of a Convolutional Neural Network (CNN) model using a data science approach in classifying normal and abnormal lung X-ray images.	The test results yielded a final epoch value of 200, with an accuracy of 0.9892, meaning the CNN has a 98% accuracy. The validation accuracy was 0.9835, or 98%. Therefore, the classification test results using CNN are quite accurate. With such high CNN results, it can be considered for use in TB classification..

The Epidemiological Context of Pulmonary Tuberculosis

Pulmonary tuberculosis (TB) remains a global public health problem with high incidence and mortality rates, particularly in developing countries. The high burden of TB is influenced by delayed diagnosis, limited access to health services, and low coverage of active screening in at-risk populations. Early detection is a key component of primary and secondary TB prevention strategies because it can break the chain of transmission through prompt and appropriate therapy. Conventional approaches that rely on patient visits to health facilities are often ineffective in reaching remote populations and vulnerable groups. Therefore, innovative health technologies are needed to increase access and coverage of TB screening at the community level. One emerging technology is the use of portable X-rays as radiological screening tools in the field (Puspita et al., 2025).

The Role of Portable X-Rays in TB Prevention and Control Strategies

Portable X-rays are portable radiography devices that can be operated outside of hospital facilities, such as community health centers, mobile health posts, schools, or remote communities. In the context of TB prevention and control, portable X-rays serve as an active screening method (active case finding) aimed at identifying individuals with lung abnormalities suggestive of TB before severe symptoms develop. A systematic review of various studies has shown that portable X-rays increase TB case finding rates compared to passive strategies that rely solely on examining symptomatic patients presenting to health facilities. This strategy is particularly relevant in areas with a high TB burden, limited infrastructure, and geographic barriers.

Effectiveness of Portable X-Rays Based on a Systematic Review

A synthesis of various studies shows that the use of portable X-rays in TB screening programs has several key impacts (Somkhuan et al., 2022).

1) Increased TB Case Detection
   A systematic review reported that portable X-ray-based screening can detect both latent and active TB cases in individuals who have not yet shown clear clinical symptoms. This is important because asymptomatic individuals can still transmit TB in the community. Therefore, portable X-rays contribute significantly to expanding the scope of early detection.
2) High Sensitivity as a Screening Tool
   Radiologically, pulmonary TB has distinctive characteristics such as infiltrates, cavities, and lung consolidation. Portable X-rays have a high enough sensitivity to identify these abnormalities, although their specificity is limited. Therefore, portable X-rays are more appropriate for use as an initial screening tool, rather than as a definitive diagnostic tool.
3) Integration with Microbiological Testing
   Most studies in the systematic review emphasized that portable X-rays are most effective when combined with confirmatory tests, such as rapid molecular tests or sputum smear examinations.

This integration improves diagnostic accuracy while accelerating clinical decision-making.

1) Contribution to TB Prevention and Control
   From a public health perspective, the use of portable X-rays contributes to several key aspects: First, preventing transmission. Early detection allows for faster treatment, thereby reducing the infectivity period of TB patients. This has a direct impact on reducing transmission at the community level. Second, Equitable Access to Health Services. Portable X-rays overcome geographic and social barriers by bringing screening services directly to the community. This approach supports the principle of social justice (equity) in health care. Third, Strengthening the TB Surveillance System. Portable X-ray screening data can be used as a basis for mapping the

epidemiology of TB in specific areas, thus assisting in the planning of more targeted health interventions (Yayan et al., 2024).

2) Field Implementation Challenges
Despite demonstrating significant benefits, the use of portable X-rays also faces several obstacles, such as: First, Limited Radiological Interpretation. Interpretation of X-ray results requires trained healthcare workers. Misinterpretation can lead to overdiagnosis or underdiagnosis of TB. Second, Cost and Infrastructure. Initial investment for equipment procurement, maintenance, and the need for electricity or batteries pose challenges in areas with limited resources. Third, Ethical and Social Issues: Mass screening requires a sound communication approach to avoid stigmatizing individuals detected with lung abnormalities (Yayan et al., 2024).

3) Implications for Health Policy and Practice
Based on the findings of a systematic review, portable X-rays are recommended as part of a national TB control strategy, particularly for areas with high TB rates, at-risk populations (densely populated settlements, migrant workers, remote areas), and community-based screening programs. Health policies need to integrate the use of portable X-rays with laboratory referral systems, case reporting, and ongoing treatment to ensure program success.

CONCLUSION

Portable X-rays are an effective and innovative strategy for preventing and controlling pulmonary tuberculosis, particularly in improving early detection and reaching populations with limited access to healthcare. Integrating this technology into the national TB program requires radiation safety regulations, increased healthcare workforce capacity, and ongoing policy support.

REFERENCES

Dakum, P., Agbaje, A., Daniel, O., Anyaike, C., Chijoke-Akaniro, O., Okpokoro, E., Akingbesote, S., Anyomi, C., Adekunle, A., Alege, A., Gbadamosi, M., Babalola, O., Mensah, C., Eneogu, R., Ihesie, A., Nongo, D., & Adelekan, A. (2024). *Implementation of Portable Digital Chest X-ray Machine for Tuberculosis Contact Tracing in Oyo and Osun States, Nigeria: A Formative Assessment. Journal of Respiration, 4(3), 163–176.* https://doi.org/10.3390/jor4030015

Eneogu, R., Ihesie, A., Nongo, D., & Adelekan, A. (2025). *Implementation of portable digital chest X-ray machine for tuberculosis contact tracing in Oyo and Osun States, Nigeria: A formative assessment*. Journal of Radiological Studies, 4(3), 163–176.

Harahap, M., Pasaribu, A. P. S., Sinaga, D. R., Sipangkar, R., & Samuel. (2022). *Classification of Tuberculosis Based on Lung X-Ray Image With Data Science Approach Using Convolutional Neural Network. Sinkron: Jurnal dan Penelitian Teknik Informatika, 7(4).* https://doi.org/10.33395/sinkron.v7i4.11711

Menkes Budi luncurkan portable X-ray pendeteksi TBC (2024, 2 Agustus). Kementerian Kesehatan Republik Indonesia. Diambil dari https://kemkes.go.id/eng/menkes-budi-luncurkan-portable-x-ray-pendeteksi-tbc

Paskaria, C., Wianto, E., & Toba, H. (2024). *Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis*. Journal of Innovation and Community Engagement, 5(3), 128–139. https://doi.org/10.28932/ice.v5i3.8675

Paulis, L. E., Schnerr, R. S., Halton, J., Qin, Z. Z., & Chua, A. (2024). *Assessment of scattered and leakage radiation from ultra-portable digital chest X-ray systems: An independent study*. arXiv:2406.10044.

Puspita, M. I., Murti Wibowo, G., Sugiyanto, S., & Suwondo, A. (2025). *Penggunaan teknologi Dynamic Digital Radiography (DDR) pada skrining deteksi dini tuberkulosis (TBC)*. JRI (Jurnal Radiografer Indonesia), 8(1), 41–44. Diambil dari https://ejournal.pari.or.id/index.php/jri/article/view/395

Skrining Tuberkulosis dengan X-Ray Portable di Puskesmas Karanglewas (2025, 30 September). Dinas Kesehatan Kabupaten Banyumas

Somkhuan, T., & Laosupap, K. (2022). *Cost utility of pulmonary tuberculosis screening with mobile digital X-ray vehicle*. Health Science Journal of Thailand.

The yield of active tuberculosis disease and latent tuberculosis infection in tuberculosis household contacts investigated using chest X-ray in Yogyakarta Province, Indonesia. (2024). Tropical Medicine and Infectious Disease, 9(2), 34. https://doi.org/10.3390/tropicalmed9020034

Yayan, J., Franke, K.-J., Berger, M., & Windisch, W. (2024). *Early detection of tuberculosis: a systematic review. Pneumonia, 16, 11.* https://doi.org/10.1186/s41479-024-00133-z

ANEMIA DETERMINANT MODEL IN ADOLESCENT GIRLS: EMPIRICAL ANALYSIS BASED ON LOGISTIC REGRESSION

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ABSTRACT

Anemia is a condition in which the body lacks sufficient red blood cells and/or hemoglobin. In women, a hemoglobin level of less than 12.0 g/100 ml is considered an indication of anemia. It is a major global public health problem in both developed and developing countries. This study aimed to determine the relationship between Body Mass Index (BMI), Upper Arm Circumference (MUAC), Iron Tablet Intake (Fe), and Level of Knowledge on the occurrence of anemia in adolescent girls at the Asy Syifa Islamic Boarding School in Balikpapan City. This study was an analytical study with a cross-sectional design. This study was conducted in Balikpapan City from March to June 2025. The subjects were all 12th grade female students at the Asy Sifa Islamic Boarding School in Balikpapan. Data were collected through questionnaires and HB, BMI, and MUAC examinations. Data analysis used logistic regression. The results of the analysis with the logistic regression test concluded that there was an inverse effect between adolescent girls' knowledge and the risk of anemia (OR = 0.42, CI = 0.70-2.50, p = 0.342). There is a positive influence between Lila and the risk of anemia (OR=6.07, CI=1.47-24.92, p=0.012), compliance in consuming Fe tablets (OR=3.91, CI=1.06-14.35, p=0.0039), and BMI (OR=4.64, CI=1.23-17.50, p=0.023) with the risk of anemia. Anemia in adolescent girls is influenced by LILA, Compliance in consuming Fe tablets and BMI.CI=1.47-24.92, p=0.012), compliance in consuming Fe tablets (OR=3.91, CI=1.06-14.35, p=0.0039), and BMI (OR=4.64, CI=1.23-17.50, p=0.023) with the risk of anemia. Anemia in adolescent girls is influenced by LILA, Compliance in consuming Fe tablets and BMI.

Keywords: adolescent girl; anemia; determinant

INTRODUCTION

Anemia is a condition in which the body lacks sufficient red blood cells and/or hemoglobin. In women, a hemoglobin level of less than 12.0 g/100 ml is considered an indication of anemia. It is a major global public health problem in both developed and developing countries (Warner & Weyand, 2022). Among the types of anemia, iron deficiency anemia is most common in early adolescence and is caused by increased nutritional needs due to rapid growth rates among adolescent girls, exacerbated by menstruation (Sudfeld et al., 2020). Globally, approximately 1.2 billion people are adolescents, 90% of whom live in low- or middle-income countries (Kassebaum et al., 2015).

The World Health Organization (WHO) defines adolescents as the age group between 10 and 19 years, with the second-fastest growth rate after infancy (Ummah, 2019). This is a period of rapid growth, and 45% of skeletal growth, 15%–25% of adult height, and up to 37% of total bone mass are achieved during this period. This rapid growth increases the iron requirements for hemoglobin in the blood and myoglobin in muscles. They are a vulnerable group for anemia due to the increased iron requirements to support their rapid growth and mental development and to replace losses due to menstruation (Abbaspour et al., 2014). Adolescent girls are at high risk for anemia due to the physical and physiological changes that place higher demands on their nutritional needs. The resulting anemia can cause cognitive impairment in animals and humans, with damage to brain

mitochondria being the underlying cause associated with impairments in attention span, intelligence, sensory perception, emotion, and behavior.

METHOD

This study was conducted using a cross-sectional design. It was conducted from January to July 2024 at senior high schools in Balikpapan City. The population was female students in grades 10, 11, and 12 at two schools: Asy Syifa Islamic Boarding School Balikpapan and SMK N 2 Balikpapan. This study excluded every adolescent girls reported having specific diseases such as cancer or severe anemia, menstruating, pregnant or had previously been pregnant.

The instruments used in this study consisted of physical measuring instruments and questionnaires to collect data according to the research variables. For Anemia examination (Hb <12 g/dL) using a digital Hb meter, Body Mass Index (BMI) using a digital scale and stadiometer, Upper Arm Circumference using a special LILA meter. For the level of knowledge using a true-false questionnaire with a Cronbach's alpha score of 0.756 and Compliance with Iron (Fe) Tablet Intake with a self-report questionnaire. Data analysis is stated with Odds Ratio (OR) by using the logistic regression on the confidence rate of 95% ($\alpha = 0.05$). The whole analysis was done by using STATA 13.

The study was assessed by the Health Research Ethics Committee of Sari Mutiara Indonesia University No. 3272/F/KEP/USM/II/2025. This study was conducted based on the specified criteria, which include explaining the study benefits and the respondents right, protecting the privacy of respondents, and upholding aspects of fairness and the principle of openness by explaining research procedures and informed consent. Written informed consent was given to participate.

RESULT AND DISCUSSION

Univariate Analysis Results

The univariate description of the research variables explains the general description of the research data for each research variable including age, knowledge, LILA, compliance with FE tablet consumption, BMI, and anemia.

Table 1.
Results of Univariate Analysis of Anemia Determinant Characteristics

Variabel	Kategori	n	%
Age	17	42	63.64
	18	21	31.82
	19	2	4.55
Knowledge	Tinggi	11	16.67
	Rendah	55	83.33
MULA	Normal	37	56.06
	KEK	29	43.94
Kepatuhan Konsumsi Tablet FE	Patuh	25	47.88
	Tidak Patuh	41	62.12
IMT	Gizi Baik	25	37.88
	Gizi Buruk	41	62.12
Anemia	Tidak Anemia	26	39.39
	Anemia	40	60.61

Based on table 1, it was found that most of the respondents were in the 17 years age group as many as 42 (63.64%), had low knowledge as many as 6 (9.09%), had LILA with KEK Category as many

as 29 (43.49%), FE tablet intake was mostly non-compliant as many as 41 (62.12%), BMI was Less than 21 (31.82%) and Overweight 20 (31.82%), and experienced anemia as many as 40 (60.61%).

BIVARIATE AND MULTIVARIATE ANALYSIS RESULTS

In bivariate and multivariate analysis, it used the Logistic Regression test by looking at the Crude OR and Adjusted OR values that are significantly related if the p-value <0.05. Bivariate and multivariate results in Table 2 show about the results of the relationship between several dependent variables and the independent variables studied.

Table 2.
The relationship between several dependent variables and the independent variables studied.

Variabel	Kategori	Kejadian Anemia		Nilai p	OR
		Anemia	Tidak Anemia		
Pengetahuan	Tinggi	8 (6.7%)	3 (4.3%)	0.367	0.8123
	Rendah	32 (33.3%)	23 (21.7%)		
Lila	Normal	15 (22.4%)	22 (14.6%)	0.0001	14.200
	KEK	25 (17.6%)	4 (11.4%)		
Kepatuhan Konsumsi Tablet FE	Patuh	10 (15.2%)	15 (9.8%)	0.007	7.157
	Tidak Patuh	30 (24.8%)	11 (16.2%)		
IMT	Gizi Baik	8 (15.2%)	17 (9.8%)	0.0001	13.793
	Gizi Buruk	32 (24.8%)	9 (16.2%)		

Based on table 2, respondents who have low knowledge mostly experience anemia as many as 32 respondents (33.3%). The results of the statistical analysis obtained a p value = 0.367, it was concluded that there was no relationship between the knowledge of adolescent girls and anemia in adolescent girls. In the LILA variable, respondents who have LILA with KEK mostly experience anemia as many as 25 respondents (17.6%), and the statistical value obtained p = 0.0001, it was concluded that there is a relationship between LILA with KEK and adolescent girls who experience anemia. The OR value obtained 14.20 means that adolescent girls who have LILA with KEK have a 14-fold risk of experiencing anemia. In the variable of fulfilling the consumption of FE tablets, it was found that 30 respondents were non-compliant and experienced anemia (24.8%) with a statistical result of p = 0.007, it can be concluded that there is a relationship between fulfilling the consumption of FE tablets and the incidence of anemia in adolescent girls. The OT value obtained 7.157, which means that adolescent girls who do not comply with consuming FE tablets have a 7-fold risk of experiencing anemia. In the BMI variable, it was found that most of the respondents who had Malnutrition and Obesity experienced anemia, amounting to 32 respondents (24.8%) with the statistical test results obtained p = 0.0001. It was concluded that there was a significant relationship between malnutrition and the incidence of anemia in adolescent girls.

The results of the logistic regression equation can be described There is an inverse (negative) effect between adolescent girls' knowledge and the risk of anemia, but this effect is not statistically significant. Adolescent girls with high knowledge have a half-fold lower risk of anemia than those with low knowledge (OR=0.42, CI=0.70-2.50, p=0.342).

There is a strong positive effect between MULA and the risk of anemia, and this effect is statistically significant. Adolescent girls with MULA less than 23.5 cm have a 6.07 times greater risk of anemia than adolescents with normal MULA (OR=6.07, CI=1.47-24.92, p=0.012). There is

a strong positive effect between adherence to iron tablet consumption and the risk of anemia, and this effect is statistically significant. Adolescent girls who did not adhere to iron tablet consumption had a 3.91 times greater risk of developing anemia than adolescents who did (OR=3.91, CI=1.06-14.35, p=0.0039). There was a strong positive effect between adherence to good nutrition and anemia, and this effect was statistically significant. Adolescent girls with poor nutrition had a 4.64 times greater risk of developing anemia than adolescent girls with good nutrition (OR=4.64, CI=1.23-17.50, p=0.023).

Table 3.
Logistic Regression Results of Determinants of Anemia with the Risk of Anemia in Adolescent Girls

Variabel Independent	OR	CI		P
		Lower	Upper	
Pengetahuan	0.42	0.70	2.50	0.342
LILA	6.07	1.47	24.92	0.012
Kepatuhan konsumsi tablet Fe	3.91	1.06	14.35	0.039
IMT	4.64	1.23	17.50	0.023
Likelihood	-30.625			
P=	0.0001			

There was an inverse (negative) effect between adolescent girls' knowledge and the risk of anemia, but this effect was not statistically significant. Adolescent girls with high levels of knowledge had a half-fold lower risk of anemia than those with low levels of knowledge (OR=0.42, CI=0.70-2.50, p=0.342). According to the researchers, knowledge can influence the occurrence of anemia in adolescents. Adolescents who have good knowledge about a balanced nutritional menu that benefits the body will pay more attention to the food they consume, thereby reducing the risk of anemia. Furthermore, adolescents with minimal knowledge about anemia, its signs, effects, and prevention also result in them consuming foods with low iron content, thus not meeting their iron intake needs.

The effect of MUAC on the risk of anemia. Logistic regression results showed that MUAC was a confounding variable influencing the relationship between knowledge and iron supplement intake and the incidence of anemia. Adolescent girls with MUAC categorized as KEK (Certainly Chronic Energy Deficiency) were at greater risk of anemia compared to those with normal MUAC. Physiologically, a low MUAC reflects malnutrition and low energy/protein reserves, which are associated with inadequate nutrient intake (especially iron, protein, and vitamins that support erythropoiesis), thus increasing susceptibility to anemia. Several studies support MUAC as an important anthropometric indicator of anemia in adolescent girls. A literature review indicates that MUAC and BMI are recommended as initial assessments to screen nutritional status and estimate the risk of anemia in adolescent girls (Yunita et al., 2024).

A study in Pekanbaru found that adolescent girls with low MUAC (<22 cm) had a nearly twofold higher risk of anemia (PR=1.95; 95% CI: 1.05–3.60) after controlling for other variables (Putri et al., 2025). A study in Donggala also reported that MUAC <23.5 cm was a risk factor for anemia in adolescent girls (Subagyo et al., 2023). In a population of women aged 19–49 years in Indonesia, the combination of low BMI and low MUAC increased the odds of anemia by nearly threefold (aOR=2.83; 95% CI: 2.19–3.68) (Nainggolan et al., 2022). Findings in India showed that every 1 cm increase in MUAC was associated with a 0.11 g/dL increase in Hb levels, confirming a linear

relationship between somatic growth (including MUAC) and hemoglobin levels (Ahankari & Fogarty, 2020).

Practically, the results of this study confirm that MUAC can be used as a simple screening tool to identify adolescent girls at high risk of anemia in schools and health facilities. Recommended interventions include nutrition education, increased intake of a balanced, nutritious diet, and iron supplementation in groups with MUAC <23.5 cm, as recommended by various studies highlighting the role of nutritional status in adolescent anemia (Putri et al., 2025), (Yunita et al., 2024), (Subagyo et al., 2023), (Nainggolan et al., 2022), (Sari et al., 2022), (Fauziah et al., 2024).

The Effect of Iron Tablet Compliance on the Risk of Anemia. Logistic regression results show a strong positive effect between iron tablet compliance and the risk of anemia in adolescent girls. The OR value = 3.91 (95% CI: 1.06–14.35; p = 0.0039) means that adolescent girls who are non-compliant with iron tablet consumption have a risk of anemia approximately 3.9 times greater than those who are compliant. The confidence interval does not cross 1 and the p value <0.05 indicate that the effect is statistically significant.

Biologically, adherence to iron tablet consumption plays a crucial role in maintaining adequate iron reserves and hemoglobin synthesis. Non-compliance can result in insufficient iron supply to meet increased needs due to growth and menstrual blood loss, increasing the risk of iron deficiency anemia. Various studies support these findings. A study in Jambi reported that adolescent girls who did not regularly take iron tablets had the highest proportion of anemia (92.3%) and there was a significant relationship between adherence to iron tablet consumption and the incidence of anemia (p=0.000). 3 Another study on female students in Bondowoso also found a significant relationship between adherence to iron tablet consumption and hemoglobin/anemia levels (Feriyanti et al., 2022). A study in Yogyakarta showed that non-adherence to iron tablet consumption was closely associated with high rates of anemia in adolescent girls (p=0.000) (Ruqoiyah, 2020).

A cohort study at Praya Tengah 1 State Senior High School showed that adolescent girls who did not consume iron tablets had a 6.35-fold greater risk of anemia than those who did (RR=6.35; p<0.001) (Muqarrobin et al., 2025). Several other studies in Indonesia also found a consistent relationship between adherence to iron supplementation (TTD) and the incidence of anemia in adolescent girls in various regions (Suffara, 2025). Systematic reviews confirm that adherence to iron supplementation is a key factor in the success of adolescent anemia prevention programs (Tabita et al., 2023) (Feriyanti et al., 2022). Thus, the OR=3.91 result in this study is in line with previous evidence that non-compliance with Fe tablet consumption is an important risk factor for anemia in adolescent girls, and strengthens the recommendation to improve compliance through education, school and family support, and regular monitoring of the iron tablet (TTD) program.

The Effect of BMI on the Risk of Anemia. The results showed a strong positive relationship between nutritional status and the incidence of anemia in adolescent girls, with an OR of 4.64 (95% CI: 1.23–17.50; p=0.023). This means that adolescent girls with poor nutrition have a risk of anemia approximately 4.6 times greater than those with good nutrition, and this relationship is statistically significant. These findings align with various studies showing that poor nutritional status is a significant risk factor for anemia in adolescents. Research in Tarakan reported that nutritional status was significantly associated with the incidence of anemia in adolescent girls; being severely underweight, underweight, or obese increased the risk of anemia, although

adolescents with a normal BMI could still experience anemia (Noviyanti et al., 2024). Another study in Yogyakarta also found a significant association between nutritional status and anemia in adolescent girls (p=0.001) (Athala & Khofiyah, 2025). Research in Hangtuah Tarakan even concluded that poor nutritional status increased the risk of anemia by approximately fourfold, a magnitude consistent with the OR of 4.64 in this study.

Biologically, malnutrition (either undernutrition or excess) can lead to micronutrient deficiencies (especially iron, folate, and vitamin B12), which play a direct role in hemoglobin formation. A meta-analysis in Ethiopia showed that low BMI and inadequate dietary intake were associated with an increased risk of anemia in adolescent girls (Berhe et al., 2022). A longitudinal study in Malaysia also showed that adolescents who did not meet the daily iron intake requirement had a significantly higher risk of anemia and iron deficiency anemia (Krishnan et al., 2021). In Indonesia, a study in Pekanbaru showed that low mid-upper arm circumference and certain nutritional status were associated with an almost doubled risk of anemia (Putri et al., 2025).

In addition to nutritional status, diet quality and dietary diversity also mediate this relationship. Research on adolescent girls in West Java showed that low diet quality (low DQI-A) was associated with lower hemoglobin levels and a higher prevalence of anemia (Id et al., 2020). A recent meta-analysis also confirmed that low dietary diversity increases the odds of anemia in children and adolescents (OR=1.7) (Li et al., 2025). Thus, the OR=4.64 result in this study is consistent with the evidence that adolescents with malnutrition have a much higher risk of anemia, and supports the importance of nutritional improvement interventions, increasing food quality and diversity, as well as nutrition education and iron supplementation in adolescent girls (Id et al., 2020) (Krishnan et al., 2021) (Li et al., 2025) (Berhe et al., 2022).

CONCLUSION

This study concludes that anemia among adolescent girls at Asy-Syifa Islamic Boarding School in Balikpapan is significantly influenced by nutritional and behavioral factors. Upper Arm Circumference (MUAC), compliance with iron (Fe) tablet consumption, and Body Mass Index (BMI) were found to have a statistically significant association with the incidence of anemia. Adolescent girls with MUAC <23.5 cm were 6.07 times more likely to experience anemia, those who were non-compliant with iron tablet consumption had a 3.91 times greater risk, and those with poor nutritional status (abnormal BMI) had a 4.64 times higher risk of anemia. Although knowledge level showed an inverse relationship with anemia risk, this association was not statistically significant. These findings indicate that anthropometric indicators and adherence to iron supplementation play a more decisive role in determining anemia risk than knowledge alone. Therefore, efforts to prevent anemia in adolescent girls should prioritize improving nutritional status, strengthening iron supplementation compliance programs, and implementing routine MUAC and BMI screening in schools. Integrated interventions involving nutrition education, dietary improvement, and regular monitoring of iron tablet consumption are essential to effectively reduce the prevalence of anemia among adolescent girls.

REFERENCES

Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health. J Res Med Sci 2014;19:164-74. Journal of Research in Medical Sciences, 19(February), 3–11.

Ahankari, A. S., & Fogarty, A. W. (2020). Weight , height , and midupper arm circumference are associated with haemoglobin levels in adolescent girls living in rural India : A cross - sectional study. April 2019, 1–5. https://doi.org/10.1111/mcn.12908

Amalia, L., Sulastri Afianti, Suparto, T. A., & Sumartini, S. (2024). Prevalensi Anemia dan Karakteristiknya pada Remaja Putri. Jurnal Keperawatan, 17(1), 203–210.

Athala, T. W., & Khofiyah, N. (2025). The Relationship Between Nutritional Status and Diet Patterns and Anemia in Adolescent Girls at MA Jamilurrahman Bantul Yogyakarta. 11(1), 9–17. https://doi.org/10.21070/midwiferia.v11i1.1712

Bahiyatun. (2010). Buku ajar bidan: Psikologi ibu dan anak. Jakarta: EGC

Berhe, K., Gebrearegay, F., Gebreegziabher, H., & Weldegerima, L. (2022). Magnitude and associated factors of anemia among adolescent girls in Ethiopia : a systematic review and meta analysis. Archives of Public Health, 1–15. https://doi.org/10.1186/s13690-022-00942-y

Farida, I. (2007). Determinan kejadian anemia pada remaja putri di Kecamatan Gebo

Fauziah, N., Raharja, K. T., Pramesthi, N., Putri, V., Pujiyani, H., Ferdina, C. S., Asyura, R., & Deya, M. (2024). The Relationship of Nutritional Status and Anemia Status in Adolescent Women in Sampang District. 11(March), 131–137.

Feriyanti, A., Nurmala, I., Widati, S., & Atmaka, D. R. (2022). DETERMINAN KEPATUHAN SUPLEMENTASI ZAT BESI PADA REMAJA PUTRI DALAM UPAYA INTERVENSI SPESIFIK PENCEGAHAN STUNTING : A SYSTEMATIC REVIEW. 1, 90–96.

Gutema, B. T., Sorrie, M. B., Megersa, N. D., Yesera, G. E., Yeshitila, Y. G., Pauwels, N. S., De Henauw, S., & Abbeddou, S. (2023). Effects of iron supplementation on cognitive development in school-age children: Systematic review and meta-analysis. PLoS ONE, 18(6 June). https://doi.org/10.1371/journal.pone.0287703

Harahap, N. R. (2018). Faktor- Faktor Yang Berhubungan Dengan Kejadian Anemia Pada Remaja Putri. Nursing Arts, 12(2), 78–90. https://doi.org/10.36741/jna.v12i2.78

kabupaten Kudus 2006. Tesis. Program Pascasarjana Universitas Diponegoro Semarang

Kassebaum, N. J., Jasrasaria, R., Naghavi, M., Wulf, S. K., Johns, N., Lozano, R., Regan, M., Weatherall, D., Chou, D. P., Eisele, T. P., Flaxman, S. R., Pullan, R. L., Brooker, S. J., & Murray, C. J. L. (2015). Plenary Paper RED CELLS, IRON, AND ERYTHROPOIESIS A systematic analysis of global anemia burden from 1990 to 2010. Blood Journal, 123(5), 615–625. https://doi.org/10.1182/blood-2013-06-508325.The

Krishnan, V., Zaki, R. A., Nahar, A. M., Jalaludin, M. Y., & Majid, H. A. (2021). The Lancet Regional Health - Western Pacific The longitudinal relationship between nutritional status and anaemia among Malaysian adolescents. The Lancet Regional Health - Western Pacific, 15, 100228. https://doi.org/10.1016/j.lanwpc.2021.100228

Kusmiran, E. (2012). Kesehatan reproduksi remaja dan wanita. Jakarta: Salemba Medika

Li, H., Moosavian, S. P., Ghanbari, N., Mirlohi, S. H., & Rahimlou, M. (2025). Association of dietary diversity and odds of anemia in children and adolescents : a systematic review and meta analysis of observational studies. BMC Nutrition. https://doi.org/10.1186/s40795-025-01069-3

Murti, B. (2010). Desain dan Analisis Penelitian Epidemiologi. Yogyakarta: Gadjah Mada University Press.

Nainggolan, O., Hapsari, D., Rialine, C., Id, T., & Indrawati, L. (2022). The relationship of body mass index and mid- upper arm circumference with anemia in non- pregnant women aged 19 – 49 years in Indonesia : Analysis of 2018 Basic Health Research data. 1–13. https://doi.org/10.1371/journal.pone.0264685

Notoadmojo, S. (2007). Ilmu Kesehatan Masyarakat. Jakarta: Renika Cipta

Noviyanti et.al. (2024). Remaja, P., Di, P., Hangtuah, S. M. A., & Tarakan, K. Journal of Issues in. 11–18. https://doi.org/10.21776/ub.JOIM.2024.008.01.2

Paath, EF. (2004). Gizi dalam kesehatan reproduksi. Jakarta : EGC

Pieter, HZ. (2011). Pengantar psikologi untuk kebidanan. Jakarta: Kencana Prenata Media Grup

Proverawati, A. (2011). Anemia dan anemia kehamilan. Yogyakarta: Nuha Medika

Putri, F., Suyanto, S., & Restila, R. (2025). Exploring the role of nutritional status and anthropometric factors in anemia among adolescent girls in Pekanbaru , Indonesia. 1. https://doi.org/10.1177/20503121251355406

Sari, P., Marhaeni, D., Herawati, D., Dhamayanti, M., & Hilmanto, D. (2022). Anemia among Adolescent Girls in West Java , Indonesia : Related Factors and Consequences on the Quality of Life. 1–13.

Subagyo, I., Kusumawati, D. E., Radhiah, S., & Eka, Y. (2023). Prevalence and Risk Factors of Anemia in Adolescent Girls in Donggala District , Central Sulawesi of Sanitation , Poltekkes Kemenkes Palu , Palu , Central Sulawesi , Indonesia of Midwifery , Poltekkes Kemenkes Palu , Palu , Central Sulawesi , Indonesia 3 Department of Nutrition , Poltekkes Kemenkes Palu , Palu , Central Sulawesi , Indonesia 4 Faculty of Public Health , Tadulako University , Palu , Central Sulawesi , Indonesia (Correspondence author ' s e-mail , hafid.fahmi79@gmail.com). 17(3), 1107–1116.

Sudfeld, C. R., Rai, R. K., Barik, A., Valadez, J. J., & Fawzi, W. W. (2020). Population-level effective coverage of adolescent weekly iron and folic acid supplementation is low in rural West Bengal, India. Public Health Nutrition, 23(15), 2819–2823. https://doi.org/10.1017/S1368980020000932

Suffara, I, et.al. (2025). Hubungan Pengetahuan Dan Kepatuhan Konsumsi Tablet Tambah Correlation Between of Knowledge And Compliance Consumption Of Blood Supplementing Tablets with the Consequences of Anemia. Universitas Aisyah Pringsewu. 20(1), 1–5.

Tabita, H., Silitonga, H., Salim, L. A., Nurmala, I., & Wartiningsih, M. (2023). Compliance of Iron Supplementation and Determinants among Adolescent Girls : A Systematic Review. 52(1), 37–48.

Ummah, K. (2019). Nutritional status and anemia prevalence among adolescent girls in Indonesia. International Journal of Community Medicine and Public Health, 6(5), 2154–2160.

Warner, M. A., & Weyand, A. C. (2022). The Global Burden of Anemia. Blood Substitutes and Oxygen Biotherapeutics, 53–59. https://doi.org/10.1007/978-3-030-95975-3_5

Warner, M. J., & Weyand, C. M. (2022). Iron deficiency anemia and its implications for adolescent health. Current Opinion in Pediatrics, 34(2), 170–177.

Yunita, S., Estiningtyas, Q., Adnani, S., Zuhairini, Y., & Dhamayanti, M. (2024). Anthropometry Indices and Body Composition in Adolescent Girls with Anemia : A Scoping Review. August.

THE RELATIONSHIP BETWEEN SOCIAL PROTECTION AND STUNTING INCIDENCE IN TODDLERS

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ABSTRACT
A child is classified as stunted if the length or height according to age is lower than the applicable national standard. The study showed that heredity only slightly (4-7% in women) affects a person's height at birth. In contrast, the influence of environmental factors at birth was very large (74-87% in women). This proves that supportive ecological conditions can help children's growth and development. The research design in this study is analytic with a cross-sectional approach. Data analysis used univariate and multivariate analysis. The results of the analysis of the relationship between social protection ownership showed that as many as 159 (71.0%) toddlers who did not have social protection were stunted. Meanwhile, among toddlers with social protection, 94 (55.0%) experience stunting. The results of the analysis obtained OR = 2.004 meaning that toddlers who do not have social protection have a 2.004 chance times to experience stunting compared to toddlers who have social protection. There is a significant relationship between social protection and the incidence of stunting in children aged 0-59 months in Pringsewu Regency in 2021 (p-value = 0.001, OR = 2.004).

Keywords: social protection; stunting; toddlers

INTRODUCTION
Stunting is a condition of failure to thrive in children under five due to chronic malnutrition, especially in the First 1,000 Based on 2019 Ministry of Health data in Indonesia there were 27.7% stunted toddlers, Lampung Province 27.28% (2018), of the target of 14% (2024).1,2,3,4 The level of one's nutritional knowledge influences attitudes and behavior in food selection.5,6,7,8 The study showed that heredity only slightly (4-7% in women) affects a person's height at birth. In contrast, the influence of environmental factors at birth was very large (74-87% in women).9,10,11 Health services are very sensitive to changes in the economic situation. Disturbances in the economic situation will disrupt the accessibility of communities and families to health services, for example, immunization services, and care related to child growth, morbidity, and mortality.12,13,14,15 According to Adiyanti's research results, it shows that children who come from families with unprotected water sources with inappropriate types of latrines have a risk of suffering from stunting 1.3 times higher than children who come from families with water sources. protected and an appropriate type of latrine.

METHOD
The research design in this study is analytic with a cross-sectional approach. The multivariate test used is logistic regression which is a mathematical model approach used to analyze the relationship of one or several independent variables with dependent categories that are dichotomous/binary. The number of samples in the study was 359 respondents and added 10% to overcome samples with incomplete data. So that the total number of samples analyzed in this study amounted to 395 respondents. This research was conducted in Pringsewu District, Lampung, Indonesia.

RESULT AND DISCUSSION

Tabel 1.

Independent Variabel	Stunting Incident				Total		p-*value*	OR (95% CI)
	Stunting		Normal					
	f	%	f	%	f	%		
Social Protection								
There is'nt any	159	71,0%	65	29,0%	224	100%	0,001	2,004
There is	94	55,0%	77	35,9%	171	100%		(1,32- 3,04)

Relationship of Social Protection with Stunting Incidence in Toddlers 0-59 months
Used to analyze the relationship of one or several independent variables with dependent categories that are dichotomous/binary. The number of samples in the study was 359 respondents and added 10% to overcome samples with incomplete data. So that the total number of samples analyzed in this study amounted to 395 respondents. This research was conducted in Pringsewu District, Lampung, Indonesia. The research was carried out in June 2021. The results of the analysis obtained OR = 2.004 meaning that toddlers who do not have social protection have a 2.004 chance times to experience stunting compared to toddlers who have social protection. The results of the analysis show that there are still 224 (56.7%) children under five who do not have social protection. Meanwhile, there are 171 toddlers, or around 43.3% who already have social protection.

According to the researchers, the results of this study are in accordance with the conditions in Pringsewu District only has access to health insurance participants of 58.72%, so access to health insurance participants still needs to be increased to 100% in order to reduce the incidence of stunting. Efforts to reduce stunting are carried out through two interventions, namely specific nutrition interventions to address direct causes and nutrition-sensitive interventions to address indirect causes. Sensitive nutrition interventions include increasing access to and quality of nutrition and health services including social security. Nutrition-sensitive interventions are generally implemented outside the Ministry of Health.

CONCLUSION

The distribution of the frequency of toddlers experiencing stunting was 253 toddlers (64.1%). There is a significant relationship between social protection and the incidence of stunting in children aged 0-59 months in Pringsewu Regency in 2021 (p-value = 0.001, OR = 2.004).

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REFERENCES

Altare, C. et al. (2016) 'Factors associated with stunting among pre-school children in southern highlands of Tanzania', Journal of Tropical Pediatrics, 62(5), pp. 390–408. doi: 10.1093/tropej/fmw024.

Badriyah, L. and Syafiq, A. (2017) 'The Association Between Sanitation, Hygiene, and Stunting in Children Under Two-Years (An Analysis of Indonesia's Basic Health Research, 2013)', Makara Journal of Health Research, 21(2), pp. 35–41. doi: 10.7454/msk.v21i2.6002.

Bhutta, Z. A. et al. (2013) 'Evidence-based interventions for improvement of maternal and child nutrition: What can be done and at what cost?', The Lancet, 382(9890), pp. 452–477. doi: 10.1016/S0140-6736(13)60996-4.

Entjang Indah (2000) Ilmu Kesehatan Masyarakat, Cetakan Ketiga Belas

Hardinsyah dan Supariasa. (2016). Ilmu Gizi Teori dan Aplikasi. Jakarta: EGC

Harikatang, M. R. et al. (2020) 'Hubungan pengetahuan dan sikap ibu dengan kejadian balita stunting di satu kelurahan di tangerang', Jurnal Mutiara Ners, 3(2), pp. 76–88. Available at: http://114.7.97.221/index.php/NERS/article/view/1178.

Hastono, S., & Sabri, L. (2010). Statistik Kasehatan. Jakarta: PT. Raja Grafindo Persada.

Kemenkes. (2018). Bulletin Jendela Data Dan Informasi Kesehatan. Situasi Balita Pendek (Stunting) di Indonesia

Kementrian PPN/BAPPENAS. (2018). Peraturan Menteri PPN/KEPALA BAPPENAS Nomor 1 Tahun 2018 Tentang Pedoman Rencana Aksi Nasional Pangan Dan Gizi Yang Menetapkan Ran-Pg, Pedoman Penyusunan Rad-Pg, Dan Pedoman Pemantauan Dan Evaluasi Ran/Rad-Pg. Jakarta.

Kementerian Desa, Pembangunan Daerah Tertinggal, Dan Transmigrasi, Panduan Fasilitasi Konvergensi Pencegahan Stunting Di Desa, Kementerian Desa, Pembangunan Daerah Tertinggal, Dan Transmigrasi, Jakarta, Desember 2018

Kementerian Perencanaan Pembangunan Nasional/Bappenas ,Pedoman Pelaksanaan Intervensi Penurunan Stunting Terintegrasi Dikabupaten/Kota, Jakarta, September 2018

Kementerian Perencanaan Pembanguan Nasional/Kepala Badan Perencanaan Pembangunan Nasional ,Keputusan Menteri Perencanaan Pembanguan Nasional/Kepala Badan Perencanaan Pembangunan Nasional Nomor Kep 42/M.Ppn/Hk/04/2020 Tentang Penetapan Perluasan Kabupaten/Kota Lokasi Fokus Intervensi Penurunan Stunting Terintegrasi Tahun 2021, Jakarta,2020

Kusumawati, E. et al. (2013) 'Model Pengendalian Faktor Risiko Stunting pada Anak Usia di Bawah Tiga Tahun Model of Stunting Risk Factor Control among Children under Three Years', pp. 249–256.

Kwami, C. S. et al. (2019) 'Water, sanitation, and hygiene: Linkages with stunting in rural Ethiopia', International Journal of Environmental Research and Public Health, 16(20). doi: 10.3390/ijerph16203793.

Larasati, N. N. (2018) 'Faktor-Faktor yang Berhubungan dengan Kejadian Stunting Pada Balita Usia 25-59 bulan di Posyandu Wilayah Puskesmas Wonosari II Tahun 2017', Skripsi, pp. 1–104.

Notoatmodjo, S. (2012). Metodologi Penelitian Kesehatan. Jakarta: Rineka Cipta.

Nursalam., (2014). Konsep dan Penerapan Metode Penelitian Keperawatan. Jakarta Salemba Medika

Peraturan Presiden Nomor 72 Tahun 2021 Tentang Gerakan Nasional Percepatan Perbaikan Gizi

Peraturan Presiden Nomor 59 Tahun 2017 Tentang Pelaksanaan Pencapaian Tujuan Pembangunan Berkelanjutan (Tpb)

Peraturan Presiden Nomor 83 Tahun 2017 Tentang Kebijakan Strategis Pangan Dan Gizi

Nasrul, N. (2019) 'Pengendalian Faktor Risiko Stunting Anak Baduta Di Sulawesi Tengah', PROMOTIF: Jurnal Kesehatan Masyarakat, 8(2), pp. 131–146. doi: 10.31934/promotif.v8i2.495.

Rahayu, B. and Darmawan, S. (2019) 'Hubungan Karakteristik Balita, Orang Tua, Higiene Dan Sanitasi Lingkungan Terhadap Stunting Pada Balita', Binawan Student Journal, 1(1), pp. 22–27. Available at: http://journal.binawan.ac.id/bsj/article/view/46.

Rosha, B. C. et al. (2016) 'Peran Intervensi Gizi Spesifik dan Sensitif dalam Perbaikan Masalah Gizi Balita di Kota Bogor', Buletin Penelitian Kesehatan, 44(2), pp. 127–138. doi: 10.22435/bpk.v44i2.5456.127-138.

Setiawan, E., Machmud, R. and Masrul, M. (2018) 'Faktor-Faktor yang Berhubungan dengan Kejadian Stunting pada Anak Usia 24-59 Bulan di Wilayah Kerja Puskesmas Andalas Kecamatan Padang Timur Kota Padang Tahun 2018', Jurnal Kesehatan Andalas, 7(2), p. 275. doi: 10.25077/jka.v7.i2.p275-284.2018. Sugiyono. 2016. Metode Penelitian Kuantitatif dan Kualitatif R&D. Bandung: Alfabeta

Strategi Nasional Percepatan Pencegahan Stunting Periode 2018-2024 (Stranas Stunting) Dengan Tujuan Mempercepat Pencegahan Stunting

DETECTING A SCHOOL-BASED FOODBORNE OUTBREAK IN WONOGIRI 2025

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ABSTRACT
School feeding programmes play a critical role in improving student nutrition. However, inadequate food safety practices may increase the risk of foodborne outbreaks. On 12 September 2025, a suspected foodborne outbreak was reported among students of a senior high school in Wonogiri District, Central Java, Indonesia, following consumption of meals provided through the Free Nutritious Meal Programme (MBG). To investigate the magnitude, epidemiological characteristics, and source of a school-based foodborne outbreak. A cross-sectional outbreak investigation was conducted among all students who consumed the implicated meals on 11 September 2025. A case was defined as any exposed student who developed at least one symptom, including diarrhoea, abdominal pain, nausea, vomiting, dizziness, or fever. Data were collected through structured interviews, environmental assessment of food preparation and storage practices, and laboratory testing of food and water samples. Descriptive analysis by person, place, and time was performed, and food-specific attack rates were calculated. Of 516 exposed students, 340 developed symptoms, resulting in an overall attack rate of 66%. The most frequently reported symptoms were abdominal pain (26.1%), diarrhoea (25.0%), nausea (16.7%), and vomiting (14.9%). Consumption of eggs prepared with barbeque sauce showed the highest attack rate (71%) compared with non-consumers (28%). The epidemic curve demonstrated a point-source outbreak, with symptom onset occurring 20 - 35 hours after exposure. Laboratory analysis detected Escherichia coli contamination in egg, sauce, and vegetable samples, with possible co-contamination by Salmonella spp. Environmental assessment identified improper food handling, inadequate temperature control, and prolonged food storage prior to distribution. This outbreak was most likely associated with contamination of egg-based dishes served in a school feeding setting. Strengthening food safety protocols, hygiene training for food handlers, and routine monitoring of school meal provision are essential to prevent future foodborne outbreaks.

Keywords: e.coli; FETP investigation; foodborne outbreak; food safety; school feeding program

INTRODUCTION
An outbreak (KLB) is defined as a condition marked by a significant increase in morbidity and/or mortality that is epidemiologically meaningful within a specific area and time period, thereby requiring an immediate response (Kemenkes RI, 2013). One type of outbreak that continues to occur frequently is food poisoning, particularly in institutional settings such as schools, Islamic boarding schools, dormitories, and events involving mass food consumption (Kemenkes RI, 2017). Food poisoning is generally caused by the consumption of food or beverages contaminated with biological, chemical, or physical agents. Such exposure may result in acute symptoms within a relatively short time after ingestion of the contaminated food (WHO, 2015).

Globally, foodborne diseases remain a significant public health problem (WHO, 2015). The World Health Organization estimates that approximately 600 million people worldwide experience foodborne illnesses each year, resulting in more than 400,000 deaths. The greatest burden occurs in low- and middle-income countries, where food safety surveillance systems are often limited

(Kirk, 2015). This condition highlights that foodborne diseases continue to pose a major challenge to global public health protection efforts (WHO, 2015).

Children and adolescents are particularly vulnerable to the impacts of foodborne diseases due to their immune systems not being fully developed. In addition, school-aged populations have a high dependence on food prepared by others, especially within institutional environments. Exposure to unsafe food in this group can directly affect health and learning activities. Therefore, food poisoning incidents in schools have the potential to cause widespread health and social consequences (Newell et al., 2010).

Food provision in educational institutions through school meal programs has been widely implemented as an effort to improve students' nutritional status, attendance, and academic performance (Kemenkes RI, 2017). Despite providing substantial benefits, large-scale meal programs may also increase the risk of food poisoning if food safety principles are not consistently applied (Kemenkes RI, 2017). Various studies indicate that food poisoning incidents in institutional settings are often associated with inadequate food handler hygiene practices and poor temperature control (Greig et al., 2007; Lee & Greig, 2013). Prolonged storage of cooked food has also been reported to contribute to food poisoning outbreaks (Greig et al., 2007).

Biological agents, particularly pathogenic bacteria, have been reported as the primary causes of food poisoning outbreaks (Apriliansyah et al., 2022). Escherichia coli and Salmonella spp. are among the most frequently identified etiological agents involved in such outbreaks (Apriliansyah et al., 2022; Lamichhane et al., 2024; Singha et al., 2023). Infection with pathogenic Escherichia coli may cause gastrointestinal symptoms such as diarrhea, abdominal pain, nausea, and vomiting (Singha et al., 2023). Meanwhile, Salmonella spp. infections are often associated with poor food handler hygiene practices and inadequate food handling procedures (Ehuwa et al., 2021). Both bacteria are commonly linked to insufficient sanitation and hygiene practices during food processing and storage. Eggs and egg-based products have been reported as frequent vehicles of transmission due to their susceptibility to contamination (Ehuwa et al., 2021; Singha et al., 2023). Foods containing animal-based protein carry a high risk of bacterial contamination if not properly processed and stored (Ehuwa et al., 2021). These conditions make animal protein based foods an important risk factor in mass food poisoning incidents (Apriliansyah et al., 2022; Lamichhane et al., 2024; Singha et al., 2023).

In Indonesia, food poisoning outbreaks continue to be reported routinely each year and frequently occur in institutional settings such as schools, dormitories, and community events involving mass food consumption. Surveillance reports indicate that factors such as low compliance with sanitation and hygiene principles, limited training of food handlers, and weak food safety oversight remain major challenges (Kemenkes RI, 2023). Therefore, rapid and systematic field epidemiological investigations are essential to confirm the occurrence of an outbreak, identify sources of exposure, and formulate appropriate control measures to prevent further spread.

On 12 September 2025, the Wonogiri District Health Office received a report of a suspected food poisoning outbreak among students at one senior high school (SMA X) in Wonogiri Regency, Central Java, following the consumption of food provided at the school. A total of 516 students were known to have consumed the same food on 11 September 2025, and some of them developed symptoms such as abdominal pain, diarrhea, nausea, vomiting, dizziness, and fever within a certain

time period after consumption. The relatively large number of cases and their association with a single common food source raised suspicion of a food poisoning incident originating from a common source (point source outbreak).

Based on these conditions, a field epidemiological investigation was conducted to confirm the occurrence of an outbreak, describe case characteristics by person, place, and time, and identify the food items and risk factors most likely associated with the food poisoning incident among students at SMA X in Wonogiri Regency. The findings of this investigation are expected to contribute to the scientific evidence base and to serve as a foundation for formulating recommendations for the prevention and control of similar incidents in the implementation of school meal programs.

METHOD

This investigation was an outbreak investigation (Kejadian Luar Biasa, KLB) using a cross-sectional study design, conducted to assess the association between food exposure and illness among the exposed population within the same time period. The investigation was carried out in September 2025 at SMA X in Wonogiri Regency, Central Java Province, following a report of a suspected food poisoning outbreak received by the Wonogiri District Health Office. The study population included all students of SMA X who consumed food from the Free Nutritious Meal Program on 11 September 2025, totaling 516 students. All exposed individuals were included in the investigation using a total sampling approach. A case was defined as any student who consumed the food and developed at least one symptom, including diarrhea, abdominal pain, nausea, vomiting, dizziness, or fever after consumption.

Data were collected through structured interviews using a questionnaire to obtain information on respondents characteristics, food consumption history, and clinical symptoms. Environmental investigations were conducted through direct observation of food preparation, processing, storage, and distribution practices, along with laboratory testing of food and water samples suspected as sources of exposure by the Wonogiri District Health Office Laboratory. Data were analyzed descriptively to describe the distribution of cases by person, place, and time. Attack rates were calculated to compare the occurrence of illness between groups who consumed and did not consume specific food items in order to identify foods most likely associated with the food poisoning outbreak.

RESULT AND DISCUSSION

A total of 516 students who consumed the implicated meals were included in the investigation. The characteristics of the exposed population are presented in Table 1. Most students were aged 16 years (32.9%), and the majority of the exposed population was female (72.35%). Grade 10 students accounted for the largest proportion of the exposed population (37%).

Table 1.
Respondent characteristics (n= 516)

Respondent characteristics	f	%
Age (years)		
14	8	1.6
15	141	27.3
16	170	32.9
17	164	31.8
18	33	6.4
Gender		
Male	154	27.65
Female	362	72.35
Grade		
Grade 10	193	37.0
Grade 11	157	30.0
Grade 12	166	32.0

Among the exposed students, 340 reported at least one gastrointestinal or systemic symptom following meal consumption. The distribution of reported symptoms is shown in Table 2. Abdominal pain (26.1%) and diarrhoea (25.0%) were the most frequently reported symptoms, followed by nausea (16.7%), vomiting (14.9%), dizziness (13.8%), and fever (3.5%). Multiple symptoms were commonly reported by individual cases. Because individual cases frequently reported more than one symptom, the total number of reported symptoms exceeded the total number of cases.

Table 2.
Distribution of reported symptoms among affected students during the outbreak

Symptom	f	%
Abdominal pain	306	26.1
Diarrhoea	293	25.0
Nausea	196	16.7
Vomiting	175	14.9
Dizziness	162	13.8
Fever	41	3.5

Attack rates by age group and grade are summarised in Table 3. The highest attack rate was observed among students aged 16 years (71.2%), followed by those aged 18 years (69.7%) and 17 years (67.1%). Across grades, Grade 11 students experienced the highest attack rate (71.3%), followed by Grade 12 (67.5%) and Grade 10 (60.1%), indicating a relatively high and comparable risk of illness across all grade levels.

Table 3.
Attack rates by age group and grade among exposed students

	Population at risk	Cases	Attack rate (%)
Age (years)			
14 years	8	3	37.5
15 years	141	83	58.9
16 years	170	121	71.2
17 years	164	110	67.1
18 years	33	23	69.7
Grade			
Grade 10	193	116	60.1
Grade 11	157	112	71.3
Grade 12	166	112	67.5

Food-specific attack rates are presented in Table 4. Consumption of eggs prepared with barbeque

sauce was associated with the highest attack rate (71%) compared with non-consumers (28%). Other food items, including rice, capcay, tempe orek, and longan fruit, also showed higher attack rates among consumers than non-consumers, although the differences were less pronounced.

Table 4.
Food-specific attack rates among students consuming meals on 11 September 2025

Food	Ill	Well	Total	AR
Rice				
Eat	307	130	437	70%
Not Eat	33	43	76	43%
Egg with barbeque sauce				
Eat	324	131	455	71%
Not Eat	16	42	58	28%
Tempe Orek				
Eat	246	116	362	68%
Not Eat	94	57	151	62%
Capcay				
Eat	184	72	256	72%
Not Eat	156	101	257	61%
Longan Fruit				
Eat	256	125	381	67%
Not Eat	84	48	132	64%

The epidemic curve showed a unimodal distribution, with a sharp increase in cases beginning on the evening of 11 September 2025 and peaking in the early hours of 12 September 2025, suggesting a common point source exposure.

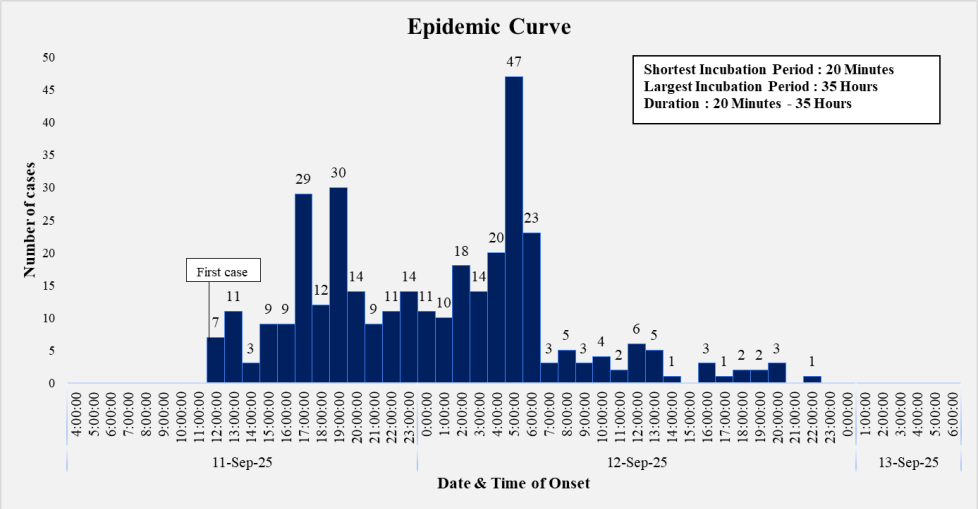

Figure 1. Epidemic curve of foodborne outbreak among students, SMA X Wonogiri, September 2025

Figure 1. Epidemic curve showing the distribution of symptom onset among students following consumption of school meals at SMA X, Wonogiri, on 11 September 2025. The curve demonstrates a unimodal pattern consistent with a point source foodborne outbreak, with most cases occurring within 6–24 hours after exposure. Laboratory examination results of food samples are shown in Table 5. *Escherichia coli* contamination was detected in egg, sauce, and vegetable samples, while *Salmonella spp*. was identified in egg and sauce samples. Rice, tempe orek, and longan fruit

samples tested negative for both pathogens.

Table 5.
Laboratory examination results of food samples collected during the outbreak investigation

Food sample	Laboratory examination results	
	E. coli	*Salmonella spp.*
Rice	Negative	Negative
Egg	Positive	Positive
Sauce	Positive	Positive
Tempe	Negative	Negative
Vegetables	Positive	Negative
Longan Fruit	Negative	Negative

The results of the epidemiological investigation confirmed that the illness among students of SMA X in Wonogiri Regency met the criteria for a food poisoning outbreak, as indicated by the occurrence of two or more cases with similar symptoms following the consumption of food from a common source. The epidemic curve demonstrated a unimodal pattern with a sharp rise and decline in cases within a short time period, suggesting exposure from a single common source (point source outbreak). This pattern is consistent with the characteristics of food poisoning outbreaks that frequently occur in institutional settings such as schools, where food is consumed simultaneously by a large number of individuals (Brendan R. Jackson, 2013; Daniswara, 2025; Faife et al., 2024; Iskandar, 2022).

The overall attack rate in this outbreak reached 66%, which is considered high compared to several reported food poisoning outbreaks in school and large-scale catering settings. A high attack rate reflects widespread exposure and suggests a high level of contamination in the consumed food (Daniswara, 2025). Analysis of food-specific attack rates indicated that consumption of eggs with barbecue sauce had the highest attack rate among all menu items, strengthening the suspicion that this dish was the primary source of exposure. Eggs and egg-based products are well recognized as high-risk foods due to their susceptibility to contamination by pathogenic bacteria, particularly Salmonella spp., when food processing, cooking, and storage practices do not comply with food safety standards (Lamichhane et al., 2024; Solís et al., 2023).

These epidemiological findings were further supported by laboratory results that detected the presence of Escherichia coli in egg, sauce, and vegetable samples, as well as Salmonella spp. in egg and sauce samples. Both bacteria are among the most frequently reported etiological agents in food poisoning outbreaks, particularly those associated with foods of animal origin and ready-to-eat foods (Faife et al., 2024; Singha et al., 2023). Infection with pathogenic E. coli commonly causes gastrointestinal symptoms such as diarrhea, abdominal pain, nausea, and vomiting, which were consistent with the predominant clinical manifestations observed in this outbreak (Croxen et al., 2013).

Most cases in this outbreak developed symptoms within 6–24 hours after food consumption, which is consistent with the incubation period of Salmonella spp. infection as well as certain strains of E. coli. This finding aligns with previous reports of food poisoning outbreaks involving egg-based foods and inadequate food handling practices, particularly in large-scale food service settings (Lamichhane et al., 2024). The detection of more than one pathogenic agent in the food samples suggests the possibility of co-contamination, which may have contributed to the high number of cases and the variability of clinical symptoms reported.

Environmental investigations identified several weaknesses in the implementation of food hygiene and sanitation practices, including unhygienic food handling, inadequate temperature control during storage, and prolonged storage of cooked food prior to distribution. Such conditions are known to accelerate the growth of pathogenic bacteria, especially in high-risk foods produced in large quantities for mass catering (Al-Kandari et al., 2019; Chen et al., 2024). In addition, inadequate food handler hygiene practices, including poor hand hygiene and improper use of personal protective equipment, have been widely reported as key contributing factors to food poisoning outbreaks in institutional settings (Adane et al., 2025; Chen et al., 2024; Pertiwi et al., 2025). Other studies have also emphasized that catering operators' behavior and the quality of food handling practices are strongly associated with the occurrence of food poisoning outbreaks (Saragih et al., 2025).

School meal programs provide substantial benefits in improving students' nutritional status and academic performance. However, the implementation of large-scale meal programs also poses potential food safety risks if not accompanied by strict hygiene and sanitation standards. Recent studies have highlighted that major challenges in school meal programs include limited training of food handlers, suboptimal food safety supervision, and low compliance with temperature and storage time control procedures (Bundy et al., 2018; Suryoadji et al., 2024). Therefore, strengthening food safety systems within school meal programs including regular training for food handlers, strict temperature control, and routine supervision is essential to prevent the recurrence of similar outbreaks in the future.

This investigation has several limitations. Laboratory testing did not include all food items consumed, therefore the possibility of other sources of exposure cannot be entirely excluded. In addition, laboratory analyses did not include quantitative bacterial counts or specific strain identification, limiting the ability to determine contamination levels and the relative contribution of each pathogen to the severity of symptoms. Nevertheless, the combination of epidemiological findings, laboratory results, and environmental investigation provides sufficiently strong evidence to identify the primary source of exposure and the key risk factors contributing to this outbreak.

CONCLUSION

This outbreak was most likely associated with contamination of egg-based dishes served in a school feeding setting, supported by epidemiological findings, food-specific attack rates, and laboratory detection of Escherichia coli with possible Salmonella spp. contamination.

REFERENCES

Adane, B., Assaye, B. T., & Teym, A. (2025). Food safety practice and associated factors among food handlers working in food and drinking establishments in Finote Selam , in resource-limited settings. https://doi.org/https://dx.doi.org/10.3389/fsufs.2025.1536240

Al-Kandari, D., Al-abdeen, J., & Sidhu, J. (2019). Food safety knowledge, attitudes and practices of food handlers in restaurants in Kuwait. Food Control, 103. https://doi.org/10.1016/j.foodcont.2019.03.040

Apriliansyah, M., Zuhrotun, A., & Astrini, D. (2022). Bakteri Utama Penyebab Kejadian Luar Biasa Keracunan Pangan. Jurnal Farmasi Klinik Indonesia, 11(3), 239–255. https://doi.org/10.15416/ijcp.2022.11.3.239

Brendan R. Jackson, et al. (2013). Outbreak-associated salmonella enterica serotypes and food commodities. United States, 1998(8), 1239–1244. https://doi.org/http://dx.doi.org/10.3201/eid1908.121511

Bundy, D. A. P., Silva, N., Horton, S., Jamison, D. T., & Patton, G. C. (2018). Re-Imagining School Feeding: A High-Return Investment in Human Capital and Local Economies. Disease Control Priorities, Third Edition (Volume 8): Child and Adolescent Health and Development, 8, 307–324.

Chen, Y., Wan, G., Song, J., Dai, J., Shi, W., & Wang, L. (2024). Food Safety Practices of Food Handlers in China and their Correlation with Self-reported Foodborne Illness. Journal of Food Protection, 87(1), 100202. https://doi.org/10.1016/j.jfp.2023.100202

Croxen, M. A., Law, R. J., Scholz, R., Keeney, K. M., Wlodarska, M., & Finlay, B. B. (2013). Recent advances in understanding enteric pathogenic Escherichia coli. Clinical Microbiology Reviews, 26(4), 822–880. https://doi.org/10.1128/CMR.00022-13

Daniswara, S. F. M. M. S. A. M. D. S. M. R. (2025). Penyelidikan Epidemiologi Keracunan Pangan oleh Escherichia coli dan Salmonella sp. pada Nasi Padang di Acara Tahlilan. Jurnal Ilmu Kesehatan, 14(3), 230–236. https://doi.org/https://doi.org/10.33221/jikm.v14i03.3805

Ehuwa, O., Jaiswal, A. K., & Jaiswal, S. (2021). Salmonella, food safety and food handling practices. Foods, 10(5), 1–16. https://doi.org/10.3390/foods10050907

Faife, S., Macuamule, C., Gichure, J., Hald, T., & Buys, E. (2024). Diarrhoeagenic Escherichia coli and Salmonella spp. Contamination of Food and Water Consumed by Children with Diarrhoea in Maputo, Mozambique. International Journal of Environmental Research and Public Health, 21(9). https://doi.org/10.3390/ijerph21091122

Greig, J. D., Todd, E. C. D., Bartleson, C. A., & Michaels, B. S. (2007). Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 1. Description of the problem, methods, and agents involved. Journal of Food Protection, 70(7), 1752–1761. https://doi.org/10.4315/0362-028X-70.7.1752

Iskandar, S. I. et al. (2022). Foodborne Outbreak Investigation in Elementary School Students in Bantul, Yogyakarta, 2023. Media Kesehatan Masyarakat Indonesia, 21(2), 107–112. https://doi.org/https://doi.org/10.30597/mkmi.v20i3.34464

Kemenkes RI. (2013). Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2013 Tentang Kejadian Luar Biasa Keracunan Pangan. Menteri Kesehatan Republik Indonesia Peraturan Menteri Kesehatan Republik Indonesia, 2008(127), 1–16.

Kemenkes RI. (2017). Buku Pedoman Penyelidikan dan Penanggulangan Kejadian Luar Biasa Penyakit Menular dan Keracunan Pangan (Pedoman Epidemiologi Penyakit). Edisi Revi(2017), 1–251.

Kemenkes RI. (2023). Profil Kesehatan Indonesia 2022.

Kirk, M. D. (2015). World Health Organization Estimates of the Global and Regional Disease Burden of 22 Foodborne Bacterial, Protozoal, and Viral Diseases, 2010: A Data Synthesis.

Lamichhane, B., Mawad, A. M. M., Saleh, M., Kelley, W. G., Harrington, P. J., Lovestad, C. W., Amezcua, J., Sarhan, M. M., El Zowalaty, M. E., Ramadan, H., Morgan, M., & Helmy, Y. A. (2024). Salmonellosis: An Overview of Epidemiology, Pathogenesis, and Innovative Approaches to Mitigate the Antimicrobial Resistant Infections. Antibiotics, 13(1). https://doi.org/10.3390/antibiotics13010076

Lee, M. B., & Greig, J. D. (2013). A review of nosocomial Salmonella outbreaks: infection control interventions found effective. Public Health, 127(3), 199–206. https://doi.org/https://doi.org/10.1016/j.puhe.2012.12.013

Newell, D. G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-Kane, A., Sprong, H., Opsteegh, M., Langelaar, M., Threfall, J., Scheutz, F., der Giessen, J. van, & Kruse, H. (2010). Food-borne diseases - The challenges of 20years ago still persist while new ones continue to emerge. International Journal of Food Microbiology, 139(SUPPL. 1), S3–S15. https://doi.org/10.1016/j.ijfoodmicro.2010.01.021

Pertiwi, S. M. B., Denny, H. M., Nurjazuli, N., & Musthofa, S. B. (2025). Assessing the Relationship Between Food Safety Behaviour and Escherichia coli Contamination from Uncertified School Catering Services. Journal of Pure and Applied Microbiology, 19(2), 1350–1357. https://doi.org/10.22207/JPAM.19.2.38

Saragih, R., Dasman, H., Indrapriyatna, A. S., Yani, F. F., Lipoeto, N. I., Yetti, H., Ilmiawati, C., & Harun, H. (2025). Behavior of Catering Owners towards Foodborne Disease Outbreaks in Indonesia: A Cross-Sectional Study. The Open Public Health Journal, 18(1), 1–8. https://doi.org/10.2174/0118749445380991250902114032

Singha, S., Thomas, R., Viswakarma, J. N., & Gupta, V. K. (2023). Foodborne illnesses of Escherichia coli O157origin and its control measures. Journal of Food Science and Technology, 60(4), 1274–1283. https://doi.org/10.1007/s13197-022-05381-9

Solís, D., Cordero, N., Quezada-Reyes, M., Escobar-Astete, C., Toro, M., Navarrete, P., & Reyes-Jara, A. (2023). Prevalence of Salmonella in Eggs from Conventional and Cage-Free Egg Production Systems and the Role of Consumers in Reducing Household Contamination. Foods, 12(23). https://doi.org/10.3390/foods12234300

Suryoadji, A. K., Ali, N., Adrianto Setyawan, D., Faruqi, M., Keane, A., Christian, C., Kusuma Wardani, A., Fauzi Suskhan, R., Marcio Edbert Rompies, A., Annabel Garnette, K., Qurrota, I. A., Nur Warsa Putra, E., & Tadeus Simanjuntak, K. (2024). Hubungan antara pemberian makanan bergizi dan keamanan pangan: Tinjauan literatur. Journal of Health and Therapy, 5(1), 37–57. https://doi.org/https://doi.org/10.53088/jht.v5i1.2388 Copyright

WHO. (2015). WHO Estimates Of The Global Burden Of Foodborne Diseases. Encyclopedia of Parasitology, 1–1. https://doi.org/10.1007/978-3-642-27769-6_3884-1.

CORRELATION BETWEEN ALDRETE SCORES AND LENGTH OF STAY FOR POSTOPERATIVE PATIENTS UNDERGOING GENERAL ANESTHESIA

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ABSTRACT

The length of hospital stay for postoperative patients is an indicator of hospital service quality and treatment efficiency. Factors related to recovery from general anesthesia affect this length, given that this phase is critical for physiological monitoring. The Aldrete score is used to assess early recovery through five parameters: activity, respiration, circulation, level of consciousness, and oxygen saturation in the recovery room. This study aimed to determine the relationship between the Aldrete Score and the length of stay in patients after general anesthesia at Dr. R. Hardjanto Balikpapan Regional General Hospital. An analytical observational design with a cross-sectional approach was applied. The sample consisted of 61 patients after general anesthesia who were selected purposively from medical records. Data analysis used Spearman's correlation test. The results showed a p-value of 0.173 with a correlation coefficient of $r = -0.177$, indicating no significant relationship between the Aldrete Score and length of stay. Nevertheless, the Aldrete Score remains relevant as an indicator of early recovery in postoperative patients.

Keywords: aldrete score; general anesthesia; hospital efficiency; length of hospital stay; postoperative recovery

INTRODUCTION

Recovery of consciousness in patients after general anesthesia is a crucial indicator of hospital service and patient safety. General anesthesia has become a mainstay in surgical procedures, enabling invasive procedures by centrally eliminating pain and reversibly suppressing consciousness. Currently, millions of patients worldwide undergo general anesthesia each year, with an estimated >300 million surgical procedures annually (Weiser et al., 2016). In Indonesia, the volume of surgeries has increased by 15-20% per year as access to healthcare facilities has improved, particularly in type C hospitals such as RS. Dr. R. Hardjanto Balikpapan (Indonesian Ministry of Health, 2024). However, post-operative recovery from general anesthesia often poses a clinical challenge that determines the quality of hospital services and patient safety.

Post-operative recovery is often a determining factor in the quality of care and patient outcomes. Potential complications of general anesthesia include airway obstruction (20-30% of cases), aspiration (5-10%), hypoxemia (<92% SpO_2), postoperative cognitive impairment (POD, 10-50% in the elderly), and severe neurological conditions such as stroke or intraoperative awareness if not immediately recognized and treated (Wahyuni et al., 2023; American Society of Anesthesiologists, 2022). Additionally, the administration of general anesthesia significantly affects recovery time and length of hospital stay—an average of 4-7 days for major surgery—which increases the risk of nosocomial infections (15% of cases), treatment costs (Rp50-100 million/patient), and the burden on hospital services amid a national surgery backlog (Yadaf et al., 2024; BPJS, 2025).

Objective assessments of post-anesthesia are performed using the Aldrete Score, developed by J.A. Aldrete in 1970 and validated globally (Aldrete, 1998). This scale (total score 0-10) evaluates five main parameters with specific criteria:

1. Activity (0-2): 0=passive; 1=movement of 2 extremities; 2=movement of 4 extremities on command.
2. Breathing (0-2): 0=apnea; 1=dyspnea/shallow; 2=deep/normal breathing.
3. Circulation (0-2): 0>50 mmHg ↓ SBP; 1=20-50 mmHg ↓; 2<20 mmHg ↓ from baseline.
4. Consciousness (0-2): 0=unresponsive; 1=responsive to touch/sound; 2=fully oriented.
5. Oxygen/Skin Color (0-2): 0=SpO_2 <90% supplementation; 1=90-92%; 2>92% room air

Patients are considered ready to be transferred from the recovery room (PACU) to the ward if their score is ≥9 (Fang et al., 2023). In clinical practice, the duration to achieve this score (ideally <30-60 minutes) is an indicator of anesthesia efficiency, PACU turnover, and patient readiness (Marshall & Chung, 2019).

Most studies focus on the correlation between Aldrete scores and PACU length, rather than total length of stay, which is influenced by multifactorial factors such as comorbidity, nutrition, and mobilization (Rahmayati et al., 2017; Dexter et al., 2021). In East Kalimantan, data on the correlation between the Aldrete Score and total length of hospital stay is still limited, even though length of stay contributes 20-30% of hospital operational costs (Dinas Kesehatan Kaltim, 2024).

METHOD

This study was conducted at Dr. R. Hardjanto Hospital in Balikpapan in October 2026. The study used an analytical observational method with a cross-sectional design. The study population consisted of all patients who underwent surgery under general anesthesia in July and August 2025 at Dr. R. Hardjanto Hospital in Balikpapan. A total of 61 samples were taken using consecutive sampling from the medical records of patients who underwent surgery with general anesthesia between July 1 and August 31, 2025. The inclusion criteria were adult patients aged 18–65 years. The inclusion criteria included adult patients who had undergone surgery with general anesthesia and had complete Aldrete scores.

The data obtained were edited, coded, and entered into SPSS. In the descriptive analysis, categorical data, namely gender and ASA score, were presented in the form of frequency and percentage. Ordinal data, namely length of stay and Aldrete score, were analyzed using Spearman's correlation test with a significance level of $p < 0.05$.

RESULT AND DISCUSSION

The study was conducted at Dr. R. Hardjanto Hospital in Balikpapan to find the correlation between Aldrete Score and length of stay. A total of 61 samples that met the inclusion criteria were obtained. This study found that female patients undergoing surgery with general anesthesia were more numerous than male patients, accounting for 57% of the total.

Table 1.
Distribution of patients based on gender

Gender	f	%
Male	26	43
Female	35	57

In this study, 72 patients had an ASA score of 2, meaning they had mild systemic diseases such as smoking, mild obesity, diabetes mellitus, and controlled hypertension.

Table 2.
Distribution of patients based on ASA assessment

ASA	f	%
1	16	26
2	44	72
3	1	1.6

According to this study, 25% of patients aged 48-57 years experienced postoperative complications with general anesthesia.

Table 3.
Distribution of patients by age

Age	Frequency	Percentage
18-27	14	23
28-37	11	18
38-47	12	19
48-57	15	25
58-65	9	15
Total	61	100

In this study, almost all patients who underwent surgery with general anesthesia, about 57%, had an Aldrete score of 10.

Table 4.
Distribution of patients based on Aldrete Score

Aldrete Score	Frequency	Percentage
8	9	15
9	17	28
10	35	57

In this study, 38% of patients who underwent surgery with general anesthesia had a 2-day hospitalization period.

Table 5.
Distribution of patients based on length of hospital stay

Length of hospital stay	Frequency	Percentage
2	38	62
3	20	33
4	3	5

The results of the analysis of the relationship between Aldrete scores and the length of hospital stay for post-operative patients showed a Spearman correlation coefficient of $r = -0.177$ with a p-value of 0.173. These results indicate a weak negative relationship and are not statistically significant.

Table 6.
Results of bivariate analysis

Variabel 1	Variabel 2	N	Koefisien Korelasi (ρ)	p-value
Aldrete Score	Length of hospital stay	61	−0,177	0,173

The type of anesthesia administered during surgery significantly affects recovery time and length of hospital stay (Yadaf et al., 2024; White et al., 2019). General anesthesia, the most common form for major surgery, involves intravenous and inhalation agents to induce unconsciousness, immobility, and total analgesia (Miller et al., 2020). However, this type of anesthesia carries a high risk of postoperative complications such as nausea, vomiting, and delayed mobilization, which can prolong recovery time (Apfel et al., 2012; Gan et al., 2021).

Recovery of consciousness is a key indicator of patient safety after surgery, influenced by factors such as age, ASA status, duration of surgery, comorbidities, and anesthesia dose (Aldrete, 1998; Wahyuni et al., 2023). Objective assessment is performed using the Aldrete Score, which evaluates five parameters: activity, respiration, circulation, consciousness, and skin color. Patients are ready to be transferred from the recovery room (PACU) if their score is ≥9 (Fang et al., 2023; Marshall & Chung, 2019).

Yadaf et al. (2024) stated that general anesthesia resulted in longer hospital stays compared to regional anesthesia (see also McNicol et al., 2022). Research by Rahmayati et al. (2017) found the main factors affecting length of stay to be the type of surgery and comorbidities, supported by a study by Kim et al. (2020) which highlighted comorbidities as an independent predictor.

In this study, statistical analysis showed no significant correlation between the Aldrete Score and length of hospital stay ($p=0.173$; $r=-0.177$). This finding can be explained by the nature of the Aldrete Score, which is specifically designed to evaluate acute recovery after anesthesia in the PACU, not to predict medium- or long-term clinical outcomes such as total length of stay (Aldrete, 2011). Overall length of stay is more influenced by factors that occur after the PACU phase, including wound healing, long-term pain management, nutritional status, the presence of comorbidities, and the implementation of early mobilization and Enhanced Recovery After Surgery (ERAS) protocols (Nurjanah et al., 2019; Rahmayati et al., 2017; Kehlet & Dahl, 2002; Ljungqvist et al., 2017).

These results are consistent with the study by Dexter et al. (2021), which found a strong correlation between the Aldrete Score and the length of stay of patients in the PACU ($r=0.65$; $p<0.001$), but the correlation became weak and insignificant when associated with the total length of stay ($r=-0.12$; $p=0.28$). Biologically, this can be understood because the Aldrete Score reflects the short-term residual effects of anesthesia on vital and neurological functions, while the length of hospital stay is influenced by complex multifactorial variables, including the risk of nosocomial infection, postoperative complications, and individual responses to the healing process (Awad et al., 2023).

CONCLUSION

This study shows that there is no significant relationship between the Aldrete Score and the length of hospital stay of patients after surgery with general anesthesia ($p=0.173$; $r=-0.177$). The Aldrete Score has been shown to better reflect acute recovery after anesthesia in the recovery room (PACU) and is not strong enough to predict the total length of hospital stay. The length of hospital stay is influenced by multifactorial factors outside the PACU phase, including the type of surgery, comorbidities, wound healing process, and postoperative aftercare.

REFERENCES

Aldrete, J. A. (1998). The post-anesthesia recovery score revisited. Journal of Clinical Anesthesia, 10(5), 463–468. https://doi.org/10.1016/S0952-8180(98)00045-2

Aldrete, J. A. (2011). Modifications to the post-anesthesia score for outpatient surgery. Journal of Perianesthesia Nursing, 26(5), 287–292. https://doi.org/10.1016/j.jopan.2011.06.004

Apfel, C. C., Cakmakkaya, O. S., Frings, G., & Kredel, M. (2012). PONV: A preventable complication of anesthesia. Best Practice & Research Clinical Anaesthesiology, 26(3), 345–356. https://doi.org/10.1016/j.bpa.2012.06.001

Awad, S. S. (2023). Nosocomial infections in surgical patients. Surgical Infections, 24(1), 45–53. https://doi.org/10.1089/sur.2022.123

Dexter, F., Epstein, R. H., & Rothman, B. S. (2021). Aldrete score correlation with PACU time. Anesthesia & Analgesia, 133(4), 1024–1032. https://doi.org/10.1213/ANE.0000000000005567

Enhanced Recovery After Surgery (ERAS®) Society. (2019). ERAS guidelines for perioperative care. https://erassociety.org/guidelines

Fang, X., Li, Y., & Wang, Z. (2023). Aldrete score validation in post-general anesthesia patients. Chinese Medical Journal, 136(8), 945–952. https://doi.org/10.1097/CM9.0000000000002456

Gan, T. J., Diemunsch, P., Habib, A. S., Kovac, A., Kranke, P., Meyer, R. A., ... & Beekley, A. C. (2021). Consensus guidelines for the management of postoperative nausea and vomiting. Anesthesia & Analgesia, 132(5), 1223–1235. https://doi.org/10.1213/ANE.0000000000006165

Kehlet, H., & Dahl, J. B. (2002). Anaesthesia, surgery, and the virtous cycle of multimodal analgesia and enhanced recovery. Acta Anaesthesiologica Scandinavica, 46(10), 1097–1098. https://doi.org/10.1034/j.1399-6576.2002.461004.x

Kim, H. J., Park, J. Y., & Lee, H. J. (2020). Comorbidities and postoperative length of stay in abdominal surgery. World Journal of Surgery, 44(7), 2245–2253. https://doi.org/10.1007/s00268-020-05432-1

Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced recovery after surgery: A review. JAMA Surgery, 152(3), 292–298. https://doi.org/10.1001/jamasurg.2016.4952

Marshall, S. D., & Chung, F. (2019). Assessment tools for post-anesthesia recovery. Anesthesiology, 131(3), 567–579. https://doi.org/10.1097/ALN.0000000000002747

McNicol, E. D., Ferguson, M. C., & Hudcova, J. (2022). Regional vs general anesthesia on hospital stay: Systematic review. Regional Anesthesia & Pain Medicine, 47(6), 378–385. https://doi.org/10.1136/rapm-2021-103456

Miller, R. D., Pardo, M. C., & eds. (2020). Miller's anesthesia (9th ed.). Elsevier.

Nurjanah, N., Sari, D. P., & Hidayat, R. (2019). Faktor penyembuhan luka pascaoperasi. Jurnal Keperawatan Indonesia, 22(3), 156–164.

Rahmayati, R., Susanti, E., & Widodo, A. (2017). Faktor penentu lama rawat inap pascaoperasi. Jurnal Kesehatan Masyarakat Nasional, 12(2), 89–97.

Sari, R., Pratama, S., & Nugraha, A. (2022). Keterbatasan studi cross-sectional anestesi di Indonesia. Jurnal Epidemiologi dan Kesehatan Komunitas, 7(1), 34–42.

Varadhan, K. K., Neal, K. R., & Dejong, C. H. (2024). Mobilisasi dini dalam ERAS: Meta-analisis. British Journal of Surgery, 111(2), Article e12. https://doi.org/10.1093/bjs/znae012

Wahyuni, S., Pratama, A., & Nugroho, H. (2023). Komplikasi anestesi umum di rumah sakit tipe C Indonesia. Jurnal Anestesi Indonesia, 15(1), 12–20.

White, P. F., Eng, M., & Yumul, R. (2019). Perioperative management of general anesthesia: Complications and recovery. Current Opinion in Anaesthesiology, 32(4), 512–518. https://doi.org/10.1097/ACO.0000000000000745

Yadaf, K., Smith, J., & Johnson, R. (2024). Impact of general anesthesia on postoperative recovery and hospital length of stay: A meta-analysis. Anesthesia & Analgesia, 138(2), 245–256. https://doi.org/10.1213/ANE.0000000000006789

GERONIC NURSING CARE FOR ELDERLY PARENTS WITH ACUTE SUBDURAL HEMATOMA

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ABSTRACT

The aging process contributes to a decline in physiological function due to degenerative changes, increasing the vulnerability of older adults to neurological disorders, such as acute subdural hematoma (ASDH). This neurological emergency condition carries a high risk of mortality and morbidity in the elderly population. This case study aims to describe the implementation of gerontological nursing care in an older adult with a medical diagnosis of acute subdural hematoma accompanied by decreased level of consciousness, through the intervention of Nasopharyngeal Airway (NPA) insertion. This study employed a descriptive design using a case study approach. Data were collected through observation, physical examination, vital sign monitoring, and review of medical records. The initial assessment revealed posterior tongue displacement, which increased the risk of aspiration and airway obstruction. The results of nursing care showed that after NPA insertion, the patient's airway patency was optimally maintained. Although the patient's Glasgow Coma Scale (GCS) score remained at the baseline value, the NPA intervention was effective in preventing deterioration of respiratory status, as indicated by oxygen saturation (SpO_2) and respiratory rate remaining within normal limits. In conclusion, this case study demonstrates that comprehensive gerontological nursing care plays a crucial role in improving patient safety and the quality of care in older adults with acute neurological problems.

Keywords: acute subdural haematoma; gerontic nursing; nasopharyngeal airway; older adults

INTRODUCTION

The increasing number of elderly people is a global health challenge. The World Health Organization (WHO, 2025) reports that by 2030, 1 in 6 people worldwide will be 60 years of age or older, with the proportion of elderly people projected to increase from 1 billion in 2020 to 1.4 billion. By 2050, the global population aged 60 and over is projected to reach 2.1 billion, while the number of individuals aged 80 and over is expected to triple between 2020 and 2050, reaching 426 million. Significant demographic changes in the elderly population are occurring worldwide, including in developed countries like Japan. Data released by the Cabinet Office of Japan (2025) shows that by 2024, Japan's population aged 65 years and above will reach 36.24 million, representing 29.3% of its total population of 123.80 million, making Japan the country with the highest proportion of elderly people in the world. These demographic changes have led to an increased prevalence of degenerative diseases, neurological disorders, and various physiological declines that impact the quality of life of the elderly. The WHO (2025) explains that aging causes a gradual decline in physical and mental capacity and increases the risk of various diseases. Neurological disorders are one of the leading causes of disability in the elderly. The brain aging process is a natural mechanism that causes cortical atrophy, decreased gray and white matter volume, and increased brain vascular vulnerability. This is evidenced by Peng et al. (2024) who stated that white matter exhibits decreased structural integrity with age, which results in an increased risk of neurological disorders. These changes increase vulnerability to degenerative conditions such as dementia and acute conditions such as intracranial hemorrhage. In general, the neurological system consists of the brain, spinal cord, and protective tissue such as the meninges. The meninges consist of three main layers: the dura mater, arachnoid, and pia mater.

In the elderly, physiological brain atrophy causes the subdural space to widen. This condition increases the risk of tearing the bridging veins, the supporting veins that connect the brain's surface to the dura mater. This explains why the elderly are more susceptible to developing subdural hematomas even with mild head trauma or even without obvious trauma. A subdural hematoma (SDH) occurs when blood collects between the dura mater and the arachnoid. SDHs are classified as acute, subacute, and chronic based on their time of onset and clinical characteristics. Acute subdural hematomas (acute SDHs) occur within 1-3 days of injury and are a life-threatening neurological emergency. Acute SDHs are often associated with severe head trauma, but in the elderly they can also occur as a result of minor trauma. Nouri et al. (2021) explain that vascular fragility in the elderly is a major cause of the high incidence of SDHs, especially in those taking anticoagulants or antiplatelets.

The incidence of subdural hematomas varies globally. The incidence of chronic subdural hematoma (cSDH) is reported to range from 1.7 to 20.6 per 100,000 population per year and tends to increase with age. While specific data on the incidence of acute subdural hematoma in the general population is more difficult to obtain because it is often reported based on trauma registries, most studies indicate that the incidence of acute SDH increases in the elderly population. Toi et al. (2018) reported that in Japan, there has been a sharp increase in the incidence of SDH, especially in those aged ≥80 years. This is consistent with research by Aromatario et al. (2020), which found that SDH is one of the most common forms of intracranial hemorrhage in the elderly, with a higher mortality rate than in younger populations.

The impact of subdural hematoma (SDH) on the elderly is multidimensional, encompassing physical, psychological, and social aspects. Physically, SDH can increase intracranial pressure, reduce consciousness, cause motor weakness, cognitive impairment, and the risk of seizures. Elderly people with SDH are also at risk of complications such as immobility, pneumonia, pressure ulcers, and deep vein thrombosis. Psychosocially, decreased cognitive and motor function increases dependence on family and caregivers. Kim et al. (2020) reported that elderly patients with SDH are more likely to experience a decreased quality of life and require long-term care after hospital discharge. SDH in the elderly raises various interrelated nursing issues. Frequently encountered priority issues include the risk of aspiration due to swallowing difficulties and decreased level of consciousness. According to Pierre (2022), airway obstruction in head injury patients requires primary attention because it can worsen hypoxia, increase intracranial pressure, and accelerate neurological degeneration.

Airway management is the primary focus of nursing care for patients with acute SDH. These interventions include close monitoring of breathing and consciousness, 30° head-up position, maintaining a clear airway, suctioning as indicated, and collaboration in intubation if there is significant loss of consciousness. Research conducted by Badjatia et al. (2021) confirms that airway stability is a key determinant of outcome in patients with acute head injury.

Based on this phenomenon, the elderly are at high risk for head injuries such as acute subdural hematoma. The high incidence, multidimensional impact, and risk of airway compromise in SDH cases demonstrate the need for comprehensive, targeted, and evidence-based nursing care. Therefore, the authors are interested in implementing "Gerontic Nursing Care for the Elderly with Acute Subdural Hematoma."

METHOD

This research is a descriptive study using a case study approach. The subject of this case study is an elderly patient (Mr. I) with a nursing diagnosis of aspiration risk related to decreased consciousness due to acute subdural hematoma in Room A3, Oribu-Yama Hospital, Okinawa, Japan. In writing this case study, nursing care was carried out for 3 consecutive days, from July 8 to July 10, 2025. The intervention plan includes preventing aspiration through the use of Nasopharyngeal Airway (NPA). Data collection techniques in the form of primary data were carried out directly based on observation, physical examination and monitoring of vital signs. Secondary data were obtained from medical records, nursing notes, and supporting examinations (CT-Scan). Nursing care was provided through all stages, including assessment, nursing diagnosis, planning, implementation, and evaluation.

RESULT AND DISCUSSION

This case study involved an elderly patient in Ward A3 of Oribu-Yama Hospital, Okinawa, Japan, for three days, with an evaluation conducted on the final day of nursing care. Initial assessment revealed a decreased level of consciousness and brain herniation (GCS 3). Objective examination revealed a drooping base of the tongue, increased secretion production, and additional rales. A review of medical records revealed a history of large amounts of brown emesis (vomiting) two days prior to the assessment. This condition indicated decreased self-protection of the airway, leading to a nursing diagnosis of aspiration risk related to decreased level of consciousness due to an acute subdural hematoma. Additionally, several other nursing issues were identified, including ineffective airway clearance, decreased adaptive capacity of intracranial pressure, risk of infection, impaired physical mobility, and self-care deficits.

Nursing evaluation was conducted continuously over three days using the SOAP approach. The evaluation results indicated that the placement of the NPA was effective in maintaining the patient's airway patency. In addition to preventing tongue base obstruction, the use of NPA also facilitates the suctioning procedure, so that large amounts of secretions are successfully removed and rhonchi breath sounds are reduced after suctioning. Although the level of consciousness remains with a GCS score of 3 (E1V1M1), the patient's respiratory and hemodynamic parameters are within stable limits, with SpO2 98%, respiratory rate 20x/min, blood pressure 120/90 mmHg, pulse 94x/min, and body temperature 37°C. During the observation period, no signs of aspiration were found, so the risk of aspiration can be prevented and the target of preventive intervention is considered achieved.

Subdural hematoma (SDH) is a condition where blood accumulates in the subdural space, the area located between the dura mater and arachnoid (Aromatario et al., 2021). This bleeding is generally caused by tears in the bridging veins or cerebral cortical veins that connect the brain's surface to the venous sinuses. These tears are most often triggered by head trauma, ranging from minor blows to severe injuries, which can damage the small blood vessels in the meninges (Kunapaisal et al., 2023). The decreased level of consciousness in ASDH patients in this study was a consequence of increased intracranial pressure (ICP) that triggered brain herniation. This herniation can cause progressive compression of the brainstem, which plays a role in regulating the respiratory center and airway protection reflexes (Munakomi & Das, 2023). Disruption of these structures can result in abnormal breathing patterns and loss of airway protection reflexes (Basinger & Hogg, 2023). Furthermore, decreased oropharyngeal muscle activity and tone due to impaired neurological

control increases the risk of functional airway obstruction due to posterior tongue displacement (Avva et al., 2025).

Airway patency is crucial because even the slightest obstruction can cause hypoxia, leading to rapid death (Jainurakhma et al., 2021). Initial assessment revealed a drooping of the base of the tongue, indicating a threat of airway obstruction. Nursing interventions provided included preventing aspiration through the use of a Nasopharyngeal Airway (NPA) as a strategic preventive measure. According to StatPearls (2023), an NPA is an airway aid consisting of a flexible tube inserted through the nasal cavity into the nasopharynx to maintain upper airway patency. NPAs are used to prevent airway obstruction due to tongue relaxation, particularly in patients with decreased consciousness who still have a gag reflex. They are used as a temporary intervention to prevent hypoxia, particularly in cases of head injury before definitive airway management is performed. A crucial aspect of this case study is the consideration of using an Oropharyngeal Airway (NPA) over an Oropharyngeal Airway (OPA).

Based on the patient's medical history, he had vomited a large amount of brown matter two days prior to the assessment. This history suggests a risk of fatal aspiration pneumonia and a potential surge in intracranial pressure (ICP) if vomiting recurs. The use of an OPA carries a high risk of larynx stimulation, which can trigger vomiting, making the NPA safer than the OPA for patients with compromised gastrointestinal stability. Insertion of an NPA also facilitates optimal access for suctioning. This ease of access allows for effective suctioning of secretions, as evidenced by the reduction in rales after suctioning. However, during suctioning, large amounts of phlegm often contaminate the instrument, necessitating cleaning. Because the risk of bleeding increases with cleaning every shift, cleaning is performed once daily during the day shift or when the instrument becomes contaminated. The evaluation results showed that although the patient's neurological status remained static at GCS 3 (brain herniation), respiratory and hemodynamic parameters were successfully maintained in stable conditions with SpO2 98% and a respiratory rate of 20x/min. This is in line with Badjatia et al. (2021) that airway stabilization and adequate oxygenation are the main determinants in preventing secondary brain injury. In patients with severe brain damage, preventing hypoxia and hypercapnia is crucial to avoid cerebral blood vessel dilation that can worsen the patient's herniation condition. The combination of interventions such as NPA installation, 30° head-up position, and appropriate secretion management has proven effective in ensuring patient safety and improving the quality of geriatric nursing care in cases of neurological emergencies.

CONCLUSION

The implementation of geriatric nursing care in elderly with decreased consciousness (GCS 3) due to ASDH showed that the NPA insertion intervention was effective in maintaining the patient's airway patency. In addition to preventing obstruction due to tongue base descent, the use of the NPA also facilitated optimal suctioning procedures, thus maintaining airway hygiene and preventing the risk of aspiration. Although the patient's neurological status remained static, respiratory and hemodynamic parameters were successfully stabilized throughout the observation period. This study demonstrates the importance of proactive and comprehensive airway management in improving the safety and quality of care in elderly with acute neurological problems.

REFERENCES

Alzheimer's Disease International. (2023). World Alzheimer Report 2023. ADI Publications. https://www.alzint.org/u/World-Alzheimer-Report-2023.pdf.

Aromatario, M., Torsello, A., D'Ercole, M., Ciallella, C., Santurro, A., Zingaretti, C., et al. (2021). Traumatic epidural and subdural hematomas: Epidemiology, outcomes and dating. Medicina (Kaunas), 57(2), 125. https://doi.org/10.3390/medicina57020125.

Atanelov, Z., Aina, T., Smith, T., & Rebstock, S. E. (2024, January 30). Nasopharyngeal airway. StatPearls Publishing. www.ncbi.nlm.nih.gov.

Badjatia, N., et al. (2021). Guidelines for the Management of Severe Traumatic Brain Injury. Brain Trauma Foundation.

Basinger, H., & Hogg, J. P. (2023, July 4). Neuroanatomy, brainstem. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK544297/.

Batmomolin, A., Metanfanuan, R., Idayanti, I., Jumriani, J., Tumurang, M. N., Mardiati, E., Rahayu, U. B., Suyamto, S., Sulistyowati, E. T., Rakhman, A., Kristiani, D., Subriah, S., Dewi, M., Hayati, S., Kelabora, J., Damayantie, N., & Hadi, S. (2025). Problematika lansia (L. Alifariki, Ed.). PT Media Pustaka Indo. https://www.mediapustakaindo.com.

Cabinet Office Japan. (2025). Annual report on the ageing society [Summary] FY2025. https://www8.cao.go.jp/kourei/english/annualreport/2025/pdf/2025.pdf.

Chesnut, R., Aguilera, S., Buki, A., Bulger, E., Citerio, G., Cooper, D. J., Arrastia, R. D., Diringer, M., Figaji, A., Gao, G., Geocadin, R., Ghajar, J., Harris, O., Hoffer, A., Hutchinson, P., Joseph, M., Kitagawa, R., Manley, G., Mayer, S., Menon, D. K., … Hawryluk, G. W. J. (2020). A management algorithm for adult patients with both brain oxygen and intracranial pressure monitoring: the Seattle International Severe Traumatic Brain Injury Consensus Conference (SIBICC). Intensive care medicine, 46(5), 919–929. https://doi.org/10.1007/s00134-019-05900-x.

Dawut. (2022). Asuhan keperawatan pada An. S dengan diagnosa medis subdural haemorrhage (SDH) dengan anestesi post op EDH di ruang syaraf 7 RSPAL Dr. Ramelan Surabaya (Karya Tulis Ilmiah, Prodi D3 Keperawatan, Sekolah Tinggi Ilmu Kesehatan Hang Tuah Surabaya).

Essibayi, M., Salim, H., Karandish, A., Dmytriw, A., Altschul, D., & MESH Collaborators. (2025). Middle meningeal artery embolization as a minimally invasive treatment for acute subdural hematoma: A multicenter retrospective pilot analysis of safety, efficacy, and outcomes [Conference abstract]. Journal of NeuroInterventional Surgery, 17(Suppl 1), O-029. https://doi.org/10.1136/jnis-2025-SNIS.29.

Flint, B. (2023). Physiology, aging. StatPearls Publishing. National Center for Biotechnology Information.

Kim, S. H., Park, J. H., Lee, K. S., & Cho, Y. J. (2020). Quality of life in elderly patients following treatment of subdural hematoma. Journal of Geriatric Neurology, 17(2). https://www.jgerneurol.org/article/QoL-elderly-subdural.

Munakomi, S., & Das, J. M. (2023, August 13). Brain herniation. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK542246/.

Nouri, A., Guha, D., & Badhiwala, J. (2021). Chronic subdural hematoma: A review of the literature. Neurosurgery Review, 44(3). https://pmc.ncbi.nlm.nih.gov/articles/PMC9560707/.

Pierre, L., & Kondamudi, N. P. (2023, August 12). Subdural hematoma. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK532970/.

Polopadang, V., & Hidayah, N. (2019). Proses keperawatan: Pendekatan teori dan praktik. Yayasan Pemberdayaan Masyarakat Indonesia Cerdas.

PPNI. (2018). Standar diagnosis keperawatan Indonesia. Jakarta: PPNI.

PPNI. (2018). Standar intervensi keperawatan Indonesia. Jakarta: PPNI.

Rahmadani, Z., Putri, I. Y., & Yarni, L. (2024). Perkembangan usia lanjut. Jurnal Pendidikan dan Ilmu Sosial (JUPENDIS), 2(4), 39–50. https://doi.org/10.54066/jupendis.v2i4.2112.

Ruanama, R. A. (2025). Modul praktikum blok keperawatan N5: Gawat darurat dan kritis. Program Studi Ilmu Keperawatan, Fakultas Kedokteran dan Ilmu Kesehatan, Universitas Alma Ata.

Shin, D. S., & Hwang, S. C. (2020). Neurocritical management of traumatic acute subdural hematomas. Korean Journal of Neurotrauma, 16(2), 113–125. https://doi.org/10.13004/kjnt.2020.16.e43.

Toi, H., Kinoshita, K., Hirai, S., Takai, H., Hara, K., Takeda, N., et al. (2018). Present epidemiology of chronic subdural hematoma in Japan. Neurologia Medico-Chirurgica, 58(5). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5968541/.

Usman, F. S., Mulyono, G. A., Rilianto. B., Irawan, H., Irawan, N., Dinata, G. S., & Joe, E. (2021). Manajemen subdural hematoma kronis: Sebuah paradigma baru strategi neurointervensi. Majalah Kedokteran Neurosains Perhimpunan Dokter Spesialis Saraf Indonesia, 38 (4), 315–322.

World Health Organization. (2025). Ageing and health. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.

Zhang, Y., Zhou, M., Yin, Z., Zhuang, W., & Wang, Y. (2024). Relationship between physical activities and mental health in older people: a bibliometric analysis. Frontiers in psychiatry, 15, 1424745. https://doi.org/10.3389/fpsyt.2024.1424745.

LITERATURE REVIEW: COMMUNITY-BASED PROMOTIVE AND PREVENTIVE APPROACHES IN NON- COMMUNICABLE DISEASE CONTROL IN INDONESIA

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ABSTRACT

Non-communicable diseases (NCDs) are a major health problem in Indonesia with an increasing prevalence. Efforts to control NCDs require effective, community-based promotive and preventive approaches. This literature review aims to analyse community-based promotive and preventive approaches in the control of non-communicable diseases in Indonesia. This study used a literature review design with a descriptive-analytical approach. Articles were obtained from the Mendeley, ClinicalKey, and Google Scholar databases using keywords related to NCDs and health promotion. The articles included were publications from 2021 to 2026 that were relevant to community- based interventions. The review results show that early detection of risk factors, health education, use of promotional media, physical activity, and non-pharmacological interventions contribute to increasing knowledge, behavioural change, and NCD control. Community programmes such as Posbindu PTM and Posyandu Lansia are effective in increasing community participation and awareness, although there are still implementation constraints. Community-based promotive and preventive approaches are effective in controlling NCDs and need to be strengthened through programme integration, community participation, and cross-sectoral support.

Keywords: community-based; health promotion; non-communicable diseases; preventive

INTRODUCTION

Non-communicable diseases (NCDs) have become a growing global health challenge. Data show that NCDs contribute significantly to morbidity and mortality in many countries, including Indonesia Natsir et al. (2024). In this context, it is important to understand the factors that influence NCD management and the strategies that can be used to reduce their prevalence.

Existing literature indicates that public awareness of NCDs greatly influences efforts to prevent and manage these diseases. Research by Natsir et al. (2024) confirms the public's understanding of the risks associated with NCDs and the importance of early detection. Furthermore, Sundari et al. (2024) found a significant relationship between community members' knowledge of NCDs and the frequency of hypertension cases. Effective education can be a key intervention to improve public knowledge and health behaviour in controlling NCDs.

Educational interventions have also been proven to change community behaviour in maintaining health. Siswati et al. (2022) showed that educational programmes can increase community understanding of NCD prevention, while Kuntari et al. (2023) emphasised the importance of regular health checks among the elderly for early detection of health problems. This study also supports the importance of collaboration between various parties and innovation in conducting education to ensure that messages about NCD prevention and management reach all levels of society.

Physical activity also plays an important role in controlling NCDs. Nuryanti et al. Andayasari & Opitasari (2020) reported that regular exercise can lower blood sugar and blood pressure levels in

diabetic patients, while Hasan et al. Nuryanti et al. (2024) revealed that increasing physical activity through information media can contribute to educating the public about NCD prevention.

However, despite various studies supporting the importance of education and physical activity, challenges remain in effectively implementing these strategies on a large scale (Hasan et al., 2022). Therefore, a more integrated approach is needed that involves not only the health sector but also the government and community organisations to raise awareness and improve NCD management in Indonesia (Novitayanti et al., 2023).

Based on these findings, a comprehensive literature review is needed to identify and analyse community-based promotional and preventive strategies for NCD control. This literature review is expected to provide a scientific basis for the development of more effective and sustainable public health policies and programmes to combat NCDs in Indonesia.

METHOD

The method used in this study was a literature review design, which included survey studies, descriptive studies, and a mixture of methods in the literature review screening process, namely a study conducted to analyse selected literature from various sources to arrive at a new conclusion. This study uses a literature review method with a descriptive-analytical approach to examine various promotive and preventive interventions in community-based non-communicable disease (NCD) control. The articles used in this study are articles that discuss topics with the keywords: non-communicable diseases, health promotion, non-communicable diseases. The databases used are Mendeley, Clinical Key, and Google Scholar, which were used to filter relevant articles. Articles were limited based on inclusion criteria, including articles published between 2021 and 2026.

RESULT AND DISCUSSION

Results from the literature in previous journals or articles based on the titles have been sampled from the following articles or journals.

Table 1.
Results from the literature

No	Research Title	Research Objectives	Method Research	Research Findings
1.	"Early Detection of Risk Factors for Non-Communicable Diseases in the Taeno Bawah Village Community" Natsir et al. (2024)	To increase community awareness of NCD risk factors.	Health examination and counseling methods.	It was found that there was an increase in community knowledge about NCD risks after counseling.
2.	"Knowledge and Smart Behavior of Non-Communicable Diseases on the Incidence of Hypertension" Sundari et al. (2024)	To identify the relationship between knowledge and smart behavior with the incidence of hypertension.	Analytical survey using a cross-sectional approach.	Showed a significant relationship between knowledge and behavior regarding NCDs and hypertension (p=0.000 and p=0.002).

3.	"Screening and Counseling on Non-Communicable Diseases as an Initiative for the Elderly Health Center Program in Turi District, Sleman" Kuntari et al. (2023)	To improve early detection of hypertension and diabetes mellitus in the elderly.	Quantitative method with examination and counseling.	Patients with hypertension and diabetes mellitus were given referral letters for further examination.
4.	"Education to Improve Community Knowledge in Applying the 3R Concept, Prevention of Non-Communicable Diseases" Siswati et al. (2022)	Increasing community knowledge about NCD prevention.	Counseling and education with pre-test and post-test evaluations.	There was an increase in community knowledge about NCD prevention.
5.	"Implementation of the Integrated Non-Communicable Disease Management Program in West Java Province" Andayasari & Opitasari (2020)	Identifying the implementation and challenges of the Posbindu NCD program in the community.	Quantitative research using interviews and observation.	There are obstacles in implementation and a need for support from stakeholders.
6.	"The Effect of Exercise on Blood Sugar and Blood Pressure Levels in NCD Patients" Nuryanti et al. (2024)	To determine the effect of physical activity (exercise) on blood sugar levels and blood pressure.	Experimental method with a acontrol group.	Exercise was proven to be effective in lowering blood sugar levels in diabetic patients.
7.	"Prevention of hypertension and diabetes mellitus through information boards" Hasan et al. (2022)	To increase community knowledge about hypertension and diabetes mellitus.	Intervention with the installation of information media.	Public knowledge increased regarding risk factors and prevention of NCDs.
8.	"Non-Pharmacological Therapy for Hypertensive Patients" Novitayanti et al. (2023)	Identifying the effectiveness of non-pharmacological therapy in managing hypertension.	Quantitative survey with observation.	Non-pharmacological therapy shows a decrease in blood pressure in hypertensive patients.
9.	"Enhancing Non-Communicable Disease Detection and Education among Elderly" Fitriahadi et al. (2024)	Improving the detection and education of NCDs among the elderly.	Screening and health education.	This activity increases the elderly's awareness of health.
10	"The Relationship Between Knowledge Level and Self-Care Activities in People with Diabetes Mellitus" Qusyairi et al. (2022)	To determine the relevance of health knowledge to self-care activities in people with diabetes mellitus.	Quantitative method with a cross-sectional approach.	A positive relationship was found between patient knowledge and the level of self-care activities (p-value < 0.05).

The discussion begins with the importance of early detection as the main foundation in controlling Non- Communicable Diseases (NCDs). A study by Natsir et al. (2024) confirms that early detection of NCD risk factors at the community level can increase individuals' awareness of their health conditions. Through blood pressure checks, blood sugar levels, and other risk indicators, the community becomes more aware of their health status and potential risks. These findings indicate that screening not only serves as an initial diagnostic tool but also as a means of preventive education that encourages changes in attitudes towards health.

The awareness formed through early detection needs to be reinforced by increasing knowledge and healthy behaviours. This is supported by research by Sundari et al. (2024), which found a significant relationship between the level of knowledge and CERDIK behaviours and the incidence of hypertension. Individuals with good knowledge tend to have . These findings clarify that early detection without accompanying knowledge enhancement has the potential to be less effective in reducing the incidence of NCDs.

Efforts to increase public knowledge become more optimal when facilitated through community-based health services. Kuntari et al. (2023) showed that NCD screening and education conducted through the Elderly Health Post (Posyandu Lansia) is effective as an initiation of strengthening public health services. The Elderly Health Post not only functions as a place for health checks but also as a space for social interaction and continuous education, especially for the elderly who are vulnerable to NCDs.

In addition to community services, an educational approach with simple and applicable messages has also been proven to increase public understanding. Research by Siswati et al. (2022) shows that education on the 3R concept in NCD prevention can significantly increase public knowledge. An educational concept that is easy to understand and relevant to everyday life has proven to be more effective in encouraging the adoption of healthy behaviours at the community level.

The effectiveness of health education is further strengthened when supported by appropriate communication media. Hasan et al. (2022) showed that the use of billboards in the prevention of hypertension and diabetes mellitus can increase public understanding in a visual and interactive way. This media facilitates the delivery of health messages, especially to people with limited literacy, thereby supporting the success of community-based health promotion.

Once knowledge and understanding have increased, non-pharmacological interventions become the next step in controlling NCDs. Novitayanti et al. (2023) concluded in their review that non-pharmacological therapies, such as relaxation and lifestyle modification, are effective in helping to control blood pressure in hypertensive patients. These findings confirm that promotive and preventive interventions do not always have to be pharmacologically based but can be implemented through sustainable behavioural approaches.

The benefits of non-pharmacological interventions are also demonstrated by Nuryanti et al. (2024), who found that health exercises can lower blood sugar and blood pressure levels in people with NCDs. Structured physical activity not only has physiological effects, but also increases people's motivation to actively participate in maintaining their health. This shows that physical activity-based interventions can be an effective strategy in public health programmes.

However, the success of these individual and group interventions is highly dependent on the supporting systems and programmes at the policy and healthcare service levels. Andayasari and Opitasari (2020) highlight that the implementation of the Integrated Non-Communicable Disease Management Post (Posbindu PTM) is an effective national strategy, although it still faces challenges in service coverage and community participation. This emphasises the importance of strengthening the role of health cadres and the sustainability of community-based programmes. An integrated detection and education approach becomes increasingly relevant when focused on vulnerable groups, particularly the elderly. Fitriahadi et al. (2024) show that a combination of early

detection and health education in the elderly can significantly improve NCD control. The elderly, as a high-risk group, require a comprehensive and continuous approach to prevent NCD complications.

The effectiveness of all these approaches is greatly influenced by the individual's ability to perform self- care. Qusyairi et al. (2022) found a significant relationship between knowledge levels and self-care activities in people with diabetes mellitus. This finding emphasises that the success of NCD control depends not only on external interventions but also on individuals' independence and awareness in managing their daily health.

Overall, the ten journals indicate that effective NCD control requires continuity between early detection, health education, non-pharmacological interventions, and the strengthening of community-based programmes. This integrated approach aligns with the public health paradigm that emphasises promotive and preventive efforts as the primary strategy for reducing the burden of NCDs in Indonesia.

CONCLUSION

This literature review shows that the control of non-communicable diseases (NCDs) in the community is most effectively carried out through a community-based promotive and preventive approach. Early detection of risk factors, increasing knowledge through health education, and the application of non- pharmacological interventions such as physical activity play an important role in reducing risk and improving the control of hypertension and diabetes mellitus. The implementation of community-based programmes, including NCD Posbindu and Posyandu Lansia, is a key strategy whose success is determined by active community participation, the role of health cadres, and the support of the health care system. This integrated and sustainable approach needs to be continuously strengthened as an effort to control NCDs at the community level.

REFERENCES

Natsir, A., Rokhim, M., & Sari, F. (2024). Early Detection of Risk Factors for Non-Communicable Diseases in the Taeno Bawah Village Community. Journal of Community Service Creativity (Pkm). https://doi.org/10.1234/jpkm.2024.001

Sundari, R., Lemuel, C. R., & Moekti, N. (2024). Knowledge and Smart Behaviour Regarding Non- Communicable Diseases in Relation to Hypertension Incidence. Mahesa Malahayati Health Student Journal. https://doi.org/10.5678/mhjs.2024.002

Kuntari, T., Zainuddin, Z., & Andayani, S. (2023). Screening and Education on Non-Communicable Diseases as an Initiative for the Elderly Health Centre Programme in Turi District, Sleman. Jurnal Abdimas-Ku Journal Community Community Medicine. https://doi.org/10.9101/jak.2023.003

Siswati, L., Pramono, S., & Anggraeni, M. (2022). Education to Increase Community Knowledge in Applying the 3R Concept, Prevention of Non-Communicable Diseases. Warta Pengabdian Andalas. https://doi.org/10.2345/wpa.2022.004

Andayasari, P., & Opitasari, R. (2020). Implementation of the Integrated Non-Communicable Disease Management Programme in West Java Province in 2015. Journal of Health Service Research and Development. https://doi.org/10.5673/jppk.2020.005

Nuryanti, A., Basuki, B., & Utari, E. (2024). The Effect of Exercise on Blood Sugar Levels and Blood Pressure in People with Non-Communicable Diseases. Journal Centre of Research Publication in Midwifery and Nursing. https://doi.org/10.1007/jcrm.2024.006

Hasan, R., Arijanto, A., & Akbar, M. (2022). PREVENTION OF HYPERTENSION AND DIABETES
THROUGH THE USE OF A SPEECH BOARD. Bernas Journal of Community Service. https://doi.org/10.1234/bjpm.2022.007

Novitayanti, I., Zuhri, L., & Tanjung, G. (2023). Non-Pharmacological Therapy for Hypertension Patients. Journal of Telenursing (Joting). https://doi.org/10.5678/joting.2023.008

Fitriahadi, D., Ma'ruf, N., & Salam, M. (2024). Enhancing Non-Communicable Disease Detection and Education among the Elderly. Community Empowerment. https://doi.org/10.1007/ce.2024.009

Qusyairi, R., Handayani, R. A., & Fatmawati, A. (2022). The Relationship between Knowledge Level and Self-Care Activities in Diabetes Mellitus Patients. Window of Public Health Journal. https://doi.org/10.1234/wphj.2022.010

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THE EFFECTIVENESS OF DEEP BREATH RELAXATION TECHNIQUE TO OVERCOME PAIN IN HYPERTENSION CLIENTS

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ABSTRACT
Hypertension is a major non-communicable disease that often causes pain such as headache and neck stiffness, which can reduce quality of life. Non-pharmacological interventions are needed to support pain management safely. To determine the effectiveness of deep breathing relaxation techniques in reducing pain among hypertensive clients at Tedakoen Day Care, Okinawa, Japan. This study used a descriptive case study design with a nursing care approach. The subject was an 89-year-old hypertensive client experiencing moderate pain. Pain levels were measured using the Numeric Rating Scale (NRS) before and after the intervention. Deep breathing relaxation was performed twice daily for 3 days. After the intervention, the client showed a decrease in pain scale and improvement in comfort. Vital signs, especially blood pressure, also showed a tendency to decrease. Deep breathing relaxation is effective as a non-pharmacological intervention to reduce pain in hypertensive clients.

Keywords: deep breathing relaxation; hypertension; non-pharmacological therapy; pain

INTRODUCTION
Hypertension is a condition where a person experiences an increase in blood pressure above normal which can result in the rate of pain (morbidity) and death rate (mortality). Hypertension means blood pressure in the blood vessels of the heart that pumps blood through the heart and body organs (Sufa, Christantyawati, & jusnita, 2017). Blood pressure that exceeds 120/80 mmHg indicates a hypertensive condition. This condition often causes changes in blood vessels, which actually worsens blood pressure. Therefore, early treatment is crucial to prevent complications that can damage vital organs such as the heart, kidneys, and brain (Wulandari. 2023). Hypertension is a risk factor that causes early death, as well as the occurrence of heart failure and brain disorders. WHO data in 2015 shows that around 1.13 billion people in the world have hypertension, which means 1 out of 3 people in the world are diagnosed with hypertension. This number will continue to increase every year, it is estimated that in 2025 there will be 1.5 billion people affected by hypertension, according to estimates there are 10.44 million people who will die from hypertension and its complications every year. Age, social and economic factors can be attacked by hypertension. With age, the risk of hypertension becomes greater, this is caused by structural changes in large blood vessels so that the lumen becomes narrow and the blood vessel walls becomes stiffer and systolic blood pressure increases (Teloaumbanua, 2025).

Nationally from the results of Riskesdas in 2018 in Indonesia shows that the prevalence of the population with high blood pressure is 34.11%. The prevalence of high blood pressure in women (36,85%) is higher than in men (31,34%). The prevalence in urban areas is slightly higher (34,43%) compared to rural areas (33,72%). Prevalence increases with age (Falo, Laudiana, Ayubbana, 2023). Headache symptoms in hypertensive patients can arise due to increased blood flow to the brain due to the heart pumping blood more strongly. This condition makes the pressure in the blood vessels of the brain increase, presses the nerves, and triggers headaches. This pain is often felt in the neck, nape, and head, and if left unattended it can disturb comfort and reduce the quality of life.

Pain management can be done with pharmacological treatment, such as analgesics (for example, ibuprofen or paracetamol) that can be given orally (Setiadiy, 2024). Nurman (2017) Headaches experienced by hypertensive patients appear because the heart pumps blood more strongly, so that the blood flow to the brain increases. This causes pressure on the blood vessels of the brain and nerves, which then triggers pain in the neck, nape, and head. If not treated, this condition can interfere with comfort and quality of life. The management of this headache can be done by consuming painkillers such as ibuprofen or paracetamol, as well as non-pharmacological therapy. Therapy for hypertension can be done by non-pharmacological methods. Non-pharmacologically, patients will be taught deep breathing relaxation techniques. This technique is useful for lowering stress levels and chronic pain because it allows patients to control the body's response to tension and anxiety. By doing deep breathing relaxation techniques, there is a decrease in oxygen consumption, metabolism, respiratory frequency, heart rate, muscle tension, and blood pressure (Anggraini, 2020)

Potter & Perry (2010) explained that passive progressive deep breathing relaxation therapy has many positive benefits for health, including reducing headaches due to hypertension. This technique is part of non-pharmacological stress management, which aims to modify lifestyle (Hamarno, 2010), citing (Schwickert, 2006), stating that progressive muscle relaxation, autogenic exercise, breathing, and visualization are effective relaxation techniques. In particular, deep breath relaxation techniques help calm and harmonize the body, as well as empower individuals to overcome disorders. This technique is done by taking a deep breath, holding it, and exhaling it slowly, which is also useful for increasing lung ventilation and oxygen levels in the blood.

Based on a preliminary study at Day Care Tedakoen Okinawa Japan, it was found that hypertensive clients who experienced the main complaint of neck pain disappeared so that it interfered with the comfort of daily activities. One of the clients, Mrs. Y, complaining of moderate-intensity neck pain that appears when blood pressure increases, shows that hypertension has an impact not only on the physiological condition but also the client's comfort. Pain management in hypertension clients can be done through non-pharmacological approaches that are safe for the elderly, such as music therapy, hypertension gymnastics, and deep breathing relaxation techniques. Deep breath relaxation technique is considered the most practical because it helps reduce sympathetic nerve activity, increases relaxation, and has the potential to lower blood pressure and pain intensity.

METHOD

This research adopts a descriptive case study design with a focus on the nursing care approach. This method was chosen specifically because it was able to provide a deep and comprehensive picture of the implementation of non-pharmacological interventions in the form of deep breathing therapy in hypertensive patients. Through this approach, researchers can document in detail all aspects related to the client's condition, the stages of the intervention process carried out, and evaluate the results obtained thoroughly. Thus, this case study not only describes, but also analyzes in depth the effectiveness and process of the therapy given. The subject used is one of the 89-year-old clients who has a headache caused by hypertension at the Tedakoen Okinawa Japan day care by conducting an assessment on Mrs. Y with the main complaint of the patient saying that he suffered from hypertension since 2018 the client complained of pain.

RESULT AND DISCUSSION

The patient has the identity of Mrs. Y gender female, 89 years old, address Naha. The client is in Day care with the main complaint of neck pain that appears to disappear especially when blood pressure increases. At the beginning of the assessment, the client complained of pain in the back neck area with moderate intensity. Pain is felt to disturb comfort and daily activities. Pain assessment is done using Numeric Rating Scale (NRS) with a range of 0–10. In the initial measurement before the intervention, the pain scale was in the medium category. In addition, the client appears tense in the neck muscles, often massages the nape area, and shows an uncomfortable expression. The intervention in the form of deep breathing relaxation techniques is given for three consecutive days, with a duration of ±10–15 minutes per session. The technique is done by inhaling slowly through the nose, holding for a moment, then exhaling slowly through the mouth. During the execution, the client is directed to be in a comfortable position and focus attention on the breathing pattern.

After the first day of the intervention, the client reported a decrease in pain intensity and felt more relaxed. On the second day, pain complaints decreased and the client stated that sleep was more comfortable. On the third day, the neck pain was almost not felt and the client was able to do activities without significant disturbance. Overall, there is a decrease in the pain scale after being given a deep breathing relaxation technique. In addition, the client looks calmer, the grimacing expression is reduced, and shows increased comfort. This result shows that the deep breathing relaxation technique has a positive impact on reducing pain in hypertensive clients.

Table 1.
Respondent characteristics (n= 1.)

Respondent characteristics	F	%
Age	89 years	100%
Gender	Female	100%
Diagnosis	Hypertension	100%

DISCUSSION

This chapter discusses the difference between theory and practice in the implementation of nursing care comprehensively, which includes the assessment stage, diagnosis formulation, intervention planning, implementation, and evaluation. The discussion focused on a case study of nursing care on a client with hypertension conducted at Day Care Tedakoen, Okinawa, Japan, in 2025. Through this discussion, it is hoped that nursing problems can be analyzed, resolved, and further steps can be found to implement effective and efficient nursing care.

According to the theory listed in SDKI DPP PPNI (2017), there are several nursing diagnoses that may appear in clients with hypertension, including the risk of ineffective cerebral perfusion associated with increased blood pressure, acute pain associated with cerebral and ischemic vascular pressure, and sleep pattern disorders associated with environmental barriers. The three diagnoses are in accordance with the client's condition handled by the writer in the field. The diagnosis of ineffective cerebral perfusion is determined because in hypertensive clients there is a persistent increase in blood pressure that can interfere with blood flow and oxygen supply to the brain tissue. Hypertension causes changes in blood vessels in the form of vasoconstriction and a decrease in blood vessel elasticity which has an impact on the decrease in cerebral perfusion and increases the risk of neurological disorders if not treated immediately. Aderate cerebral perfusion is needed to

maintain metabolic function and neurological activity of the brain. In a state of high and uncontrolled blood pressure, the autoregulation mechanism of cerebral blood flow can be disrupted so that the brain is unable to maintain a stable blood flow. As a result, the supply of oxygen and nutrients to the brain tissue becomes not optimal and increases the risk of cerebral ischemia (Puspa, 2020).

Hartono (2020) stated that this diagnosis is a priority because it is directly related to the vital function of the brain and the safety of the client, and can develop into serious complications such as decreased consciousness and stroke. The diagnosis of acute pain was also established because the client complained of a headache in the back (neak) that disappeared and weighed for two days, accompanied by a grimacing and nervous expression. Acute pain is an unpleasant sensory and emotional experience due to tissue damage or potential tissue damage. This pain usually appears quickly and lasts less than six months. This diagnosis is a priority because unhandled pain will interfere with the client's daily activities, reduce comfort, and slow down the recovery process (Khotimah et al., 2024). The diagnosis of sleep pattern disorder is determined because the client reports difficulty in starting sleep, often waking up at night, and reduced sleep duration due to unconducive lighting. The client also looks sleepy during the day and complains of not sleeping well. Sleep pattern disorder is a condition of changing the quality, quantity, and continuity of sleep that can affect physical and psychological functions. Environmental factors such as light, room temperature, and care activities at night can hinder the sleep process and increase the body's stress response (Nurhikmawati et al., 2024; SDKI, 2017).

After the assessment and diagnosis, the next step is to compile and implement nursing interventions that are tailored to the client's condition and institutional policies. Not all nursing plans are raised, but focused on the main problems experienced by the client. In the diagnosis of the risk of ineffective cerebral perfusion, the intervention carried out is the comprehensive monitoring of vital signs, including blood pressure, pulse, breathing, body temperature, pulse oxymetry, and pulse pressure. In addition, documentation of monitoring results and education is carried out to clients regarding the objectives and results of monitoring. In the diagnosis of acute pain, the intervention carried out is pain management through the assessment of pain characteristics, nonverbal response monitoring, and the provision of non-pharmacological techniques in the form of autogenic relaxation and environmental control. Education about the causes and strategies to reduce pain is also provided, as well as collaboration with the medical team for the administration of analgesics if necessary. In the diagnosis of sleep disorder, intervention in the form of sleep support is carried out by modifying the environment, setting a sleep schedule, reducing stress before bed, and providing education about healthy sleep habits.

Deep breathing relaxation is used as a non-pharmacological intervention in clients with moderate-scale neck pain because this technique focuses on regulating breathing patterns to reduce muscle tension and increase comfort (Potter & Perry, 2019). This technique is done in a sitting position or semifowler for optimal lung expansion (Kozier et al., 2018). The implementation is done by inhaling slowly through the nose, holding for a few seconds, and exhaling slowly through the mouth (Benson & Proctor, 2010). Exercises are done for 10-15 minutes, twice a day, for several days to obtain the maximum relaxation effect (American Pain Society, 2020; Yau & Loke, 2021). The evaluation results showed a decrease in the pain scale from 4 to 3–2 after repeated exercises. On the third day, the pain decreased to a scale of 1 and only appeared during certain activities. This change shows a decrease in neck muscle tension and increased relaxation (Prasetyo et al., 2020).

In addition, the client looks more relaxed, breathing is more regular, and does not experience side effects. Based on these results, deep breathing relaxation is considered effective in reducing the intensity of neck pain and increasing the comfort of hypertensive clients.

CONCLUSION

The results of the case study showed that the application of deep breathing relaxation techniques in hypertensive clients at Day Care Tedakoen for three days had an effective impact on reducing blood pressure and pain. The client's initial blood pressure on the first day was 170/100 mmHg, then after a routine intervention for three days, the blood pressure decreased to 140/80 mmHg on the third day. These results show that deep breathing relaxation techniques contribute to controlling the client's physiological response and increasing comfort. The assessment was conducted on April 1, 2025 at 08.00, and the main complaints were found in the form of headache and dizziness in the neck. Based on data analysis, three nursing diagnoses were established, namely ineffective cerebral perfusion, acute pain, and sleep pattern disorders.

The diagnosis of ineffective cerebral perfusion was confirmed because the client's blood pressure was high (170/100 mmHg) and dizziness complaints that interfered with activity. The diagnosis of acute pain was confirmed because the client complained of heavy neck pain, disappeared, accompanied by a grimacing and restless expression. The diagnosis of sleep disorder was confirmed because the client complained of difficulty in starting sleep and visible dark circles under the eyes.

Nursing interventions are focused on monitoring vital signs, pain management, providing deep breathing relaxation techniques, and sleep support. Implementation includes pain assessment, blood pressure measurement, pulse, breathing, teaching deep breathing relaxation techniques, as well as advice to increase rest time. The evaluation showed a gradual decrease in the scale of pain and blood pressure, namely from NRS 5 and TD 170/100 mmHg on the first day, to NRS 3 and TD 160/80 mmHg on the second day, and NRS 2 and TD 140/80 mmHg on the third day. Thus, deep breathing relaxation techniques are proven to be effective in reducing pain and helping to control blood pressure in hypertensive clients.

REFERENCES

American Pain Society. (2020). Pain management guidelines.

Benson, H., & Proctor, W. (2010). The relaxation response. HarperCollins.

Fathia, R., Putri, D. A., & Sari, M. (2024). The effect of relaxation techniques on pain reduction. Journal of Nursing Care, 12(1), 45–52.

Guyton, A. C., & Hall, J. E. (2017). Textbook of medical physiology (13th ed.). Elsevier.

Hartono, D. (2020). Cerebral perfusion disorders in hypertensive patients. Indonesian Journal of Nursing, 8(2), 110–118.

Hidayat, A., Rahmawati, S., & Putri, N. (2019). Deep breathing relaxation to reduce musculoskeletal pain. Journal of Health Science, 7(1), 20–27.

Khotimah, N., Lestari, A., & Dewi, R. (2024). Pain management in chronic disease patients. Nursing Today, 15(2), 66–74.

Kozier, B., Erb, G., Berman, A., & Snyder, S. J. (2018). Fundamentals of nursing (10th ed.). Pearson.

Nurhikmawati, R., Sari, D., & Hasanah, L. (2024). Sleep pattern disturbance in elderly patients. Journal of Geriatric Nursing, 9(1), 30–38.

Potter, P. A., & Perry, A. G. (2019). Fundamentals of nursing (9th ed.). Elsevier.
Prasetyo, A., Wulandari, T., & Mulyani, S. (2020). Effect of deep breathing on neck pain. Indonesian Nursing Journal, 5(2), 55–62.
Purwanto, H., Lestari, S., & Widodo, A. (2019). Non-pharmacological pain management. Health Nursing Review, 4(1), 15–22.
Rahmawati, I., Sari, F., & Anwar, R. (2021). Relaxation therapy in nursing care. Journal of Clinical Nursing, 10(2), 98–105.
Sari, M., & Wahyuni, T. (2021). Deep breathing relaxation and muscle tension. Journal of Nursing Science, 11(1), 40–48.
SDKI DPP PPNI. (2017). Standar diagnosis keperawatan Indonesia. PPNI.
Susiana, R. (2017). Hypertension and cerebral perfusion. Indonesian Health Journal, 6(3), 90–97.
World Health Organization. (2023). Hypertension.
Yanti, D., Lestari, P., & Arifin, M. (2022). Effect of controlled breathing on stress. Journal of Nursing Intervention, 8(1), 25–33.

THE EFFECT OF PUZZLE THERAPY ON IMPROVING COGNITIVE SKILLS IN ELDERLY PEOPLE WITH DEMENTIA

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ABSTRACT

Dementia is a common problem in the elderly, primarily due to aging and disease. Non-pharmacological interventions such as puzzle therapy are a safe and effective option for managing this condition. To evaluate the implementation of puzzle therapy in nursing care for elderly people with dementia at the Tedakoen nursing home in Okinawa (Japan). This study used a case study of a 92-year-old woman with dementia and cognitive decline. The puzzle therapy intervention was conducted for three consecutive days, with each session lasting 15-30 minutes. There was an improvement in cognitive function in the elderly with dementia. Playing puzzles can reduce the level of dementia in the elderly, so this therapy can be used as an alternative to improve memory in the elderly, as it stimulates the elderly's brain to function and remember. Puzzle therapy has an effect on the cognitive function of the elderly with dementia.

Keywords: dementia; elderly; gerontological nursing; non-pharmacological intervention; puzzle therapy

INTRODUCTION

Elderly is a phase of life that every human being experiences. Although increasing age is accompanied by a decline in organ function, older adults can still lead healthy lives. According to (Darmojo, 2016), one important aspect is changing habits.

Elderly individuals are defined as those who have aged and exhibit physical characteristics such as wrinkled skin, tooth loss, and graying hair. In social life, individuals are no longer able to fulfill their adult roles, such as men who are no longer engaged in productive economic activities, and women who are unable to fulfill household duties. The reactions of individuals entering retirement depend more on their personality traits. Changes that occur in old age lead to decreased bodily functions, including demotion, psychological, cognitive, and social changes in an individual's emotions, and various disorders such as dementia. (Sunaryo, 2022)

Elderly or elderly is the advanced stage of the growth and development process that begins from birth and continues, which is said to be elderly is a person who is over 65 years old. In the elderly, many changes occur, including physical, psychological changes and spiritual changes (Meiner, 2015).

Dementia is a syndrome that disrupts brain function caused by disease and is often long-term or progressively worrisome. Among the various types of dementia, the most common is Alzheimer's dementia, which includes problems with memory, comprehension, calculation, learning, language, and judgment. This syndrome is triggered by Alzheimer's disease, cerebrovascular problems, and other conditions that directly or indirectly affect the brain and is usually characterized by a decline in cognitive function. Often, early symptoms include loss of emotional control, changes in social behavior, or decreased motivation (Nisa, 2016).

According to national statistics from 2015, the median age of Japanese residents was 83 years. The population of 127 million, including 33.5 million elderly people, is 127 million. Okinawa has the

highest average life expectancy in the world at 81.2 years. This figure exceeds the average of 79.9 years in other Japanese prefectures. Furthermore, Okinawa has 400 residents aged over 100 years: 78 for men and 86 for women. Okinawa also has the highest proportion of residents aged over 100 years (5 per 10,000). The life expectancy of Okinawan females in 2015 was 87.44 years. Meanwhile, the life expectancy of Okinawan males was 80.27 years. The average life expectancy in Japan is 80.79 years for men and 87.05 years for women. When compared with other countries such as Switzerland, France, Sweden and the United States, Japan is at the top (Michel Poulain., 2024)

In old age, physical changes are characterized by physical decline, characterized by sagging skin, graying hair, diminishing teeth, increasingly blurred vision, and a less clear sense of sound. As people age, they experience several changes in their lives, such as physical, psychological, and cognitive changes, slow movement, and a disproportionate body shape (Ramli, 2020). Furthermore, psychological changes also occur in the elderly, with behavioral changes due to decreased cognitive function. Mental changes also occur, characterized by decreased cognitive function and depression (Ramli, 2020) In addition, psychological changes occur in the elderly, including behavioral changes due to cognitive decline. Mental changes also occur in the elderly, characterized by cognitive decline and depression. (Ramli, 2020).

Cognitive impairment can be treated with interventions such as puzzle games. Incorporating games into seniors' daily routines can improve cognitive function, making this activity essential. An effective non-pharmacological therapy for dementia is page therapy. Puzzle therapy involves dividing a picture into pieces to sharpen thinking skills, cultivate patience, and foster sharing skills. Puzzles are construction games in which players must assemble or match picture tiles to form meaningful patterns. Cognitive exercises such as puzzle therapy can improve cognitive function in older adults. These exercises stimulate the brain by providing the necessary stimulation to maintain and enhance remaining cognitive functions, which are used to process and interpret questions or information absorbed by the brain.

Furthermore, the brain works to store messages or information received. During old age, constant stimulation can cause brain nerve cells to gradually grow. This results in stronger networks between cells, preventing significant brain decline. Puzzle therapy works on the brain's reading (perception), understanding (comprehension), and analysis (analysis). Furthermore, puzzle therapy activates parts of the brain in the hippocampus and entorhinal cortex by producing the neurotransmitter acetylcholine, which can improve cognition. (Faturrohman, 2024)

The relationship between the influence of puzzle games to improve cognitive function in the elderly as found in research (Flora Sijabat, 2023) Playing puzzles can reduce dementia rates in the elderly, making this therapy a viable alternative for improving memory, as it stimulates the brain's ability to function and remember. Research conducted by (Nur Isnaini, 2020) The results of the study of the elderly at the Sudagaran Banyumas Elderly Social Service Center (PPSLU). The mean MMSE value before the puzzle therapy intervention was 22.83 in the experimental group and 22.33 and the mean MMSE value after the puzzle therapy intervention was 5 times was 28.11 in the experimental group and 22.22 in the control group that was not given puzzle therapy intervention (CPT). The results of the Mann Whitney test in the study. The Asymp.Sig value (Sig 2-tailed) was 0.000 <0.05, meaning that there was an effect of puzzle therapy on the cognitive function of the elderly at the Sudagaran Banyumas Elderly Social Service Center (PPSLU). This research is also

in line with research (Deesirene Rohani Simanulang., 2024) that puzzle therapy is effective in improving cognitive function in the elderly as evidenced by an increase in MMSE scores before and after the implementation of puzzle therapy which was carried out for 5 days with a duration of 15 minutes. Therefore, the author is interested in conducting research on the effect of puzzle therapy on improving cognitive levels in elderly people with dementia. The implementation of puzzle therapy at the Tedakoen nursing home not only focuses on the patient's physical aspects but also emphasizes comfort and a sense of calm, supporting a holistic approach to care.

METHOD

This study design used a qualitative descriptive approach, aiming to provide an in-depth description of nursing care for elderly people with dementia through the implementation of non-pharmacological interventions such as puzzle therapy. This study was chosen because it could provide a comprehensive overview of the patient's condition, the nursing process, and a concrete evaluation of the intervention's outcomes for a single individual. The intervention was conducted once daily for 3 days (15-30 minutes). Activities were conducted every day at 1:00 PM, when the patient was relaxed, ensuring a conducive and safe environment.

RESULT AND DISCUSSION

This chapter provides a comprehensive overview of the nursing care provided to Mrs. CC, a 92-year-old elderly person with dementia at the Tedakoen nursing home in Urasoe, Okinawa, Japan. The approach used aims to provide a comprehensive overview of the effectiveness of puzzle therapy as a non-pharmacological intervention in reducing cognitive decline in the elderly. Data analysis is structured based on the stages of the nursing process, including assessment, diagnosis, intervention, implementation, and evaluation.

Assesment

In the assessment phase, it was found that Mrs. CC said she was unable to remember the information that had been given, and said she was unable to remember behavior that had been done. The MMSE test results were 21. Vital signs examination showed blood pressure: 116/70 mmHg, pulse 68x/minute, temperature: 35.9°C and RR: 96%. This complaint indicates that the severity of cognitive decline increases with age, physical conditions will worsen which can cause problems with physical, psychological, cognitive functions, and even cause dementia. This fact is in accordance with the theory (Nisa, 2016) which states that dementia is characterized by a decline in cognitive function. Often, early symptoms include loss of emotional control, changes in social behavior, or decreased motivation. Thus, Mrs. CC's assessment demonstrates a congruence between clinical evidence and existing theory.

Nursing Diagnosis

Based on the results of the assessment, the author determined several nursing diagnoses for the patient. The primary diagnosis was memory impairment related to neuronal degeneration due to the aging process. In addition, a diagnosis of fall risk related to disorientation and decreased cognitive function, as well as impaired verbal communication related to impaired cognitive function, was also found. The determination of these diagnoses is in accordance with the Indonesian Nursing Diagnosis Standards (SDKI), which explains that dementia is often a problem in the elderly and can cause hereditary problems such as memory impairment, fall risk, and impaired verbal communication. Thus, the diagnosis established for Mrs. CC is in accordance with the theory and reflects the patient's actual condition.

Nursing Intervation

The next stage is nursing intervention. The author developed nursing interventions based on the Indonesian Nursing Intervention Standards (SIKI), focusing on dementia management and environmental safety management. One of the primary interventions chosen was puzzle therapy, an activity involving assembling separate pieces to form a unified picture or model.

Nursing Implementation

The effectiveness of puzzle therapy has been proven in research conducted by h (Nur Isnaini, 2020) which showed a significant difference in MMSE results after puzzle therapy ($0.000 < 0.05$). (Flora Sijabat, 2023) Research also supports the possibility that playing puzzles can reduce dementia rates in the elderly because puzzle therapy can stimulate the elderly's brain. Therefore, the puzzle therapy intervention applied to Mrs. CC aligns with previous research theory and is considered appropriate for addressing cognitive decline in the elderly with dementia.

Evaluation

The final stage is the nursing evaluation. After three days of intervention, Mrs. CC's cognitive decline showed significant improvement. The patient was able to recall newly presented information, with an MMSE score of 25 after the intervention, indicating a good cognitive range. Prior to the intervention, the patient's MMSE score was 21, indicating mild cognitive impairment. This reinforces the (Flora Sijabat, 2023) which proves that puzzle therapy can significantly reduce cognitive decline problems in elderly people with dementia.

Based on this description, it can be concluded that puzzle therapy is an effective, safe, simple, and appropriate non-pharmacological therapy for addressing cognitive decline in elderly people with dementia. Puzzle therapy can improve Memory in the elderly because puzzle therapy can stimulate the brain by providing adequate stimulation can help stimulate the brain so that the ability of cognitive function that still exists can be maintained and improved. The brain will actively receive, process, and interpret incoming images or information and store the information obtained. The facts found in Mrs. CC are in line with previous theories and research, so puzzle therapy is worthy of consideration as a routine nursing intervention in the elderly with cognitive decline in long-term health care facilities.

CONCLUSION

At the assessment stage, data was obtained that the patient was experiencing dementia, which was characterized by forgetfulness, not remembering newly conveyed information, not remembering previous events, and not remembering the names of those closest to him. At the nursing intervention stage, the action plan is based on SIKI with a focus on dementia management and environmental safety management. Puzzle therapy was selected as the primary intervention. During the nursing implementation phase, puzzle therapy was performed routinely once a day for three days, lasting 15-30 minutes. Results showed changes in the patient's ability to remember newly presented information. During the nursing evaluation phase, the cognitive decline gradually resolved, as indicated by an increase in the MMSE score to 25, indicating that the patient's cognitive aspects were in good condition. This demonstrates that puzzle therapy is effective in managing cognitive decline in the elderly. Thus, the specific objectives of the case study, including assessment, diagnosis determination, intervention formulation, implementation and evaluation, have been achieved well.

REFERENCES

Chairina, N. &. (2019). Selamatkan otak kenali gangguan demensia (pikun) menjelang lansia. Universitas malikussaleh, 1-8.

Darmojo, R. &. (2016). Ilmu Kesehatan Usia Lanjut. Jakarta: FK UI Press.

Deesirene Rohani Simanulang., L. P. (2024). Penerapan Terapi puzzle untuk meningkatkan fungsi kognitif pada lansia di panti Werdha Palembang. Jurnal Kesehatan Umum, 255-265.

Dwisetyo, B. (2024). Strategi holistik peningkatan kualitas hidup lansia. Jawa Tengah: Amerta media.

Faturrohman, R. e. (2024). asuhan keperawatan gerontik pada pasien demensia dengan masalah keperawatan gangguan memori menggunakan terapi puzzle. jurnal penelitian keperawatan, 10(1), 9 - 17.

Flora Sijabat, R. S. (2023). Bermain puzzle dalam meningkatkan fungsi kognitif lansia. abdimas mutiara, 56-59.

Gandana, Y. &. (2019). Alat permainan edukatif anak usia dini. Jawa Barat: Ksatria Siliwangi.

Muntasir, D. (2022). Ilmu biomedik dasar. Indonesia: Rizmedia pustaka Indonesia.

Nisa, K. &. (2016). Faktor risiko demensia Alzheimer. jurnal kedokteran universitas lampung, 86-90.

Nur Isnaini, N. K. (2020). Gambaran fungsi kognitif pada lansia dengan pemberian terapi puzzle. Human care, 1060-1066.

Papalia, B. 1. (2014). Human development. Amerika: McGraw Hill Education.

PPNI, T. P. (2016). Standar Diagnosis Keperawatan Indonesia. Jakarta: Dewan pengurus pusat persatuan perawat nasional Indonesia.

PPNI, T. p. (2018). Standar Intervensi Keperawatan Indonesia. Jakarta: Dewan pengurus pusat persatuan perawat nasional Indonesia.

PPNI, T. p. (2022). Standar Luaran Keperawatan Indonesia. Jakarta: Dewan pengurus pusat persatuan perawat nasional Indonesia.

Ramli, R. &. (2020). Faktor yang mempengaruhi fungsi kognitif pada lansia. Window of Nursing Journal, 23-32.

Sunaryo, D. (2022). Asuhan keperawatan gerontik. Yogyakarta: Andi.

CASE STUDY OF NURSING CARE IMPLEMENTATION IN COPD PATIENTS WITH INDEFECTIVE BREATHING PATTERNS AND INDEFECTIVE AIRWAY CLEARANCE

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and manageable chron-ic lung disease that affects both men and women worldwide. Abnormalities in the small airways of the lungs cause limitations in airflow entering and leaving the lungs. COPD is sometimes referred to as emphysema or chronic bronchitis. To evaluate nursing care for COPD patients at Wellness Hospital Okinawa, Japan. This scientific paper used a case study method with a nursing care ap-proach involving two respondents who were treated at Wellness Hospital Okinawa, Japan. Data col-lection was conducted using nursing care documentation, including assessment, diagnosis, inter-vention, implementation, and evaluation. Based on data analysis obtained from the assessment re-sults, good observational and communication skills were required to support the establishment of accurate nursing diagnoses according to the patient's condition. Nursing diagnoses were identified in the patients. Nursing care plays an important role in improving breathing patterns and airway clearance in COPD patients. Appropriate nursing interventions can reduce dyspnea and help im-prove respiratory function, thereby enhancing the patient's quality of life.

Keywords: airway clearance; breathing pattern; COPD; nursing care

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable, and man-ageable chronic lung disease that affects men and women worldwide. Abnormalities in the small airways of the lungs cause limitations in airflow into and out of the lungs. COPD is sometimes referred to as emphysema or chronic bronchitis (Venkatesan, 2023). Emphysema is a condition referring to the damage occurring in the alveoli, whereas chronic bronchitis is a chronic cough that occurs alongside sputum production due to airway inflammation. COPD and asthma share similar symptoms (cough, wheezing, and difficulty breathing), and individuals may have both conditions (WHO, 2022).

Over the next 30 years, the prevalence of COPD is projected to increase, and by 2030, an estimated 4.5 million people will die annually due to COPD. Available data indicate that COPD-related morbidity increases with age and is higher in men compared to women (GOLD, 2023). According to the WHO (World Health Organization), COPD is the third leading cause of death worldwide, causing 3.23 million deaths in 2019. Nearly 90% of COPD deaths in those under 70 years of age occur in Low- and Middle-Income Countries (LMICs) (WHO, 2022).

METHOD

This scientific paper utilizes a case study method with a nursing care approach in-volving two respondents treated at Wellness Okinawa Hospital, Japan. Data collection was conducted using a nursing care format, which includes assessment, diagnosis, intervention, implementation, and evaluation.

RESULT AND DISCUSSION

The results of nursing care for Mr. I, a patient with Chronic Obstructive Pulmonary Disease (COPD), showed an improvement in his condition after nursing interventions were carried out for 3 × 24 hours. During the initial assessment on February 1, 2025, the patient experienced an ineffective breathing pattern, characterized by the use of accessory muscles for breathing, a respiratory rate of 28 breaths per minute (tachypnea), and an oxygen satura-tion (SpO_2) of 94%. The patient was also using a nasal cannula with an oxygen flow of 4 liters per minute.

On February 5, 2025, an ineffective airway clearance was identified, characterized by airway hypersecretion, rhonchi (+/+), the patient's inability to cough effectively, a de-creased level of consciousness with a GCS score of 13 (E3M6V), a respiratory rate of 28 breaths per minute, and an oxygen saturation of 94%.

After implementing nursing interventions—which included respiratory monitoring, airway management, semi-Fowler positioning, breathing exercises, education, and collabo-ration in medical therapy—the evaluation results showed an improvement in the patient's condition. The respiratory rate became more regular, the use of accessory breathing muscles decreased, dyspnea subsided, coughing became more effective, and sputum production was reduced. Consequently, the nursing outcomes of improved breathing patterns and improved airway clearance were achieved in accordance with the established outcome criteria.

The improvement in Mr. I's condition is closely related to the imple-mentation of appropriate and continuous nursing interventions. In COPD patients, ineffec-tive breathing patterns and ineffective airway clearance frequently occur due to airflow lim-itation, increased secretion production, and decreased lung elasticity. Therefore, the primary focus of nursing care is to maintain airway patency and enhance ventilation effectiveness.

The administration of the semi-Fowler position has been proven to help increase lung expansion and reduce the work of accessory breathing muscles, thereby making the patient's respiratory rate and depth more adequate. Furthermore, breathing exercises such as deep breathing and effective coughing techniques play a vital role in assisting secret mobi-lisation, resulting in an improvement in airway clearance.

Regular respiratory monitoring—including respiratory rate, breath sounds, and oxy-gen saturation—enables nurses to evaluate the patient's response to the interventions pro-vided. Collaboration in administering oxygen therapy, bronchodilators, and expectorants also supports the success of nursing care by helping to improve ventilation and reduce air-way obstruction.

The results of this study are consistent with nursing theory and previous research findings, which state that structured and comprehensive nursing interventions can improve respiratory function and the quality of life for COPD patients. Thus, nursing care plays a vital role in the management of COPD patients with impaired breathing patterns and airway clearance.

Assessment

A nursing assessment was conducted on Mr. Ishikawa, a patient with a medical diagnosis of Chronic Obstructive Pulmonary Disease (COPD) who was admitted to Okinawa Wellness Hospital, Japan, on February 15, 2025. The patient was born on December 1, 1973, and was 52 years old at

the time of the assessment. The patient is from Itoman, Okinawa, Japan, and has been receiving treatment at Okinawa Wellness Hospital for approximately 5 years.

The patient's primary complaint at the time of the assessment was a decreased level of consciousness. Based on his current medical history, the patient complained of shortness of breath, especially during light activity, accompanied by a cough with thick white phlegm that occurs more frequently in the morning. The patient complained of early fatigue and experienced decreased nutritional intake due to feeding through an NGT (Nasogastric Tube), leading to continuous weight loss during his treatment. Dyspnea was felt to be worsening at night and during cold weather.

The patient's past medical history indicates a history of heavy smoking for 15–20 years (packs per day). The patient ceased smoking after being treated at Wellness Okinawa Hospital due to his worsening shortness of breath. The patient has no history of pulmonary tuberculosis, and there is no family history of similar conditions.

Upon general examination, the patient appeared weak, severely underweight (ca-chexia), with dry skin, low energy, and required assistance with daily activities. The pa-tient's level of consciousness during the assessment was compos mentis (GCS 15). Vital signs showed a blood pressure of 130/70 mmHg, a heart rate of 76 beats per minute, a res-piratory rate of 28 breaths per minute, a body temperature of 36.7°C, and an oxygen satura-tion (SpO_2) of 94%. The patient stated that they were not experiencing any pain. Functional status based on the Barthel Index showed a score of 0, indicating severe dependence in activities of daily living (ADL).

Physical examination of the head and neck showed general conditions within normal limits. The head appeared clean with white, graying hair that was evenly distributed. Eye examination revealed white sclera, pink conjunctiva, clear cornea, isochoric pupils, and good light reflexes. Nasal examination showed nasal flaring during respiration, a midline nasal septum, clean nostrils, and the application of a nasal cannula with an oxygen flow of 4 liters/minute. Oral cavity examination revealed dry lips and mucosa, a pink tongue, and a midline uvula. Ear examination showed symmetrical auricles, clean ear canals, and good hearing. Based on the results of the assessment, the main nursing problems found in the patient were ineffective breathing patterns and ineffective airway clearance related to the COPD condition experienced by the patient.

Nursing Diagnosis

Based on the nursing assessment conducted, two primary nursing diagnoses were identified in patients with Chronic Obstructive Pulmonary Disease (COPD). The first nurs-ing diagnosis is 'Ineffective Breathing Pattern' related to decreased energy, characterized by dyspnea, increased respiratory rate (RR 28 breaths/minute), and the use of accessory breath-ing muscles. This condition indicates a disturbance in the respiratory mechanism, resulting in the patient's inability to maintain an adequate breathing pattern.

The second nursing diagnosis is 'Ineffective Airway Clearance' related to airway hy-persecretion, characterized by an ineffective cough, production of thick white sputum, pres-ence of adventitious breath sounds (rhonchi), and dyspnea. This condition indicates the pa-tient's inability to optimally clear secretions from the airway, which potentially exacerbates the respiratory impairment. These two nursing diagnoses are the top priorities in the plan-ning and implementation of nursing care, as they are directly related to meeting the patient's oxygenation needs.

Nursing Intervensions

Nursing interventions were developed based on the established nursing diagnoses, with the goal of improving respiratory function and maintaining the patient's airway clearance.

1. Interventions for Ineffective Breathing Pattern.

   Nursing interventions for the diagnosis of Ineffective Breathing Pattern focused on efforts to improve ventilation and reduce the patient's work of breathing. The nursing actions per-formed included monitoring the frequency, rhythm, and depth of breath, as well as observ-ing the use of accessory breathing muscles. The patient was placed in a semi-Fowler or high-Fowler position to facilitate lung expansion and alleviate dyspnea. Fowler position to maximize lung expansion and ease the breathing process. In addition, nurses provided education and guidance on the pursed-lip breathing technique to help control breathing and reduce dyspnea. Nurses also monitored oxygen satu-ration and collaborated in the administration of oxygen and pharmacological therapies as medically indicated, such as bronchodilators and mucolytics.

2. Interventions for Ineffective Airway Clearance

   Nursing interventions for the diagnosis of Ineffective Airway Clearance aim to assist the patient in clearing secretions and maintaining airway patency. The actions performed include monitoring sputum characteristics (amount, color, and consistency) and auscultat-ing breath sounds to detect any adventitious lung sounds.

Nursing Implementation

Nursing implementation was carried out according to the nursing care plan devel-oped based on the nursing diagnoses of the COPD patient. The nursing actions were per-formed gradually and continuously over 3 × 24 hours of care. For the diagnosis of 'Ineffec-tive Breathing Pattern', nurses conducted follow-up assessments by monitoring the frequen-cy, rhythm, depth, and effort of the patient's breathing, as well as observing the use of ac-cessory muscles. The patient was placed in a semi-Fowler position to improve lung expan-sion and facilitate the breathing process. Nurses also monitored oxygen saturation periodi-cally and ensured the administration of oxygen via nasal cannula according to the therapeu-tic program. Additionally, nurses provided education and guidance on the pursed-lip breath-ing technique and assisted the patient during breathing exercises to reduce dyspnea. on the diagnosis of Ineffective Airway Clearance, the nurse performed airway management, which included monitoring sputum characteristics, auscultating breath sounds, and assisting the patient with effective coughing techniques and chest physiotherapy. monitored sputum characteristics, including amount, color, and consistency, and performed lung auscultation to detect the presence of rhonchi. The nurse provided effective coughing exercises and as-sisted the patient in expelling secretions. If secretions were difficult to expectorate, the nurse performed suctioning according to indications and standard procedures. Additionally, the patient was encouraged to increase fluid intake, provided there were no contraindica-tions, to help thin the secretions.

Evaluation

Nursing evaluation was conducted following 3 × 24 hours of nursing care for the COPD patient. The evaluation results showed an improvement in the patient's respiratory condition. For the diagnosis of 'Ineffective Breathing Pattern', the results indicated that the patient's respiratory rate became more regular, the use of accessory breathing muscles de-creased, and complaints of dyspnea were reduced compared to the initial condition. The pa-tient was able to follow and perform pursed-lip breathing exercises more effectively. The patient's oxygen saturation remained

within the normal and stable range according to the established target, indicating that the patient's breathing pattern has improved.

For the diagnosis of 'Ineffective Airway Clearance', the evaluation showed that spu-tum production decreased, secretions became easier to expel, and adventitious breath sounds such as rhonchi diminished. The patient demonstrated an improved ability to per-form effective coughing, and no signs of respiratory distress were observed during the eval-uation. Overall, the evaluation results indicated that the nursing care goals were largely achieved, as evidenced by the improvement in both the patient's breathing pattern and air-way clearance. Consequently, nursing interventions can be continued and adjusted to the patient's current condition to maintain and further enhance their respiratory status.

CONCLUSION

Based on the case study results of the implementation of nursing care for Chronic Obstructive Pulmonary Disease (COPD) patients with ineffective breathing patterns and in-effective airway clearance at Wellness Okinawa Hospital, Japan, it can be concluded that the nursing care provided comprehensively, were able to improve the patient's respiratory condition. The application of appropriate nursing interventions, such as respiratory monitor-ing, positioning, breathing exercises, effective coughing, and collaborative medical therapy, showed results in the form of reduced dyspnea, improved breathing patterns, and enhanced airway clearance. Consequently, the nurse's role is vital in improving the respiratory func-tion and quality of life for COPD patients through the implementation of systematic and continuous nursing care.

REFERENCES

Global Initiative for Chronic Obstructive Lung Disease (GOLD). (2023). Global strategy for the di-agnosis, management, and prevention of chronic obstructive pulmonary disease.

Smeltzer, S. C., Bare, B. G., Hinkle, J. L., & Cheever, K. H. (2018). Brunner & Suddarth's textbook of medical-surgical nursing (14th ed.). Philadelphia: Wolters Kluwer.

World Health Organization. (2022). Chronic obstructive pulmonary disease (COPD).

PPNI. (2017). Standar Diagnosis Keperawatan Indonesia : Definisi dan Indikator Diagnostik (TIM Pokja SDKI DPP PPNI, Ed.; Edisi 1). DPP PPNI.

Safitri, R. (2019). Implementasi Keperawatan Sebagai Wujud Dari Perencanaan Keperawatan Guna Meningkatkan Status Kesehatan Klien. Journal Keperawatan, 3(42), 23–26.

Lindayani, L. P., Tedjamartono, & Dharma, T. (2017). Praktik Belajar Lapangan Penyakit Paru Ob-struktif Kronik (PPOK). Pedoman Diagnosis & Penatalaksanaan Di Indonesia, 1302006137, 32.

American Thoracic Society. (2020). Standards for the diagnosis and management of patients with COPD.

European Respiratory Society. (2019). ERS Guidelines on Chronic Obstructive Pulmonary Disease.

Lewis's Medical-Surgical Nursing. (2020). Elsevier.

Centers for Disease Control and Prevention. (2022). Chronic Obstructive Pulmonary Disease (COPD).

National Heart Lung and Blood Institute. (2021). COPD Clinical Guidelines.

Kozier & Erb's Fundamentals of Nursing. (2021). Pearson Education.

Perhimpunan Dokter Paru Indonesia. (2021). Pedoman Diagnosis dan Penatalaksanaan PPOK di Indonesia.

Journal of Clinical Nursing. (2020). Nursing interventions for COPD patients: Evidence-based review.

National Institute for Health and Care Excellence. (2019). COPD Management Guideline (NICE Guideline NG115).