Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (1-10)
e-ISSN 2477-8184
p-ISSN 1858-0610
http://doi.org/10.31101/jkk.3691

Original Research Paper

Attitudes towards patient safety culture among pediatric nurses at government tertiary hospital in Vietnam

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Submitted: January 8, 2024 Revised: March 10, 2024 Accepted: June 5, 2024

Abstract

Pediatric patients are vulnerable to medication errors. Nurses have essential roles in patient safety and their quality of care. Therefore, nurses' attitudes regarding safety culture help nurses gain a profound insight into patient safety problems as well as potential solutions to cope with them. Motivating nursing professionals to understand safety culture and how they act about patient safety is one of the first steps to improving patient safety in healthcare institutions. This study aims to investigate attitudes towards patient safety culture among pediatric nurses and related factors. A cross-sectional descriptive correlational design was used with a sample size of 105 pediatric nurses at a selected government hospital in the Mekong Delta, Vietnam. Nurses' attitudes towards patient safety culture were examined using a 4-likert questionnaire including 30 items divided into six subscales. Data analysis was performed in SPSS Version 26.0 using descriptive statistics and analysis of variance (ANOVA). The study findings showed that the overall mean score of attitude towards patient safety culture was 3.30 (SD = 0.45). Among subscales of attitudes, teamwork climate had the lowest mean scores. There were statistically significant associations between the level of education, experience, and nurses' attitudes. According to the results, nurses' attitudes regarding patient safety culture were good. However, there were some aspects that should be enhanced. It is strongly recommended that specific training interventions be performed to enhance the teamwork climate in the hospital.

Keywords: attitude; patient safety; pediatric nurses; safety culture; Vietnamese

1. Introduction

Patient safety aims to prevent and reduce risks, errors, and harm that occur to patients during the provision of health care (Mueller et al., 2019; Vaismoradi et al., 2020). It is a global issue, not only among developing countries but also in developed countries (Sonğur et al., 2018). In terms of nursing care, it is one of the central elements of providing care services among healthcare organizations. In addition, patient safety remains an important challenge for quality improvement in all health systems, especially in developing countries (Elmontsri et al., 2018; Harrison et al., 2015). Lack of safe care kills and harms millions of people each year. It also exerts a great economic cost on health systems and society, consuming valuable resources that could be put to productive use elsewhere (O'Dowd, 2018).

One of the major factors in improving patient safety in hospitals is compliance with the patient safety culture. Leadership, teamwork, safety climate, job satisfaction, emotional exhaustion, stress recognition, and working conditions were identified as critical factors impacting the patient safety culture (Brooks Carthon et al., 2019; Salih et al., 2021). Enhancing patient safety culture is an essential objective in the establishment of clinical governance as well as nursing leadership. Nurses who have

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essential roles in patients' recovery and health strongly contribute to patient-centered care, patient safety, and quality of care (Cathro, 2016; Gaffney et al., 2016). Their awareness and perception regarding safety culture help them have a profound insight into patient safety problems as well as potential solutions to cope with them. Motivating nursing professionals to understand safety culture and how they act about patient safety is one of the first steps to improving patient safety in health care institutions (Alaqeli & Altarhuni, 2021).

Healthcare organizations with a positive safety culture are distinguished by mutual trust-based communication, shared perceptions of the importance of safety, trust in the efficacy of preventive measures, positive beliefs about how things work in the organization, and the interaction of these with work units and organizational structures, as well as systems that produce behavioral norms in healthcare organizations that promote patient safety (Wu et al., 2022). Besides, safe services have become a focus of nursing leaders at all levels within the healthcare system, and leadership is one of the major predictors of safety culture.

The evaluation of attitudes is a reliable measure for assessing the efficacy of patient safety programs. Studies on the evaluation of patient safety culture in several countries show an overarching composite score for patient safety culture that spans from 12.4% to 48% (Camacho-Rodríguez et al., 2022; Konlan & Shin, 2022), indicating the necessity for enhancements. Several previous studies have discussed nurses' attitudes towards patient safety culture, but they are more directed towards nurses in emergency care unit, intensive care unit or nurses in general (Aydemir & Koç, 2023; Durgun & Kaya, 2018; Farzi et al., 2017; Saberi et al., 2017; Salih et al., 2021). Unfortunately, there is a lack of examination of pediatric nurses' attitudes towards patient safety culture. Even though pediatric patients are vulnerable to medication errors.

Previous studies in several countries have shown high rates of medication errors in pediatric patients ranging from 41.8% to 72% (Bante et al., 2023; Baraki et al., 2018; Brennan-Bourdon et al., 2020; Feleke et al., 2015; Feyissa et al., 2020). Meanwhile, Khan et al. (2016) also found that the medical error rate and avoidable adverse events in hospitalized children are 6.0 per 100 admissions and 1.8 per 100 admissions, respectively. Medical errors caused pediatric patients to stay in the hospital longer and were more likely to have metabolic or neuromuscular disorders (Khan et al., 2016). Vietnam has proven that it is committed to providing its citizens with safe, high-quality healthcare services. One of the forms of their commitment is the issuance of Circular 43/BYT/2018, "Guideline for prevention of medical adverse events in health care facilities.", by the Vietnam Ministry of Health. The guidelines seek to create a healthcare setting in which medical errors are recognized, examined, reported, and addressed to prevent occurrence in the future (World Health Organization, 2019). Therefore, this study aims to investigate attitudes towards patient safety culture among pediatric nurses and related factors.

2. Research Methods

A descriptive cross-sectional design was used in this study. The study was conducted at a government tertiary hospital in the Mekong Delta. A sample of 105 respondents was randomly selected from a group of nurses working in government pediatric hospitals in the Mekong Delta, Vietnam, based on inclusion criteria including (1) working full-time to care for pediatric patients, (2) having experience as a pediatric nurse for at least 6 months, and (3) being willing to participate in the study.

The instruments used in this study are (1) Demographic Questionnaire: nursing participants' demographic data was collected by using a self-report questionnaire, including information on age, gender, level of education, and experience in years; (2) Nurses' attitudes toward patient safety culture: were examined by using the Safety Attitude Questionnaire (the SAQ). The scale included 30 items and was developed by (Sexton et al., 2006) for measuring healthcare workers's safety attitudes. Its subscales included teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of

management, and working conditions (Sexton et al., 2006). The responses for each item were reflected on a Likert scale from 1 (strongly disagree) to 4 (strongly agree). The overall domain score was calculated by summing all the items in each domain and then dividing by the number of items. The higher scores indicated a more positive assessment regarding safety culture. The original instrument in English was adapted and translated into Vietnamese by using the back-translation method. Then, the questionnaire was distributed to 30 nurses who had the same characteristics as the study participants for the pilot study. By using 30 nurses who had the same characteristics as the sample to complete the translated questionnaires to check the language understanding of the subjects. Accomplishment of the questionnaires took approximately 10 minutes. The reliability of Vietnamese versions of questionnaires was also tested. In this study, the internal consistency reliability was 0.90.

To achieve the objectives of the current study, the data were analyzed using Statistical Package for Social Science (SPSS) version 26.0. Descriptive statistics in terms of frequency, percent, mean, standard deviation, and range were used to examine demographic characteristics and attitudes towards patient safety culture among nursing respondents. A One-way ANOVA test was used to determine relationships between nurses' safety attitudes and related factors. Statistical significance was considered at lower than 0.05. The study was approved by the Ethical Review Board before data gathering (Decision No. TUA.IERC.015.R02 August 12, 2022). Written informed consent was obtained from the nurses, and the participants were assured of their anonymity.

3. Results and Discussion

3.1.Characteristics of Respondent

The mean age among respondents was 31.1±4.4 years. Most of the participants were female (72.4%). The nursing profession is a female-dominated profession (Berkery et al., 2014). The nursing profession is more suitable for women (S. Cho & Jang, 2021; Sasa, 2019), because women are considered more feminine and motherly and have a high sense of empathy that suits this profession. Half of the study participants hold a bachelor's degree in nursing (55.2%) and have 5 to 10 years of experience as nursing professionals (41.0%).

3.2.Attitudes Toward Patient Safety Culture Among Pediatric Nurses

Pediatric nurses had high mean attitudes toward patient safety culture scores of 3.30/4.00 (SD = 0.45). Among the subscales, stress recognition had the highest score, while teamwork climate and working conditions had the lowest (Table 1).

Table 1. Attitude Toward Patient Safety Culture Among Pediatric Nurses

	Number of items	Mean	S.D.
Attitude toward patient safety culture	30	3.30	0.45
Subscales			
Teamwork climate	6	3.14	0.57
Safety climate	7	3.29	0.51
Job satisfaction	5	3.29	0.58
Stress recognition	4	3.48	0.45
Perceptions of management	4	3.45	0.50
Working conditions	4	3.27	0.54

Source: Primary Data, 2023

Table 2 shows that most nursing participants agreed that stress recognition strongly affected their working performance. Meanwhile, there was a lack of support and teamwork in caring for patients, as well as coordination between nurses and physicians in the clinical environment (Table 3).

Table 2. The Highest Mean Scores Of Nurses' Attitudes Toward Patient Safety Culture

No	Dimensions	Mean	S.D.
1	Fatigue impairs my performance during emergency situations (e.g., emergency resuscitation, seizure)	3.52	0.57
2	Hospital management does not knowingly compromise the safety of patients	3.52	0.52
3	I am less effective at work when fatigued	3.50	0.56
4	I am provided with adequate, timely information about events in the hospital that might affect my work	3.48	0.64
5	I am more likely to make errors in tense or hostile situations	3.46	0.62
6	When my workload becomes excessive, my performance is impaired	3.45	0.60
7	Trainees in my discipline are adequately supervised	3.44	0.50

Source: Primary Data, 2023

Table 3. The lowest mean scores of nurses' attitudes toward patient safety culture

No	Dimensions	Mean	S.D.
1	I have the support I need from other personnel to care for patients	2.48	0.95
2	In this unit, it is easy to discuss errors.	2.94	0.90
3	In this unit, it is easy to speak up if I perceive a problem with patient care	3.07	0.85
4	This hospital does a good job of training new personnel	3.11	0.64
5	The physicians and nurses here work together as a well-coordinated team	3.18	0.77
6	This hospital constructively deals with problem physicians and employees	3.21	0.71

Source: Primary Data, 2023

Patient safety has been a major healthcare challenge since incidents have received increased attention in recent years. It is the shared attitudes, beliefs, values, and assumptions that underlie how people perceive and act upon safety issues within their organizations. Patients could receive safer care, fewer medical errors, fewer days of hospitalization, and better outcomes when nurses had a high level of attitude regarding safety. Our study indicated a high mean score of attitudes towards patient safety culture among pediatric nurses (mean = 3.30/4.00). This finding is relevant to previous studies. According to Salih et al. (2021), the mean score of attitudes regarding patient safety among nurses was 3.00/4.00 among the participants (Salih et al., 2021). Consistently, a descriptive cross-sectional study conducted with 386 registered nurses working at the University of Gondar specialized hospital indicated that 56.1% of the respondents had a favorable attitude regarding patient safety (Biresaw et al., 2020).

Similarly, the findings from a study by Moda et al. (2021) showed a high score and positive mean in nurses' attitudes regarding patient safety culture. They also revealed that developing positive attitudes of safety culture in healthcare organizations was an important pillar, as it strives to eliminate the factors that contribute toward the management of mental and physical exhaustion, medical errors, patient harm, unsafe conditions, and the enhancement of overall patient safety (Moda et al., 2021). When we

considered the mean score among domains of safety culture, the domain of stress recognition had the highest score, while teamwork climate and work conditions had the lowest. The difference between the mean scores among these subscales might come from the requirement to achieve these dimensions.

Research conducted by (Kanneganti et al., 2022) in 23 hospitals in four countries (Indonesia, Singapore, India, and Malaysia) found a significant correlation among poor safety attitudes with shifts lasting longer than 12 hours, fatigue, and depression. Fatigue is correlated with mental health problems, decreased cognitive function, as well as a loss of focus and alertness. It has been linked to lower patient safety and subpar nursing performance (Bell et al., 2023; H. Cho & Steege, 2021). Factors that contribute to fatigue in nurses are aspects of workload, shift work, such as disruptions to the circadian cycle, nurse shift length, and overtime (Bell et al., 2023; Jarrar et al., 2019). As a nurse, especially a nurse working in a stressful environment such as hospitals, being aware of occupational stress and how nurses performances in stressful working environments are influenced by occupational stressors is a common requirement, and most nurses prepare themselves for that. It will need a few interventions to help this situation. This includes promoting a healthy lifestyle through health programmes, enhancing work-life balance, and creating stress management programmes.

Effective teamwork is a complex process that requires more practice and effort not only from nurses but also from other healthcare workers, especially physicians (Alzahrani et al., 2019). Our findings indicate the importance of creating a culture of safety and teamwork climate to improve nurses' satisfaction and retention as well as patient outcomes in hospitals. The nurse managers need to identify the aspects requiring qualifications in order to aggregate actions with the potential to improve safety culture for staff and safety care for patients. Besides, when referring to the score of each item, we found that the weakest component of the teamwork climate domain is "I have the support I need from other personnel to care for patients", with the lowest mean score. The reason might come from the gap of cooperation in healthcare institutions.

Patient care has become increasingly complex as healthcare units strive to meet the full spectrum of patient needs. This can be challenging for healthcare workers to adapt to. In that stressful situation, anxiety, depression, aggressiveness, narcissism, and current events influencing mood, attitude, and actions also contribute to ineffective communication and sharing. It might proceed to decrease the amount of support among healthcare workers (Berry et al., 2020; Kairytė et al., 2022). According Thu et al. (2023), there is a need for improvement in two areas: organizational learning and communication openness. These two areas are closely linked to the culture of patient safety and knowledge sharing among healthcare providers.

With all that is discussed in this study, working as a well-coordinated team among nurses at pediatric hospitals is an issue that needs to be improved. Moreover, cultural background, organizational policy, and leadership are also correlated with the enhancement of the safety climate in healthcare institutions. These reasons might explain the different mean scores on these dimensions of self-assessed safety culture among pediatric critical care nurses in selected government tertiary hospitals. Based on this result, the improvement of work conditions, collaboration, and collegiality in order to secure support from other personnel to care for patients should be considered.

3.3.Factors Related To Attitudes Toward Patient Safety Culture Among Pediatric Nurses

The results revealed that there was no association between gender and attitudes towards patient safety culture among pediatric nurses ($p>0.05$). The level of education was significantly associated with safety attitudes among nurses. These findings were shown in Table 4. Besides, the finding of the one-way ANOVA test indicated that experience in year was related to attitudes towards patient safety culture among nursing participants, with the p-value of 0.003 (Table 5).

Table 4. Associations Between Gender, Level of Education, and Attitudes Towards Patient Safety Culture Among Pediatric Nurses

Variables		Attitudes towards patient safety culture	p-value One-way ANOVA
Gender	Male (n=29)	3.32+0.37	0.83
	Female (n=76)	3.30+0.47	
Level of education	Intermediate (n=8)	2.98+0.45	0.006
	College (n=27)	3.13+0.43	
	Bachelor (n=58)	3.41+0.42	
	Postgraduate (n=12)	3.41+0.44	

Source: Primary Data, 2023

Table 5. Association Between Experience in Year And Attitudes Towards Patient Safety Culture Among Pediatric Nurses

Variables		Attitudes towards patient safety culture	p-value
Experience in year	<3 years (n=11)	2.68+0.15	0.003 (ANOVA)
	3-5 years (n=21)	3.17+0.44	
	5-10 years (n=41)	3.27+0.44	
	>10 years (n=32)	3.47+0.40	

Source: Primary Data, 2023

In the present study, there were statistically significant associations between nurses' attitudes regarding patient safety culture and their level of education as well as their experience in year. In other words, pediatric nurses' attitudes regarding patient safety culture were different among groups by level of education and experience. Meanwhile, there was no relationship between gender and safety attitudes among nurses.

The relationships between safety attitudes among nurses and levels of education and experience were also revealed in previous studies. A study conducted by 350 nurses working at a university hospital in Egypt indicated that educational level and experience were the main factors related to patient safety attitudes, while gender had no significant association with the attitudes (Salih et al., 2021). Compared to less experienced healthcare practitioners, experienced healthcare providers exhibit greater attitudes towards patient safety (Bottcher et al., 2019; Elsous et al., 2017; Jarrar et al., 2020). This result was similar to that of (Al-Mugheed et al., 2022), who found that younger nurses had lower scores of safety attitudes than those who had more experience.

Nurses' professional characteristics, including education and experience, as well as nursing systems that pertain to staffing levels, have an impact on the quality of care they provide. For example, it is thought that having a larger percentage of baccalaureate-degree holders among registered nurses (RNs) in hospitals will help with effective adverse event detection and prevention because these RNs will have greater knowledge, more effective communication skills, and the capacity to monitor patients (Audet et al., 2018; Liao et al., 2016). In the same way, more experience is considered to expose RNs to a variety of patient situations and clinical scenarios that foster the growth of knowledge, technical proficiency, and critical thinking. These factors are also thought to have an impact on how well nurse surveillance works (Audet et al., 2018; Stalpers et al., 2015). In addition to nurse characteristics, some factors that play a role in quality of care are the workplace environment, including the physical environment, communication and collaboration systems, and related support services (Malinowska-Lipień et al., 2021).

4. Conclusion

In the present context, most of the pediatric nurses had a high mean score of attitudes towards patient safety culture. However, work conditions and teamwork in caring for patients should be enhanced. Workload calculations also need to be considered to prevent burnout in nurses. Continued education and training towards patient safety need to be provided, especially for young nurses and nurses with intermediate or college diplomas. Furthermore, our findings make it particularly important to design specific interventions to enhance the work conditions and teamwork climate in clinical institutions.

Acknowledgements

We would like to thank all nurse participants in this study. Our thanks also go to Trinity University of Asia and Can Tho University of Medicine and Pharmacy, Viet Nam, for their support and contribution.

References

Alaqeli, E., & Altarhuni, A. (2021). Assessment of Patient Safety Culture at intensive care units in public hospitals in Benghazi from the health care professional's perspective | AlQalam Journal of Medical and Applied Sciences. AlQalam Journal of Medical and Applied Sciences, 4(2). https://www.ajol.info/index.php/ajmas/article/view/218338

Al-Mugheed, K., Bayraktar, N., Al-Bsheish, M., AlSyouf, A., Jarrar, M., AlBaker, W., & Aldhmadi, B. K. (2022). Patient Safety Attitudes among Doctors and Nurses: Associations with Workload, Adverse Events, Experience. Healthcare (Basel, Switzerland), 10(4), 631. https://doi.org/10.3390/healthcare10040631

Alzahrani, N., Jones, R., Rizwan, A., & Abdel-Latif, M. E. (2019). Safety attitudes in hospital emergency departments: A systematic review. International Journal of Health Care Quality Assurance, 32(7), 1042–1054. https://doi.org/10.1108/IJHCQA-07-2018-0164

Audet, L.-A., Bourgault, P., & Rochefort, C. M. (2018). Associations between nurse education and experience and the risk of mortality and adverse events in acute care hospitals: A systematic review of observational studies. International Journal of Nursing Studies, 80, 128–146. https://doi.org/10.1016/j.ijnurstu.2018.01.007

Aydemir, A., & Koç, Z. (2023). Patient safety culture and attitudes among emergency care unit nurses in Türkiye. Eastern Mediterranean Health Journal = La Revue De Sante De La Mediterranee Orientale = Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit, 29(3), 195–204. https://doi.org/10.26719/emhj.23.026

Bante, A., Mersha, A., Aschalew, Z., & Ayele, A. (2023). Medication errors and associated factors among pediatric inpatients in public hospitals of gamo zone, southern Ethiopia. Heliyon, 9(4), e15375. https://doi.org/10.1016/j.heliyon.2023.e15375

Baraki, Z., Abay, M., Tsegay, L., Gerensea, H., Kebede, A., & Teklay, H. (2018). Medication administration error and contributing factors among pediatric inpatient in public hospitals of Tigray, northern Ethiopia. BMC Pediatrics, 18(1), 321. https://doi.org/10.1186/s12887-018-1294-5

Bell, T., Sprajcer, M., Flenady, T., & Sahay, A. (2023). Fatigue in nurses and medication administration errors: A scoping review. Journal of Clinical Nursing, 32(17–18), 5445–5460. https://doi.org/10.1111/jocn.16620

Berkery, E., Tiernan, S., & Morley, M. (2014). The relationship between gender role stereotypes and requisite managerial characteristics: The case of nursing and midwifery professionals. Journal of Nursing Management, 22(6), 707–719. https://doi.org/10.1111/j.1365-2834.2012.01459.x

Berry, J. C., Davis, J. T., Bartman, T., Hafer, C. C., Lieb, L. M., Khan, N., & Brilli, R. J. (2020). Improved Safety Culture and Teamwork Climate Are Associated With Decreases in Patient Harm and Hospital Mortality Across a Hospital System. Journal of Patient Safety, 16(2), 130–136. https://doi.org/10.1097/PTS.0000000000000251

Biresaw, H., Asfaw, N., & Zewdu, F. (2020). Knowledge and attitude of nurses towards patient safety and its associated factors. International Journal of Africa Nursing Sciences, 13, 100229. https://doi.org/10.1016/j.ijans.2020.100229

Bottcher, B., Abu-El-Noor, N., Abuowda, Y., Alfaqawi, M., Alaloul, E., El-Hout, S., Al-Najjar, I., & Abu-El-Noor, M. (2019). Attitudes of doctors and nurses to patient safety and errors in medical practice in the Gaza-Strip: A cross-sectional study. BMJ Open, 9(8), e026788. https://doi.org/10.1136/bmjopen-2018-026788

Brennan-Bourdon, L. M., Vázquez-Alvarez, A. O., Gallegos-Llamas, J., Koninckx-Cañada, M., Marco-Garbayo, J. L., & Huerta-Olvera, S. G. (2020). A study of medication errors during the prescription stage in the pediatric critical care services of a secondary-tertiary level public hospital. BMC Pediatrics, 20(1), 549. https://doi.org/10.1186/s12887-020-02442-w

Brooks Carthon, J. M., Hatfield, L., Plover, C., Dierkes, A., Davis, L., Hedgeland, T., Sanders, A. M., Visco, F., Holland, S., Ballinghoff, J., Del Guidice, M., & Aiken, L. H. (2019). Association of Nurse Engagement and Nurse Staffing on Patient Safety. Journal of Nursing Care Quality, 34(1), 40. https://doi.org/10.1097/NCQ.0000000000000334

Camacho-Rodríguez, D. E., Carrasquilla-Baza, D. A., Dominguez-Cancino, K. A., & Palmieri, P. A. (2022). Patient Safety Culture in Latin American Hospitals: A Systematic Review with Meta-Analysis. International Journal of Environmental Research and Public Health, 19(21), 14380. https://doi.org/10.3390/ijerph192114380

Cathro, H. (2016). Navigating Through Chaos: Charge Nurses and Patient Safety. The Journal of Nursing Administration, 46(4), 208–214. https://doi.org/10.1097/NNA.0000000000000326

Cho, H., & Steege, L. M. (2021). Nurse Fatigue and Nurse, Patient Safety, and Organizational Outcomes: A Systematic Review. Western Journal of Nursing Research, 43(12), 1157–1168. https://doi.org/10.1177/0193945921990892

Cho, S., & Jang, S. J. (2021). Do Gender Role Stereotypes and Patriarchal Culture Affect Nursing Students' Major Satisfaction? International Journal of Environmental Research and Public Health, 18(5), 2607. https://doi.org/10.3390/ijerph18052607

Durgun, H., & Kaya, H. (2018). The attitudes of emergency department nurses towards patient safety. International Emergency Nursing, 40, 29–32. https://doi.org/10.1016/j.ienj.2017.11.001

Elmontsri, M., Banarsee, R., & Majeed, A. (2018). Improving patient safety in developing countries – moving towards an integrated approach. JRSM Open, 9(11), 2054270418786112. https://doi.org/10.1177/2054270418786112

Elsous, A., Akbari Sari, A., AlJeesh, Y., & Radwan, M. (2017). Nursing perceptions of patient safety climate in the Gaza Strip, Palestine. International Nursing Review, 64(3), 446–454. https://doi.org/10.1111/inr.12351

Farzi, S., Moladoost, A., Bahrami, M., Farzi, S., & Etminani, R. (2017). Patient Safety Culture in Intensive Care Units from the Perspective of Nurses: A Cross-Sectional Study. Iranian Journal of Nursing and Midwifery Research, 22(5), 372–376. https://doi.org/10.4103/ijnmr.IJNMR_150_16

Feleke, S. A., Mulatu, M. A., & Yesmaw, Y. S. (2015). Medication administration error: Magnitude and associated factors among nurses in Ethiopia. BMC Nursing, 14(1), 53. https://doi.org/10.1186/s12912-015-0099-1

Feyissa, D., Kebede, B., Zewudie, A., & Mamo, Y. (2020). Medication Error and Its Contributing Factors Among Pediatric Patients Diagnosed with Infectious Diseases Admitted to Jimma University Medical Center, Southwest Ethiopia: Prospective Observational Study. Integrated Pharmacy Research & Practice, 9, 147–153. https://doi.org/10.2147/IPRP.S264941

Gaffney, T. A., Hatcher, B. J., & Milligan, R. (2016). Nurses' role in medical error recovery: An integrative review. Journal of Clinical Nursing, 25(7–8), 906–917. https://doi.org/10.1111/jocn.13126

Harrison, R., Cohen, A. W. S., & Walton, M. (2015). Patient safety and quality of care in developing countries in Southeast Asia: A systematic literature review. International Journal for Quality in Health Care: Journal of the International Society for Quality in Health Care, 27(4), 240–254. https://doi.org/10.1093/intqhc/mzv041

Jarrar, M., Al-Bsheish, M., Dardas, L. A., Meri, A., & Sobri Minai, M. (2020). Adverse events in Malaysia: Associations with nurse's ethnicity and experience, hospital size, accreditation, and teaching status. The International Journal of Health Planning and Management, 35(1), 104–119. https://doi.org/10.1002/hpm.2822

Jarrar, M., Minai, M. S., Al-Bsheish, M., Meri, A., & Jaber, M. (2019). Hospital nurse shift length, patient-centered care, and the perceived quality and patient safety. The International Journal of Health Planning and Management, 34(1), e387–e396. https://doi.org/10.1002/hpm.2656

Kairytė, G., Gudaityte, J., Šimonytė, L., Pikčiūnaitė, E., & Macas, A. (2022). Assessment of Anaesthesia Nurses' Attitude to Teamwork. Proceedings of the Latvian Academy of Sciences. Section B. Natural, Exact, and Applied Sciences., 76, 382–386. https://doi.org/10.2478/prolas-2022-0059

Kanneganti, A., Tan, B. Y. Q., Nik Ab Rahman, N. H., Leow, A. S.-T., Denning, M., Goh, E. T., Lim, L. J. H., Sia, C.-H., Chua, Y. X., Kinross, J., Tan, M., Tan, L. F., Wan, Y. M., Sharma, A., Danuaji, R., Komal Kumar, R., Sheng, C. K., Kheng, C. P., Abdul Karim, S. S., … Ooi, S. B. S. (2022). Safety attitudes, burnout and well-being among healthcare workers during the COVID-19 pandemic: An Indo-Pacific regional cross-sectional study. Singapore Medical Journal, 64(11), 667–676. https://doi.org/10.11622/smedj.2022014

Khan, A., Furtak, S. L., Melvin, P., Rogers, J. E., Schuster, M. A., & Landrigan, C. P. (2016). Parent-Reported Errors and Adverse Events in Hospitalized Children. JAMA Pediatrics, 170(4), e154608. https://doi.org/10.1001/jamapediatrics.2015.4608

Konlan, K. D., & Shin, J. (2022). The status and the factors that influence patient safety in health care institutions in Africa: A systematic review. PLOS Global Public Health, 2(12), e0001085. https://doi.org/10.1371/journal.pgph.0001085

Liao, L.-M., Sun, X.-Y., Yu, H., & Li, J.-W. (2016). The association of nurse educational preparation and patient outcomes: Systematic review and meta-analysis. Nurse Education Today, 42, 9–16. https://doi.org/10.1016/j.nedt.2016.03.029

Malinowska-Lipień, I., Micek, A., Gabryś, T., Kózka, M., Gajda, K., Gniadek, A., Brzostek, T., & Squires, A. (2021). Nurses and physicians attitudes towards factors related to hospitalized patient safety. PLOS ONE, 16(12), e0260926. https://doi.org/10.1371/journal.pone.0260926

Moda, H. M., Dama, F. M., Nwadike, C., Alatni, B. S., Adewoye, S. O., Sawyerr, H., Doka, P. J. S., & Danjin, M. (2021). Assessment of Workplace Safety Climate among Healthcare Workers during the COVID-19 Pandemic in Low and Middle Income Countries: A Case Study of Nigeria. Healthcare (Basel, Switzerland), 9(6), 661. https://doi.org/10.3390/healthcare9060661

Mueller, B. U., Neuspiel, D. R., Fisher, E. R. S., & COUNCIL ON QUALITY IMPROVEMENT AND PATIENT SAFETY, COMMITTEE ON HOSPITAL CARE. (2019). Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care. Pediatrics, 143(2), e20183649. https://doi.org/10.1542/peds.2018-3649

O'Dowd, A. (2018). Poor quality services are harming global drive to improve healthcare, experts warn. BMJ, 362, k3008. https://doi.org/10.1136/bmj.k3008

Saberi, M., Jamshidi, E., Rajabi, F., Seydali, E., & Bairami, F. (2017). Nurses' Attitude toward Patient Safety Culture: A Cross-sectional Study of Hospitals in Tehran. Journal of Patient Safety and Quality Improvement, 5, 0. https://doi.org/10.22038/PSJ.2017.9037

Salih, S. A., Abdelkader Reshia, F. A., Bashir, W. A. H., Omar, A. M., & Ahmed Elwasefy, S. (2021). Patient safety attitude and associated factors among nurses at Mansoura University Hospital: A cross sectional study. International Journal of Africa Nursing Sciences, 14, 100287. https://doi.org/10.1016/j.ijans.2021.100287

Sasa, R. I. (2019). Male nurse: A concept analysis. Nursing Forum, 54(4), 593–600. https://doi.org/10.1111/nuf.12374

Sexton, J. B., Helmreich, R. L., Neilands, T. B., Rowan, K., Vella, K., Boyden, J., Roberts, P. R., & Thomas, E. J. (2006). The Safety Attitudes Questionnaire: Psychometric properties, benchmarking data, and emerging research. BMC Health Services Research, 6(1), 44. https://doi.org/10.1186/1472-6963-6-44

Sonğur, C., Özer, Ö., Gün, Ç., & Top, M. (2018). Patient Safety Culture, Evidence-Based Practice and Performance in Nursing. Systemic Practice and Action Research, 31(4), 359–374. https://doi.org/10.1007/s11213-017-9430-y

Stalpers, D., de Brouwer, B. J. M., Kaljouw, M. J., & Schuurmans, M. J. (2015). Associations between characteristics of the nurse work environment and five nurse-sensitive patient outcomes in hospitals: A systematic review of literature. International Journal of Nursing Studies, 52(4), 817–835. https://doi.org/10.1016/j.ijnurstu.2015.01.005

Thu, N. T. H., Anh, B. T. M., Ha, N. T. T., Tien, D. N. T., Giang, P. H., Nga, T. T., Nam, N. H., & Hung, P. T. (2023). Health staff perceptions of patient safety and associated factors in hospitals in Vietnam. Frontiers in Public Health, 11, 1149667. https://doi.org/10.3389/fpubh.2023.1149667

Vaismoradi, M., Tella, S., A. Logan, P., Khakurel, J., & Vizcaya-Moreno, F. (2020). Nurses' Adherence to Patient Safety Principles: A Systematic Review. International Journal of Environmental Research and Public Health, 17(6), 2028. https://doi.org/10.3390/ijerph17062028

World Health Organization. (2019). Quality and patient safety in Viet Nam. https://www.who.int/vietnam/health-topics/patient-safety

Wu, H.-H., Lee, Y.-C., Huang, C.-H., & Li, L. (2022). Healthcare professional's perception of patient safety assessed by the hospital survey on patient safety culture in Taiwan: A systematic review. The TQM Journal, 35(3), 615–629. https://doi.org/10.1108/TQM-11-2021-0317

Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (11-18)
e-ISSN 2477-8184
p-ISSN 1858-0610
https://doi.org/10.31101/jkk.3553

Original Research

Effectiveness of *Moringa oleifera* extract supplementation in increasing Glucagon-like peptide-1 (GLP-1) in prediabetic model

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Submitted: February 6, 2024 Revised: March 30, 2024 Accepted: June 5, 2024

Abstract
Prediabetes is a serious global health problem. The prevalence of prediabetes is estimated to be higher than that of diabetes mellitus (DM), and 5%-12.5% of prediabetic patients will develop DM. Epidemiological studies showed that consumption of polyphenol-rich foods impacts blood glucose control and improves insulin resistance. Moringa leaves contain high levels of flavonoids that are effective in glucose control. This study aimed to determine the effect of moringa leaf extract supplementation on increasing GLP-1 levels in prediabetes models. This study used a randomized controlled trial-post-test-only design. Twenty-five male Rattus norvegicus were divided into five groups, namely the normal group, the prediabetes group, and three intervention groups, each given moringa leaf extract at a dose of 75 mg/kgbb, 150 mg / kgbb and 225 mg / kgbb. After 4 weeks of intervention, a GLP-1 examination was conducted. Data analysis using the ANOVA test. There was a significant difference in GLP-1 levels in the intervention group compared to the prediabetes control group ($p<0.05$). GLP-1 levels increased as the dose given increased. In the intervention group, the dose of 225 mg/kg bw showed the highest increase in GLP-1 levels, but there was no significant difference compared to the 150 mg/kg bw dose group. Moringa leaf extract supplementation is proven to increase GLP-1 in the Rattus norvegicus model. The effect gets better with increasing doses. Further development and testing related to this supplementation are needed so it can be used as a safe non-pharmacological treatment for prediabetes and DM patients.

Keywords: *Glucagon-like peptide-1; Moringa oleifera leaf extract*; prediabetes

1. Introduction

Diabetes is a global health emergency in the 21st century. International Diabetes Federation (IDF) reported that in 2021 the number of diabetics increased sharply, in the age range of 20-79 years there were 537 million, which means that for every 10 people there is 1 person with diabetes (IDF, 2022). Indonesia has the largest number of diabetics, with a sharp increase of 167% in the last ten years (IDF, 2022). Diabetes is a development of a previous prediabetic condition. Estimating that 5% to 12.5% percent of prediabetic patients will progress to DM (Anthony et al., 2021; Lee et al., 2022). Prediabetes is a serious global health problem, and it is estimated that the prevalence of prediabetes is much higher than that of diabetes, but comprehensive data are not yet adequate (Kusumawati, 2023). The prevalence of prediabetes globally is increasing rapidly (Lee et al., 2022). Prediabetes by value *Impaired Glucose Tolerance* (IGT) in individuals aged 20-79 years of age of 7.3% equivalent to 352.1 million people in 2017 and is estimated to increase to 8.3% equivalent to 586 million people in 2045 (IDF, 2017).

Prediabetes is a condition that is at high risk for the development of diabetes in the future. Incretin abnormalities are important in the development of pancreatic β cell damage in T2DM. Patients with

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prediabetes are found to have changes in circulating concentrations of incretin. Incretin is a hormone produced by the intestinal mucosa in response to oral nutrient intake by increasing insulin secretion stimulated by increased glucose and lowering blood glucose levels. The hormone incretin consists of: *glucagon like peptide-1* (GLP-1) and *glucose-dependent insulinotropic peptide* (GIP) has a useful effect in the therapy of diabetes. The hormone incretin will be rapidly degraded by the enzyme dipeptidyl peptidase IV (DPP-IV) which has an impact on decreasing insulinotropic activity (Husna et al., 2019). GLP-1 is an incretin hormone that has the effect of lowering glucose, slowing gastric emptying and suppressing glucagon secretion (Bell & Watts, 2015). Incretin deficits are associated with decreased effects of GLP-1, impaired insulin secretion capacity, increased insulin resistance, and hyperglycemia. (Hinnen, 2017). The new approach to controlling diabetes is based on the use of GLP-1, an incretin hormone, which has been shown to reduce postprandial glycemia and fasting in T2DM (Singh et al., 2021).

Previous research revealed in prediabetic individuals found a decrease in GLP-1 concentrations. A decrease in GLP-1 in patients with impaired glucose tolerance leads to insulin resistance. Damage to GLP-1 secretion contributes to the pathogenesis of prediabetes. Incretin-based therapies have been shown to increase β cell mass, glycemic control, weight loss and improve liver cells and the cardiovascular system. Incretin-based therapies (DPP IV inhibitors and GLP-1 agonists) have been shown to improve β cell function and mass in experimental animals and clinical trials (Ahmadieh & Azar, 2014). GLP-1 increases pancreatic cell mass and inhibits cell apoptosis and increases insulin secretion. GLP-1 agonists can normalize hyperglycemia, delay gastric emptying, increase insulin release, decrease glucagon, decrease food intake and improve cell function (Pegah et al., 2021). GLP-1 is highly unstable in vivo with a very short half-life, and is easily degraded and inactivated by the enzyme dipeptidyl peptidase (DPP-IV). Prolonging the hypoglycemic effects of GLP-1 by inhibiting DPP-IV is one of the key mechanisms of DMT2 treatment. DPP-IV inhibitors currently present are sitagliptin and vitagliptin which have significant hypoglycemic effects, but have side effects such as hypersensitivity reactions, rashes and upper respiratory tract infections (Yang et al., 2020).

Conventionally, prediabetes is managed by a combination of pharmacotherapy and lifestyle modifications such as dietary interventions (Gamede et al., 2021). Epidemiological studies show that consumption of polyphenol-rich foods has an impact on blood glucose control and improves insulin resistance. A healthy diet rich in vegetables, fruits, whole grains containing polyphenols can reduce the risk of DMT2 by 14% (Maghsoudi et al., 2016; Zamora-Ros et al., 2013). Natural flavonoids and alkaloids have DPP-IV inhibiting activity can be used as a drug source (Yang et al., 2020). Moringa leaves (*Moringa oleifera*) contains polyphenols especially the most important are flavonoids quercetin, kaempferol, phenolic acids, chlorogenic acid and caffeoylquinic acid which are antihyperglycemic acting as competitive inhibitors of SGLT 1 in the mucosa of the small intestine (duodenum and jejenum) thereby reducing the absorption of glucose in the intestine (Vargas-Sánchez et al., 2019). Although many non-pharmacological treatments related to diabetes have been developed, studies related to the effects of moringa leaves on increasing GLP-1 in prediabetes are currently very limited. This study aims to determine the effect of Moringa leaf extract supplementation on increasing GLP-1 levels in the prediabetic models *Rattus norvegicus.*

2. Research Methods

2.1.Research Design

This study used design *Randomized Controled Trial Post Test Only*. The research protocol has been approved by the health research ethics committee of Diponegoro University with number 25/EC/H/FK-UNDIP/IV/2022. The sample in this study was 25 heads *Rattus norvegicus* male, age 8 weeks, average body weight 179+4 grams. Rats were divided into five groups randomly, namely the normal control

group (K1), the prediabetes control group (K2), and three treatment groups each given Moringa leaf extract doses of 75 mg / kgbb (P1), doses of 150 mg / kgbb (P2) and 225 mg / kgbb (P3).

Making a high fat diet: the high-fat diet mass is compacted and ovened in pellet form at 1800C for 2 hours. The high-fat diet was adopted from previous studies with minor modifications (Huda et al., 2020). Making moringa leaf extract: moringa leaves are taken from the Klaten region, Central Java. Moringa leaves that have been picked are then sorted, washed and drained, then in the oven at 500C for 2x24 hours until the leaves dry. Dried Moringa leaves are then ground and sieved using mesh 40. Moringa leaf powder is then macerated with 96% ethanol in a ratio of 1: 5 for 3 days. Every day stirring is carried out for + 10 minutes. After the third day the maceration results are filtered, then evaporation is carried out with a *rotary evaporator*, to get a viscous extract not dripping.

Induction of prediabetes is done by administering a high-fat diet (DTL) for 4 weeks. The composition of a high-fat diet consists of Comfeed PAR-s 60%, wheat 27.8%, cholesterol 2%, cholic acid 0.2%, lard 10% in 100 grams of feed. Determination of the prediabetic mouse model was carried out when the results of the fasting glucose level examination were 100 -160 mg / dL (Abdel-Hamid & Firgany, 2019). In the treatment group, Moringa leaf extract was given through sonde according to the dose in each group for 4 weeks. At the end of week 4, blood samples were taken through retro-orbitals for GLP-1 examination. Data analysis using ANOVA, if the results of the $p< 0.05$ value are continued *Post-Hoc Least Significant Difference* (LSD).

3. Results and Discussion

3.1.Characteristics of Experimental Animals

Prediabetes is characterized by mild hyperglycemia and is a high risk factor for diabetes. The most common changes in prediabetes are evidenced by the presence of impaired fasting glucose and/or glucose intolerance due to deregulation of glucose control as well as cell dysfunction (Zborowski et al., 2021). Maintaining glycemic control is a major treatment goal in prediabetes and diabetes because it can reduce the risk of health complications and death (Ahmad et al., 2019). In this study, making a prediabetes model *Rattus norvegicus* performed with the administration of a high-fat diet (DTL) for 4 weeks *ad libitum*. The prediabetes model is determined if blood glucose after an 8-hour fast is 100 -160 mg/dL (Abdel-Hamid & Firgany, 2019). DTL induction results in the prediabetes group (K2, P1, P2, and P3) showed an average fasting blood glucose of 131.68±3.201mg/dL. In line with previous research showing that administering a high-fat diet improves serum glucose levels, insulin resistance and impaired glucose metabolism metabolism (Balakumar et al., 2016; Hassan-Danboyi et al., 2021).

The results of this study also proved that administering a high-fat diet increased body weight and Lee index > 300 in the prediabetes control group (K2) and intervention group (P1,P2,P3) as shown in Table 1. This condition is likely due to an increase in fat mass and a decrease in lean mass simultaneously (Lee et al., 2022). A high-fat diet induces a positive energy balance resulting in visceral fat deposits (El-Shehawi et al., 2021). Previous research has shown that feeding a high-fat diet improves serum glucose levels, insulin resistance and impaired glucose metabolism (Balakumar et al., 2016; Hassan-Danboyi et al., 2021).

Table 1. Characteristics of Experimental Animals Before and After the 4-Week Intervention

Variable	Measurement period	Control Groups		Treatment Groups		
		Normal (K1)	Prediabetes (K2)	EMo75 (P1)	EMo150 (P2)	EMo225 (P3)
Body weight (g)	Before	212±3.16	238.8±3.11	234.8±4.81	233.6±3.20	232.2±3.70
	After	235.4±2.70	295.4±3.43	270.6±5.31	262.6±3.64	260.4±4.39
Length of body (cm)	Before	20.07±0.11	18.80±0.37	18.72±0.12	18.53±0.12	18.42±0.15
	After	20.73±0.12	18.98±0.21	20.61±0.14	20.90±0.15	21.30±0.06

Variable	Measurement period	Control Groups		Treatment Groups		
		Normal (K1)	Prediabetes (K2)	EMo75 (P1)	EMo150 (P2)	EMo225 (P3)
Indeks Lee	Before	296.9±0.80	330.09±5.97	329.7±5.99	332.2±4.13	333.6±6.92
	After	297.7±1.18	350.8±3.48	313.7±2.44	306.37±2.17	299.7±1.58

Source: Primary Data, 2022

Normal (K1) : Normal Mouse (Negative Control)
Prediabetes (K2) : Prediabetic Rats (Positive Control)
EMo75 (P1) :Extract *M. oleifera* 75 mg/kgbb (Treat 1)
EMo 150 (P2) :Extract *M. oleifera* 150 mg/kgbb (Treat 2)
EMo 225 (P3) : M. oleifera extract 225 mg/kgbb (Treat 3)

After 4 weeks of intervention there was an increase in body weight (g) in all groups as shown in Table 1. The highest increase in body weight was found in the K2 group (prediabetic control group), while the lowest body weight and Lee index were found in the EMo dose group of 225 mg / kgbb (P3). When compared to the prediabetes control group (K2), the EMo treatment group (P1, P2, P3) showed lower body weight. This is in line with previous research that states the provision of Moringa leaf extract significantly reduces body weight in experimental animals given a high-fat diet (Monraz-Méndez et al., 2022). GLP-1 has effects on various organ systems, most relevantly causing a decrease in body weight in the long term (Popoviciu et al., 2023).

3.2.Differences in GLP-1 Levels Between the Intervention Group and the Control Group

Table 2. The difference in GLP-1 levels between groups after 4 weeks of intervention

Group	n	Mean±SD	*p-value*
K1	5	19.8±0.76	0,000
K2	5	5.86±0.52	
P1 (EMo 75)	5	11.73±0.80	
P2 (EMo 150)	5	13.73±0.80	
P3 (EMo 225)	5	14.66±0.96	

Source: Primary Data, 2022

Table 2 shows GLP-1 levels in the normal control group, prediabetes control and EMo intervention group. The highest GLP-1 levels (19.8±0.76) were found in the normal control group. The lowest GLP-1 levels (5.86±0.526) were found in the prediabetes group and the highest GLP-1 levels (14.668±0.962) were found in the Emo 225 intervention group. The results of the analysis using *one way ANOVA* showed a significant difference in GLP-1 levels in the normal control group (K1), prediabetes control (K2), EMo (P1, P2, P3).

GPL-1 is a powerful stimulator of insulin secretion. GLP-1 stimulates insulin gene expression and proinsulin biosynthesis. GLP-1 has an anti-apotosis effect on β cells. Incretin, especially GLP-1, is secreted by enteroendocrine L cells in the intestine in response to regulation of postprandial glucose levels. GLP-1 increases pancreatic cell mass and inhibits cell apoptosis and increases insulin secretion. In patients with T2DM, GLP-1 secretion is reduced compared to healthy people (Pegah et al., 2021). This is consistent with the results of the study that GLP-1 levels in the prediabetes control group (K2) showed the lowest value on average 5.86±0.526 pg/mL.

The results of this study showed that after 4 weeks of EMo administration Doses of 75 mg/kgbb, 150 mg/kgbb, and 225 mg/kgbb cause significant increase in GLP-1 levels compared to prediabetes control group (ρ <0,05). This is likely to exist proteins/peptides contained in leaf extracts *M. oleifera*

which has an insulin-mimetic effect. The GLP-1 hormone is secreted by cells in the gastrointestinal tract in response to the presence of carbohydrates in food. GLP-1 helps promote glycemic normalization after carbohydrate consumption by stimulating insulin secretion by cells. This mechanism is the basis of therapeutic treatment of hypoglycemic in T2DM known as dipeptidyl peptidase 4 (DPP-IV) inhibitors by increasing the half-life of the GLP-1 hormone and triggering the secretagogue effect of insulin. Moringa contains insulin-like proteins detectable from seed coats, seedless fruits and leaves. Moringa leaves contain promising sources of protein/peptides with relevant in vivo insulin mimetic effects (Paula et al., 2017).

3.3.Differences in GLP-1 Levels in Each Group

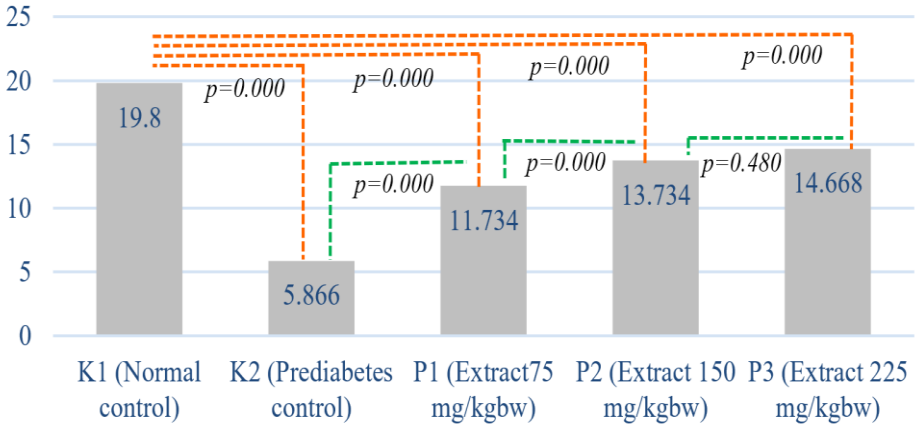

Figure 1. Differences in GLP-1 Levels After 4 Weeks of Intervention

Figure 1 shows differences in GLP-1 levels in the control, prediabetes and EMo treatment groups (P1,P2,P3). The results showed that GLP-1 levels in the prediabetes group (K2) significantly decreased ($p<0.05$) when compared to the control group (K1). In the P1,P2 group, P3 showed a significant increase in GLP-1 when compared to prediabetes controls. Changes in EMo 150 to 225 dose did not show a statistically significant increase in GLP-1 ($p>0.05$) but descriptively still showed an increase in GLP-1 levels.

Elevated GLP-1 levels affect the improvement of blood glucose control through mechanisms of action, namely: 1) glucose-dependent insulinotropic action, 2) suppress glucagon secretion (except during hypoglycemia episodes), 3) slow gastric emptying. Changes in appetite, satiety, reduction in calorie intake (Nauck et al., 2021). Moringa leaves likely play a role in delaying gastric emptying, inhibiting intestinal glucose uptake, increased glucose uptake in muscles and liver contributing to hypoglycemic effects (Gómez-Martínez et al., 2022). Alkaloids, phenolic acids, amino acid polysaccharides, peptidoglycan, and glycopeptides in Moringa leaves contain antioxidant properties that function as DPP-4 inhibitors. The mechanism of action of DPP4 inhibitors through blocking enzyme activity, increasing the half-life of GLP-1, increasing insulin secretion and limiting glucagon secretion (Singh et al., 2021).

The results of this study are different from previous studies that stated that supplementation *M. oleifera* potential as a blood glucose controlling agent in prediabetic patients, but supplementation *M. oleifera* has no effect on intestinal hormones (GLP-1) (Gómez-Martínez et al., 2022). Other studies mention quercetin content in *M. oleifera* has the ability to inhibit *α-glucosidase* by increasing GLP-1 secretion in healthy individuals as well as T2DM patients (Ganjayi et al., 2023). Inhibition *α-*

glucosidase causes a delay in the breakdown of carbohydrates in the small intestine by intensifying glucose absorption in the lower intestine thereby reducing glucose levels (Hossain et al., 2020).

Administration of Moringa leaf extract dose of 225 mg / kgbb increased the highest GLP-1 levels. Alkaloids, phenolic acids, amino acid polysaccharides, peptidoglycan, and glycopeptides contain antioxidant properties that function as DPP-4 inhibitors (Singh et al., 2021). DPP4 inhibitor mechanism through blocking enzyme activity, increasing the half-life of GLP-1, increasing insulin secretion and limiting glucagon secretion (Singh et al., 2021). Moringa leaves also contain compounds O-Ethyl-4-[(α-NS-rhamnosyloksi)benzyl]carbamate which has excellent pharmacokinetic properties and safety and is a potential lead compound against DPP-IV (Yang et al., 2020). Previous research in prediabetes treated with GLP-1 analogues for 24 weeks showed normoglycemia (Farr & Mantzoros, 2017). The hypoglycemic mechanism via the GLP-1 pathway is safe because GLP-1 increases insulin secretion depending on glucose concentration. GLP-1 stimulates increased insulin secretion when blood glucose levels rise, but when blood glucose levels are too low, GLP-1 maintains normal insulin secretion levels (Yang et al., 2020).

4. Conclusion

This study showed that Moringa leaf extract was effective in increasing GLP-1 levels in a prediabetic model of *Rattus norvegicus*. The effect gets better with increasing doses of administration. Further development and testing related to moringa leaf extract supplementation is needed so that it can later be used as a safe non-pharmacological treatment for patients with prediabetes and diabetes mellitus.

Reference

Abdel-Hamid, A. A. M., & Firgany, A. E. D. L. (2019). Correlation between pancreatic mast cells and the low grade inflammation in adipose tissue of experimental prediabetes. *Acta Histochemica*, *121*(1), 35–42. https://doi.org/10.1016/j.acthis.2018.10.005

Ahmad, J., Khan, I., & Blundell, R. (2019). Moringa oleifera and glycemic control: A review of current evidence and possible mechanisms. *Phytotherapy Research*, *33*(11), 2841–2848. https://doi.org/10.1002/ptr.6473

Ahmadieh, H., & Azar, S. T. (2014). The role of incretin-based therapies in prediabetes: A review. *Primary Care Diabetes*, *8*(4), 286–294. https://doi.org/10.1016/j.pcd.2014.02.005

Anthony, N., Lenclume, V., Fianu, A., Moullec, N. L., Debussche, X., Gérardin, P., Marimoutou, C., & Nobécourt, E. (2021). Association between prediabetes definition and progression to diabetes: The REDIA follow-up study. *Diabetes Epidemiology and Management*, *3*, 100024. https://doi.org/10.1016/j.deman.2021.100024

Balakumar, M., Raji, L., Prabhu, D., Sathishkumar, C., Prabu, P., Mohan, V., & Balasubramanyam, M. (2016). High-fructose diet is as detrimental as high-fat diet in the induction of insulin resistance and diabetes mediated by hepatic/pancreatic endoplasmic reticulum (ER) stress. *Molecular and Cellular Biochemistry*, *423*(1–2), 93–104. https://doi.org/10.1007/s11010-016-2828-5

Bell, D. A., & Watts, G. F. (2015). Contemporary and Novel Therapeutic Options for Hypertriglyceridemia. *Clinical Therapeutics*, *37*(12), 2732–2750. https://doi.org/10.1016/j.clinthera.2015.08.001

El-Shehawi, A. M., Alkafafy, M., El-Shazly, S., Sayed, S., Farouk, S., Alotaibi, S., Madkour, D. A., Khalifa, H. K., & Ahmed, M. M. (2021). Moringa oleifera leaves ethanolic extract ameliorates high fat diet-induced obesity in rats. *Journal of King Saud University - Science*, *33*(6), 101552. https://doi.org/10.1016/j.jksus.2021.101552

Farr, O. M., & Mantzoros, C. S. (2017). Treating prediabetes in the obese: Are GLP-1 analogues the answer? *The Lancet*, *389*(10077), 1371–1372. https://doi.org/10.1016/S0140-6736(17)30315-X

Gamede, M., Mabuza, L., Ngubane, P., & Khathi, A. (2021). Preventing the onset of diabetes-induced chronic kidney disease during prediabetes: The effects of oleanolic acid on selected markers of chronic kidney disease in a diet-induced prediabetic rat model. *Biomedicine and Pharmacotherapy*, *139*, 111570. https://doi.org/10.1016/j.biopha.2021.111570

Ganjayi, M. S., Karunakaran, R. S., Gandham, S., & Meriga, B. (2023). Quercetin-3-O-rutinoside from Moringa oleifera Downregulates Adipogenesis and Lipid Accumulation and Improves Glucose Uptake by Activation of AMPK/Glut-4 in 3T3-L1 Cells. *Revista Brasileira De Farmacognosia*, *33*(2), 334–343. https://doi.org/10.1007/s43450-022-00352-9

Gómez-Martínez, S., Díaz-Prieto, L. E., Castro, I. V., Jurado, C., Iturmendi, N., Martín-Ridaura, M. C., Calle, N., Dueñas, M., Picón, M. J., Marcos, A., & Nova, E. (2022). Moringa oleifera leaf supplementation as a glycemic control strategy in subjects with prediabetes. *Nutrients*, *14*(1), 1–15. https://doi.org/10.3390/nu14010057

Hassan-Danboyi, E., Jimoh, A., Alhassan, A., Danboyi, T., Mohammed, K. A., Dubo, A. B., Haruna, J., & Yakubu, B. B. (2021). Antioxidant Effects of L-citrulline Supplementation in High-fat Diet- and Dexamethasone-induced Type-2 Diabetes Mellitus in Wistar Rats (Rattus norvegicus). *Nigerian Journal of Experimental and Clinical Biosciences*, *9*(2), 95. https://doi.org/10.4103/njecp.njecp_4_21

Hinnen, D. (2017). Glucagon-Like Peptide 1 Receptor Agonists for Type 2 Diabetes. *Diabetes Spectrum*, *30*(3), 202–210.

Hossain, U., Das, A. K., Ghosh, S., & Sil, P. C. (2020). An overview on the role of bioactive α-glucosidase inhibitors in ameliorating diabetic complications. *Food and Chemical Toxicology*, *145*, 111738. https://doi.org/10.1016/j.fct.2020.111738

Huda, N., Herowati, R., & Nurrochmad, A. (2020). Aktivitas Fraksi-Fraksi Etanol Murbei (Morus australis Poir.) Terhadap Fungsi Hati Tikus Putih Model Hiperkolesterolemia yang Diberi Diet Tinggi Lemak. *Jurnal Farmasi & Sains Indonesia*, *3*(2), 28–36.

Husna, F., Suyatna, F. D., Arozal, W., & Purwaningsih, E. H. (2019). Model Hewan Coba pada Penelitian Diabetes Animal Model in Diabetes Research. *Pharmaceutical Sciences and Research*, *6*(3), 131–141.

IDF. (2017). *IDF Diabetes Atlas Eighth Edition*.

IDF. (2022). *IDF. Diabetes Atlas, 10th edn*.

Kusumawati, N. (2023). *Prediabetes* (A. Hamid, Ed.; 1st ed.).

Lee, J. H., Kim, D. Y., Pantha, R., Lee, E. H., Bae, J. H., Han, E., Song, D. K., Kwon, T. K., & Im, S. S. (2022). Identification of Pre-Diabetic Biomarkers in the Progression of Diabetes Mellitus. *Biomedicines*, *10*(1), 5–10. https://doi.org/10.3390/biomedicines10010072

Maghsoudi, Z., Ghiasvand, R., & Salehi-Abargouei, A. (2016). Empirically derived dietary patterns and incident type 2 diabetes mellitus: A systematic review and meta-analysis on prospective observational studies. *Public Health Nutrition*, *19*(2), 230–241. https://doi.org/10.1017/S1368980015001251

Monraz-Méndez, C. A., Escutia-Gutiérrez, R., Rodriguez-Sanabria, J. S., Galicia-Moreno, M., Monroy-Ramírez, H. C., Sánchez-Orozco, L., García-Bañuelos, J., De la Rosa-Bibiano, R., Santos, A., Armendáriz-Borunda, J., & Sandoval-Rodríguez, A. (2022). Moringa oleifera Improves MAFLD by Inducing Epigenetic Modifications. *Nutrients*, *14*(20), 1–19. https://doi.org/10.3390/nu14204225

Nauck, M. A., Quast, D. R., Wefers, J., & Meier, J. J. (2021). GLP-1 receptor agonists in the treatment of type 2 diabetes – state-of-the-art. *Molecular Metabolism*, *46*(October 2020), 101102. https://doi.org/10.1016/j.molmet.2020.101102

Paula, P. C., Oliveira, J. T. A., Sousa, D. O. B., Alves, B. G. T., Carvalho, A. F. U., Franco, O. L., & Vasconcelos, I. M. (2017). Insulin-like plant proteins as potential innovative drugs to treat diabetes—The Moringa oleifera case study. *New Biotechnology*, *39*, 99–109. https://doi.org/10.1016/j.nbt.2016.10.005

Pegah, A., Abbasi-Oshaghi, E., Khodadadi, I., Mirzaei, F., & Tayebinia, H. (2021). Probiotic and resveratrol normalize GLP-1 levels and oxidative stress in the intestine of diabetic rats. *Metabolism Open*, *10*, 100093. https://doi.org/10.1016/j.metop.2021.100093

Popoviciu, M. S., Păduraru, L., Yahya, G., Metwally, K., & Cavalu, S. (2023). Emerging Role of GLP-1 Agonists in Obesity: A Comprehensive Review of Randomised Controlled Trials. *International Journal of Molecular Sciences*, *24*(13). https://doi.org/10.3390/ijms241310449

Singh, A. K., Yadav, D., Sharma, N., & Jin, J. O. (2021). Dipeptidyl peptidase (Dpp)-iv inhibitors with antioxidant potential isolated from natural sources: A novel approach for the management of diabetes. *Pharmaceuticals*, *14*(6), 1–16. https://doi.org/10.3390/ph14060586

Vargas-Sánchez, K., Garay-Jaramillo, E., & González-Reyes, R. E. (2019). Effects of moringa oleifera on glycaemia and insulin levels: A review of animal and human studies. *Nutrients*, *11*(12), 1–19. https://doi.org/10.3390/nu11122907

Yang, Y., Shi, C.-Y., Xie, J., Dai, J.-H., He, S.-L., & Tian, Y. (2020). Identification of Potential Dipeptidyl Peptidase (DPP)-IV Inhibitors among Moringa oleifera Phytochemicals by Virtual Screening, Molecular Docking Analysis, ADME/T-Based Prediction, and In Vitro Analyses. *Molecules (Basel, Switzerland)*, *25*(1), 189. https://doi.org/10.3390/molecules25010189

Zamora-Ros, R., Forouhi, N. G., Sharp, S. J., González, C. A., Buijsse, B., Guevara, M., Van Der Schouw, Y. T., Amiano, P., Boeing, H., Bredsdorff, L., Clavel-Chapelon, F., Fagherazzi, G., Feskens, E. J., Franks, P. W., Grioni, S., Katzke, V., Key, T. J., Khaw, K. T., Kühn, T., … Wareham, N. J. (2013). The association between dietary flavonoid and lignan intakes and incident type 2 diabetes in european populations: The EPIC-InterAct study. *Diabetes Care*, *36*(12), 3961–3970. https://doi.org/10.2337/dc13-0877

Zborowski, V. A., Heck, S. O., Marques, L. S., Bastos, N. K., & Nogueira, C. W. (2021). Memory impairment and depressive-like phenotype are accompanied by downregulation of hippocampal insulin and BDNF signaling pathways in prediabetic mice. *Physiology and Behavior*, *237*(October 2020). https://doi.org/10.1016/j.physbeh.2021.113346

Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (19-26)
e-ISSN 2477-8184
p-ISSN 1858-0610
https://doi.org/10.31101/jkk.3416

Original Research Paper

Stress level and interdialytic weight gain (IDWG) in hemodialysis patients

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Submitted: November 1, 2023 Revised: February 3, 2024 Accepted: June 5, 2024

Abstract
Stress has various impacts on hemodialysis patients. Stress in hemodialysis patients can cause physical symptoms (fatigue, muscle cramps, nausea, and vomiting), a decrease in quality of life, and non-compliance with self-management, one of which is compliance related to limiting fluid intake, thus adversely affecting on the patient's IDWG. IDWG is an important indicator for fluid monitoring in hemodialysis patients. Increasing IDWG that exceeds the tolerance limit can have a negative impact and can even cause mortality. This study aimed to determine the correlation between stress level and IDWG among hemodialysis patients. This study was conducted in the hemodialysis unit of RSD Mangusada, involving 95 respondents. This study was quantitative, with non-experimental research using a cross-sectional approach. Data collection was carried out with DASS questionnaires for stress and observation sheets for the IDWG. The data was analyzed using Pearson's Spearman Rank ($\alpha<0.05$). Respondents with IDWG within tolerance limits were the majority unstressed, and none experienced severe stress or very severe stress. There is a positive and weak correlation between stress and IDWG among patients undergoing hemodialysis. The findings from this study may provide useful information in reviewing existing nursing care and standards of care provided in hemodialysis units, including the need to consider psychological assistance services in the care of hemodialysis patients. Qualitative research is needed to explore the in-depth experience of stress in hemodialysis patients and the factors associated with it.

Keywords: hemodialysis; interdialytic weight gain; stress

1. Introduction

Chronic kidney disease (CKD) patients need long-term care. Treatment of CKD is prioritized to reduce the progression of kidney function decline (The Ministry of Health The Republic of Indonesia, 2018). Hemodialysis (HD) is a lifelong therapy to replace some kidney function with the help of a dialysis machine (Lee, 2017). The prevalence of patients diagnosed with CKD and undergoing hemodialysis in Bali Province exceeds the national average. The prevalence of patients undergoing hemodialysis in Bali is 38.5%, ranked second nationally after DKI Jakarta, above the national prevalence of 19.3% (Indonesian Society of Nephrology, 2018).

Patients undergoing hemodialysis should monitor interdialytic weight gain (IDWG). IDWG is one of the important indicators of patient compliance in regulating the fluids of patients undergoing hemodialysis and determining the amount of fluid entering during the interdialytic period (Kahraman et al., 2015). The higher the IDWG, the greater the amount of fluid in the patient's body and the greater the risk of complications (Bossola et al., 2018). An increase in IDWG that exceeds the tolerance limit can have a negative impact (Ozen et al., 2019). Increased predialysis blood pressure, greater intradialytic reductions in blood pressure due to higher ultrafiltration rates, and elevated mortality are all linked to a higher IDWG (Ipema et al., 2016). As many as 60%–80% of patients die from excess fluid intake during the interdialytic period. Excess fluid intake during the interdialytic period can result

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in edema, ascites, and even lung congestion, so monitoring fluid intake in hemodialysis patients is the main action that must be considered by the nurses (Indonesian Society of Nephrology, 2018).

There are various factors that affect IDWG in patients undergoing hemodialysis (Maimani et al., 2021). Stress is one of the psychological problems that can have an impact on the patient's condition. Patients who undergo hemodialysis in addition to experiencing problems related to physical health and mental problems, including stress and anxiety (Zibaei et al., 2020). The prevalence of stress in hemodialysis patients is quite high. The prevalence of moderate stress and severe stress in hemodialysis patients ranges from 14% to 69.49% and 37.5% to 56%, respectively (Dhungana et al., 2023; George et al., 2022; Zibaei et al., 2020). Stress in hemodialysis patients can be caused by physical and psychological factors. Physical factors that can cause stress are physical dependence on hemodialysis equipment, limited physical function, changes in sexual function and diet, fluid restriction, use of various drugs, loss of appetite and energy, fatigue (Camelia et al., 2016). Psychological factors that can cause stress are not having enough time to do dialysis, losing a job, losing independence, changes in self-perception, and fear of death (Parvan et al., 2015).

Stress can cause various repercussions for hemodialysis patients. Hemodialysis patients who experience stress may experience physical symptoms such as fatigue, diarrhea, muscle cramps, nausea, and vomiting (Hintistan & Terzi, 2018; Moledina & Perry Wilson, 2015). In addition, stress can also cause hemodialysis patients to experience decreased quality of life and non-compliance with self-management (Lim & Lee, 2022; Sulistni et al., 2021). Non-compliance with self-management, one of which is fluid intake restrictions, can have a negative impact on the patient's IDWG (Angraini & Putri, 2016). Although there have been many studies related to hemodialysis patients, there have not been many studies that highlight the psychological conditions of patients, especially those related to IDWG. Previous study have recommended examining factors that influence IDWG, one of which is stress (Murdaningsih et al., 2023). Psychological problems such as stress are important to study because it related to self-management among hemodialysis patient. This study aimed to determine the correlation between stress level and IDWG among hemodialysis patients.

2. Research Methods

This study was a quantitative study with a type of non-experimental research using a cross-sectional approach. The population of this study was patients undergoing hemodialysis at RSD Mangusada, which amounted to 123 patients. The sample was 95 patients undergoing hemodialysis, selected by purposive sampling. The criteria for inclusion in the study were patients aged 18–65 years, undergoing hemodialysis for at least six months, and being able to understand Bahasa. The criteria for exclusion from the study were patients who experienced congestive disorders based on hospital medical records.

Data collection was carried out for approximately 7 days (8-14 October 2023), using DASS (Depression Anxiety and Stress Scale) questionnaires to measure stress and observation sheets to measure patient IDWG. DASS consists of 14 statement items consisting of four Likert scales, namely 0 = never, 1 = sometimes, 2 = often, and 3 = very often. The scores obtained will be totaled and categorized according to the stress level of the respondents. The stress level response was categorized into 5, namely 0–14 = normal, 15–18 = mild stress, 19–25 = moderate stress, 26–33 = severe stress, and >34 = very severe stress. The validity and reliability test of the DASS was done by Marsidi (2021).The validity test of the DASS instrument has a positive Pearson correlation value of more than 0,532 and a Cronbach alpha value of 0.951. It is all indicated that the DASS has proven reliable. IDWG is obtained by using the formula that includes the body weight of the respondent using the weight scales, calibrated regularly in the hemodialysis unit. The results were written down on the observation sheet. IDWG was measured using the IDWG formula in persentase units (%).

The collected data was then analyzed as univariate and bivariate data. A univariate analysis was conducted to provide an overview of stress and IDWG. Bivariate analysis began with a data normality test with Kolmogorov-Smirnov. Test analysis using Spearman rank is necessary because stress data and IDWG are not normally distributed. The level of significance of the study ($\alpha<0.05$) to analyze whether there is a correlation between stress and IDWG among patients undergoing hemodialysis.This study was conducted by upholding the ethical principle of maintaining the confidentiality of the respondent by using the initials (confidentiality), not harming respondents (non-maleficence), and being voluntary without any coercion from any party. Respondents can refuse and withdraw from research at any stage (autonomy). This study has received ethical clearance from the Health Research Ethics Committee, Rumah Sakit Daerah Mangusada, with the ethical approval number 070/8025/RSDM/2023.

In this study, the lead researcher was assisted by 1 research member and 2 enemurators, namely hemodialysis nurses at RSD Mangusada. The chief researcher has the task of fully controlling the research process and is directly involved in data collection, as well as accounting for research results until they are published. Co-researchers are tasked with assisting researchers in obtaining research permits, data collection, and data analysis. The enemurator is assigned to be a facilitator during the data collection process.

3. Results and Discussion

3.1.Descriptive of Stress and IDWG

This research carried out at the Hemodialysis Unit of RSD Mangusada in October 2023. The number of samples in this study was 95 respondents. The results of the study were presented in the tables and explained in the narratives form.

Tabel 1. Category Stres and IDWG Respondents (n=95)

Variable		f	%
Stres Category	No Stress	40	42.1
	Mild Stress	24	253
	Moderate stress	25	26.3
	Severe stress	6	6.3
	Very Severe Stress	0	0
IDWG Category	Within tolerance limits	73	76.8
	Exceeding tolerance limits	22	23.2

Source: Primery Data, 2023

Table 1 showed that most respondents do not experience stress (42.1%). In contrast to the results of previous research by George et al. (2022), who reported that the majority of hemodialysis patients had severe stress (56%). One factor that may influence this condition is social support. Judging from the characteristics of the respondents, most of whom are married and all of whom live with their families, it is likely that they get a lot of support from their spouses and families. Social support was very important to help patients carry out self-management during hemodialysis (Jo et al., 2020; Noviana & Zahra, 2021; Song et al., 2022). Additionally, social support for dialysis patients can give them access to a network of people based on their own needs, enhancing their sense of self-worth, shielding them from pathological symptoms caused by stress, and having a positive impact on their social, mental, and physical well-being (Stevenson et al., 2018). Previous studies showed that there were several other things that cause stress in hemodialysis patients, namely feeling uncomfortable, fatigue, health problems that will be faced, and a long duration of hemodialysis (Gedara et al., 2022; D. Pratiwi, 2015; Tu et al., 2014). In this study, based on interviews, patients mostly feel comfortable during hemodialysis, rarely have serious complications, and have long experience in hemodialysis, so they are well prepared before hemodialysis and manage themselves at home.

We found that the IDWG category was within the tolerance limit (76.8%), showing that the respondents' IDWG was within the normal range. The length of time on hemodialysis was assumed by researchers to contribute to respondents' stress levels and IDWG results. This may occur because the average respondent has undergone hemodialysis for 4 years, so they have experience controlling fluids. Increasing the duration of hemodialysis may allow patients to adapt to hemodialysis. Patients who have been on hemodialysis for more than three years have become accustomed to the symptoms (Nurdina & Anggraeni, 2022). According to Indramayu et al. (2016), younger patients usually have a larger appetite accompanied by greater sodium and water intake, which impacts IDWG. The higher the IDWG, the greater the amount of excess fluid in the patient's body and the higher the risk of complications (Bossola et al., 2018). In this study, the average age of the patients was 63 years old, and they had a good IDWG (within tolerance). Based on this, we assume that the elderly have more experience in fluid control and integrating self-care behaviours, so they have a good IDWG compared to younger patients.

3.2.Correlation between stress and IDWG

Tabel 2. Cross Tabulation Stres with IDWG (n=95)

		Stres Category				
		No Stress	**Mild stress**	**Moderate Stress**	**Severe Stress**	**Very Severe Stress**
IDWG Category	Within tolerance limits	39	21	13	0	0
	Exceeding tolerance limits	1	3	12	6	0

Source: Primery Data, 2023

Table 2 showed that respondents with IDWG within tolerance limits were mostly unstressed, and none experienced severe stress or very severe stress. Meanwhile, respondents with IDWG exceeding the tolerance limit mostly experienced moderate stress. The main stressors experienced by patients undergoing hemodialysis were related to fluid restriction (Efe & Kocaöz, 2015; Novitasari, 2015). Stress was a depressed and anxious mood that has a negative impact on physical and emotional (Dennick et al., 2017). Hemodialysis patients who experience stress will have an impact on emotional, motivational and behavioral disorders (Hong et al., 2017). Symptoms of depression and dietary non-adherence are particularly prevalent in patients with end-stage kidney disease receiving hemodialysis therapy (Gebrie & Ford, 2019). The stress experienced by patients will affect their health behaviour. stress can also cause hemodialysis patients to experience decreased quality of life and non-compliance with self-management (Lim & Lee, 2022; Sulistni et al., 2021). The success or failure of hemodialysis therapy greatly depends on the patient's compliance with the prescribed course of action and any health advice.

The results of this study showed that respondents with IDWG within tolerance limits mostly did not experience stress, and none experienced severe stress or very severe stress. We assumed that patients who are not stressed can follow self-management well, so that they can achieve IDWG targets within tolerance limits. The respondents' education level, which was mostly SMA/SMK, may also have contributed to this condition. Gela & Mengistu (2018) found that a higher level of education can assist patients in increasing awareness and concern for individual health.

Tabel 3. Spearman Rank Analysis Results (n=95)

Variable	p-value	r	r (%)
Correlation stress with IDWG	0.001	0.341	11.6

Source: Primery Data, 2023

Table 3 showed a positive and weak correlation between stress and IDWG in hemodialysis patients. The lower the respondent's stress, the lower the respondent's IDWG. The results of this study were also supported study by Gebrie and Ford (2019) which explains that there was a significant correlation between depressive symptoms and dietary non-compliance (Gebrie & Ford, 2019). Previous study showed that depression was associated with an increased risk of poor outcomes in CKD patients such as poor quality of life, increase hospitalization, major cardiovascular adverse events, mortality, and poor treatment compliance (Bautovich et al., 2014; Zhu et al., 2023).

Stress was also related to the each person's coping strategies in hemodialysis patients (Ahmad & Al Nazly, 2015; Camelia et al., 2016; Ghaffari et al., 2019). Every person had a unique way of handling stress and a unique set of strategies for coping. The results of this study showed a weak strength of association between stress and IDWG, with a r of 0.341. This is because there are many factors that influence IDWG that were not studied. The results also showed an R of 11.6%, which means that stress affects IDWG by 11.6% and the rest is influenced by other factors. In addition to psychological factors, IDWG is also strongly influenced by physical factors such as fluid diet, duration of hemodialysis, complications during HD, physical activity management, and nutrition (Mosleh et al., 2020).

Psychological factors can influence the self-management behavior of hemodialysis patients, such as not restricting fluids and nutrition, not doing physical activity, and not routinely or completely undergoing hemodialysis therapy (Ma et al., 2022; S. H. Pratiwi et al., 2019). This can have an impact on poor treatment outcomes in hemodialysis patients, one of which is an increase in IDWG. Increased IDWG beyond the normal range can increase the risk of complications and even death in hemodialysis patients. (Dantas et al., 2019) found that in patients receiving conventional HD, IDWG ≥4% of DW was found to be a borderline outcome for cardiovascular death and an independent predictor of mortality from all causes.

4. Conclusion

Based on the results of the study, it can be concluded that there is a positive and weak relationship between stress and IDWG in patients undergoing hemodialysis, with p-value 0,001 (<0,05). This study also had limitations. We conducted this study cannot control other factors related to IDWG. In addition, data collection was in the form of self-report, which can be a major limitation. Researchers are then expected to examine other factors that affect IDWG so as to determine the most dominant factor affecting IDWG in hemodialysis patients and also qualitative research on stress among hemodialysis patient with its related factor. This study can be a basic literature for nurses to pay attention on psychological aspect and also for the stakeholder.

Acknowledgements

We would like to express our gratitude to the RSD Mangusada Bali and relevant authorities for their financial and moral support of this study and we would like to thank the STIKES Bina Usada Bali. Also, we would like to show our appreciation to all the participating hemodialysis patients.

Reference

Ahmad, M. M., & Al Nazly, E. K. (2015). Hemodialysis: Stressors and coping strategies. *Psychology, Health & Medicine*, *20*(4), 477–487. https://doi.org/10.1080/13548506.2014.952239

Angraini, F., & Putri, A. F. (2016). Pemantauan Intake Output Cairan pada Pasien Gagal Ginjal Kronik dapat Mencegah Overload Cairan. *Jurnal Keperawatan Indonesia*, *19*(3), 152–160. https://doi.org/10.7454/jki.v19i3.475

Bautovich, A., Katz, I., Smith, M., Loo, C. K., & Harvey, S. B. (2014). Depression and chronic kidney

disease: A review for clinicians. *Australian & New Zealand Journal of Psychiatry*, *48*(6), 530–541. https://doi.org/10.1177/0004867414528589

Bossola, M., Pepe, G., & Vulpio, C. (2018). The Frustrating Attempt to Limit the Interdialytic Weight Gain in Patients on Chronic Hemodialysis: New Insights Into an Old Problem. *Journal of Renal Nutrition*, *28*(5), 293–301. https://doi.org/10.1053/j.jrn.2018.01.015

Camelia, S., Păduraru, A., & Iorga, M. (2016). Stress, coping mechanisms and quality of life in hemodialysis patients. *Archives of Medical Science - Civilization Diseases*, *1*, 16–23. https://doi.org/10.5114/amscd.2016.59601

Dantas, L. G. G., de Seixas Rocha, M., Junior, J. A. M., Paschoalin, E. L., Paschoalin, S. R. K. P., & Sampaio Cruz, C. M. (2019). Non-adherence to Haemodialysis, Interdialytic weight gain and cardiovascular mortality: A cohort study. *BMC Nephrology*, *20*, 402. https://doi.org/10.1186/s12882-019-1573-x

Dennick, K., Sturt, J., & Speight, J. (2017). What is diabetes distress and how can we measure it? A narrative review and conceptual model. *Journal of Diabetes and Its Complications*, *31*(5), 898–911. https://doi.org/10.1016/j.jdiacomp.2016.12.018

Dhungana, M., Shrestha, P., Pandey, S., Paudyal, S., & Agrawal, K. K. (2023). Moderate Stress Level among Patients Undergoing Hemodialysis in a Tertiary Care Centre. *JNMA: Journal of the Nepal Medical Association*, *61*(264), 651–653. https://doi.org/10.31729/jnma.8231

Efe, D., & Kocaöz, S. (2015). Adherence to diet and fluid restriction of individuals on hemodialysis treatment and affecting factors in Turkey. *Japan Journal of Nursing Science: JJNS*, *12*(2), 113–123. https://doi.org/10.1111/jjns.12055

Gebrie, M. H., & Ford, J. (2019). Depressive symptoms and dietary non-adherence among end stage renal disease patients undergoing hemodialysis therapy: Systematic review. *BMC Nephrology*, *20*(1), 429. https://doi.org/10.1186/s12882-019-1622-5

Gedara, T., Gunarathne, T. N., Tang, L., Khatijah, L. A., Nanayakkara, N., Lim, S., & Mohajer, S. (2022). Factors Influencing Stress Perception among Hemodialysis Patients: A Systematic Review. *Iranian Red Crescent Medical Journal*, *24*. https://doi.org/10.32592/ircmj.2022.24.6.2074

Gela, D., & Mengistu, D. (2018). Self-management and associated factors among patients with end-stage renal disease undergoing hemodialysis at health facilities in Addis Ababa, Ethiopia. *International Journal of Nephrology and Renovascular Disease*, *11*, 329–336. https://doi.org/10.2147/IJNRD.S184671

George, S., Zaidi, S. Z. H., & Kazmi, S. (2022). Stress, anxiety and perceived social support among hemodialysis patients with chronic kidney disease. *International Journal of Health Sciences*. https://doi.org/10.53730/ijhs.v6nS1.7184

Ghaffari, M., Morowatisharifabad, M. A., Mehrabi, Y., Zare, S., Askari, J., & Alizadeh, S. (2019). What Are the Hemodialysis Patients' Style in Coping with Stress? A Directed Content Analysis. *International Journal of Community Based Nursing and Midwifery*, *7*(4), 309–318. https://doi.org/10.30476/IJCBNM.2019.81324.0

Hintistan, S., & Terzi, A. (2018). Evaluation of Symptoms in Patients Undergoing Hemodialysis. *Bezmialem Science*, *6*, 112–118. https://doi.org/10.14235/bs.2018.1530

Hong, L. I., Wang, W., Chan, E. Y., Mohamed, F., & Chen, H. (2017). Dietary and fluid restriction perceptions of patients undergoing haemodialysis: An exploratory study. *Journal of Clinical Nursing*, *26*(21–22), 3664–3676. https://doi.org/10.1111/jocn.13739

Indonesian Society of Nephrology. (2018). 11th Report Of Indonesian Renal Registry 2018. *Irr*, 1–46.

Indramayu, D. I. R., Saefulloh, M., & Nuraeni, W. (2016). Efficacy dan Menurunkan IDWG Pasien Hemodialisa. *Pendidikan Keperawatan Indonesia*, *2*(1).

Ipema, K. J. R., Kuipers, J., Westerhuis, R., Gaillard, C. A. J. M., van der Schans, C. P., Krijnen, W. P., & Franssen, C. F. M. (2016). Causes and Consequences of Interdialytic weight gain. *Kidney and Blood Pressure Research*, *41*(5), 710–720. https://doi.org/10.1159/000450560

Jo, A., Ji Seo, E., & Son, Y. (2020). The roles of health literacy and social support in improving adherence to self-care behaviours among older adults with heart failure. *Nursing Open*, *7*(6), 2039–2046. https://doi.org/10.1002/nop2.599

Kahraman, A., Akdam, H., Alp, A., Huyut, M. A., Akgullu, C., Balaban, T., Dinleyen, F., Topcu, A., Gelmez, H., Atakan, N., Akar, H., & Yenicerioglu, Y. (2015). Impact of Interdialytic Weight Gain (IDWG) on Nutritional Parameters, Cardiovascular Risk Factors and Quality of Life in Hemodialysis Patients. *BANTAO Journal*, *13*(1), 25–33. https://doi.org/10.1515/bj-2015-0006

Lee, K. Y. (2017). A unified pathogenesis for kidney diseases, including genetic diseases and cancers, by the protein-homeostasis-system hypothesis. *Kidney Research and Clinical Practice*, *36*(2), 132–144. https://doi.org/10.23876/j.krcp.2017.36.2.132

Lim, K. A., & Lee, J. H. (2022). Factors Affecting Quality of Life in Patients Receiving Hemodi-alysis. *Iranian Journal of Public Health*. https://doi.org/10.18502/ijph.v51i2.8688

Ma, L.-C., Liu, Y.-M., Lin, Y.-C., Liao, C.-T., Hung, K.-C., Chen, R., Lu, K.-C., Ho, K.-F., & Zheng, C.-M. (2022). Factors Influencing Self-Management Behaviors among Hemodialysis Patients. *Journal of Personalized Medicine*, *12*(11), 1816. https://doi.org/10.3390/jpm12111816

Maimani, Y. Al, Elias, F., Salmi, I. Al, Aboshakra, A., Alla, M. A., & Hannawi, S. (2021). Interdialytic Weight Gain in Hemodialysis Patients: Worse Hospital Admissions and Intradialytic Hypotension. *Open Journal of Nephrology*, *11*(02), 156–170. https://doi.org/10.4236/ojneph.2021.112013

Marsidi, S. R. (2021). Identification of Stress, Anxiety, and Depression Levels of Students in Preparation for the Exit Exam Competency Test. Journal of Vocational Health Studies, 5(2), 87. https://doi.org/10.20473/jvhs.v5.i2.2021.87-93

Moledina, D. G., & Perry Wilson, F. (2015). Pharmacologic Treatment of Common Symptoms in Dialysis Patients: A Narrative Review. *Seminars in Dialysis*, *28*(4), 377–383. https://doi.org/10.1111/sdi.12378

Mosleh, H., Alenezi, M., Al johani, S., Alsani, A., Fairaq, G., & Bedaiwi, R. (2020). Prevalence and Factors of Anxiety and Depression in Chronic Kidney Disease Patients Undergoing Hemodialysis: A Cross-sectional Single-Center Study in Saudi Arabia. *Cureus*. https://doi.org/10.7759/cureus.6668

Murdaningsih, L., Indriyawati, N., & Trisnaningtyas, W. (2023). Factors Affecting Interdialytic Weight Gain (IDWG) in Kidney Failure. *Jendela Nursing Journal*, *7*(1), 20–29.

Noviana, C. M., & Zahra, A. N. (2021). Social support and self-management among end-stage renal disease patients undergoing hemodialysis in Indonesia. *Journal of Public Health Research*, *11*(2), 2733. https://doi.org/10.4081/jphr.2021.2733

Novitasari, I. (2015). *Gambaran Tingkat Kecemasan, Stres, Depresi Dan Mekanisme Koping Pasien Penyakit Ginjal Kronik Yang Menjalani Hemodialisis di RSUD dr. Moewardi*. FK Universitas Diponegoro.

Nurdina, G., & Anggraeni, D. (2022). Interdialytic Body Weight Gain, Anxiety, Fatigue and Quality of Life in Hemodialysis Patients During the COVID-19 Pandemic. *KnE Life Sciences*. https://doi.org/10.18502/kls.v7i2.10348

Ozen, N., Cinar, F. I., Askin, D., Mut, D., & Turker, T. (2019). Nonadherence in Hemodialysis Patients and Related Factors: A Multicenter Study. *Journal of Nursing Research*, *27*(4), e36. https://doi.org/10.1097/jnr.0000000000000309

Parvan, K., Ahangar, R., Hosseini, F. A., Abdollahzadeh, F., Ghojazadeh, M., & Jasemi, M. (2015).

Coping methods to stress among patients on hemodialysis and peritoneal dialysis. *Saudi Journal of Kidney Diseases and Transplantation: An Official Publication of the Saudi Center for Organ Transplantation, Saudi Arabia*, *26*(2), 255–262. https://doi.org/10.4103/1319-2442.152409

Pratiwi, D. (2015). *Hubungan Dukungan Keluarga dengan Tingkat Depresi Pasien Gagal Ginjal Kronik dengan Hemodialisis di RS PKU Muhammadiyah Yogyakarta*. STIKES Aisyiyah Yogyakarta.

Pratiwi, S. H., Sari, E. A., & Kurniawan, T. (2019). Kepatuhan Menjalankan Manajemen Diri Pada Pasien Hemodialisis. *Jurnal Perawat Indonesia*, *3*(2), 131. https://doi.org/10.32584/jpi.v3i2.308

Song, Y., Chen, L., Wang, W., Yang, D., & Jiang, X. (2022). Social Support, Sense of Coherence, and Self-Management among Hemodialysis Patients. *Western Journal of Nursing Research*, *44*(4), 367–374. https://doi.org/10.1177/0193945921996648

Stevenson, J., Tong, A., Campbell, K. L., Craig, J. C., & Lee, V. W. (2018). Perspectives of healthcare providers on the nutritional management of patients on haemodialysis in Australia: An interview study. *BMJ Open*, *8*(3), e020023. https://doi.org/10.1136/bmjopen-2017-020023

Sulistni, R., Damanik, H. D., & Lukman. (2021). *Anxiety Stress and Fatigue in Hemodialysis Patient*. https://doi.org/10.2991/assehr.k.210415.020

The Ministry of Health The Republic of Indonesia. (2018). *Hasil Utama Riskesdas 2018*. Badan Penelitian Dan Pengembangan Kesehatan. http://www.depkes.go.id/resouces/download/info-terkini/hasil-riskesdas-2018.pdf

Tu, H.-Y., Shao, J.-H., Wu, F.-J., Chen, S.-H., & Chuang, Y.-H. (2014). Stressors and coping strategies of 20–45-year-old hemodialysis patients. *Collegian*, *21*(3), 185–192. https://doi.org/10.1016/j.colegn.2013.02.003

Zhu, N., Virtanen, S., Xu, H., Carrero, J. J., & Chang, Z. (2023). Association between incident depression and clinical outcomes in patients with chronic kidney disease. *Clinical Kidney Journal*, *16*(11), 2243–2253. https://doi.org/10.1093/ckj/sfad127

Zibaei, M., Nobahar, M., & Ghorbani, R. (2020). Association of stress and anxiety with self-care in hemodialysis patients. *Journal of Renal Injury Prevention*, *9*(2), Article 2. https://doi.org/10.34172/jrip.2020.14

Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (27-38)
e-ISSN 2477-8184
p-ISSN 1858-0610
https://doi.org/10.31101/jkk.3636

Systematic Review

Cost-effectiveness of gestational diabetes screening in middle-income countries: a systematic review

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Submitted: January 10, 2024 Revised: March 30, 2024 Accepted: June 6, 2024

Abstract
The majority of GDM occurs in low- and middle-income countries. GDM is associated with increased maternal and infant complications as well as an increased burden of health financing. Accurate and cost-effective screening is needed for prevention and further treatment. Unfortunately, there is a lack of research on the cost-effectiveness of GDM screening in middle-income countries. The objective of this study was to uncover scientific proof concerning the cost-effectiveness analysis of screening for gestational diabetes in middle-income countries. We conducted a systematic review using Pubmed and ScienceDirect. Four reviewers screened the title and abstract of each article, followed by the selection of the full text based on the inclusion criteria (cost-effectiveness analysis studies of GDM screening and original research). Quality articles were assessed using the CHEC-Extended tool. A total search of 1239 articles found 3 studies that met the inclusion criteria. A screening program is more cost-effective than no screening, this represents a savings of $1,329,671. The ICER value is less than 3x GDP per capita, which indicates that the intervention is cost-effective. Compared to two-step screening, one-step screening is more likely to be cost-effective since it detects more cases. As the prevention of DALYs is mainly due to the prevention of T2DM, middle-income countries should focus more on postnatal care for women with GDM in the future. It is advised that long-term follow-up studies be a major focus of future research in order to evaluate the follow-up GDM screening intervention's possible long-term health benefits and financial effects.

Keywords: Cost-effectiveness analysis; economic evaluation; gestational diabetes mellitus; GDM screening; middle-income countries

1. Introduction

In 2020, approximately 287,000 women died from pregnancy and childbirth. Almost 95% of all maternal deaths in 2020 occurred in low- and middle-income countries (WHO, 2024). Complications during pregnancy, childbirth, and postpartum account for 75% of maternal deaths (WHO, 2024). Gestational diabetes mellitus (GDM) is associated with an increased risk of complications during pregnancy and postpartum in the mother and her baby (Bhandiwad et al., 2015; Jafari-Shobeiri et al., 2015). Some previous studies have shown that GDM increased risk of preeclampsia (Lee et al., 2017; Yang & Wu, 2022), macrosomia (Bai et al., 2023; Sweeting et al., 2022; Ye et al., 2022), instrumental delivery (Ye et al., 2022), preterm birth (Ye et al., 2022), cesarean section delivery (Akinyemi et al., 2023; Ye et al., 2022; Zhuang et al., 2020), and stillbirth (Ye et al., 2022). Even within 8 to 10 years after pregnancy, women with GDM have a 10-fold risk of developing type 2 DM (Eades et al., 2015; Herath et al., 2017). Gestational diabetes mellitus also has the potential to increase the economic burden of healthcare. The results of a study on the economic burden of GDM in Italy showed that, compared to normal pregnant women, antenatal costs in pregnant women with GDM were greater than €326.9 (8 times), while the cost of maternity hospitalization was greater than €234 (1.39 times) for mothers and

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€257 (1.3 times) for infants. As a result, in 2014, the national economy bore the financial burden of about €44.8 million due to the overall cost per case differential between GDM and normal pregnancies of €817.8 (Meregaglia et al., 2018).

The serious impact of GDM requires serious prevention and treatment. One of them involves GDM screening. Unfortunately, there isn't a "gold standards" on GDM screening strategies and diagnostic criteria; hence, the standards used in each nation vary. Some frequently used diagnostic criteria for GDM include: World Health Organization (WHO), American Diabetes Association (ADA), Society of Obstetricians and Gynecologists of Canada, International Federation of Gynecology and Obstetrics, American College of Obstetricians and Gynecologist (ACOG), and International Association of the Diabetes and Pregnancy Study Group (IADPSG) (American Diabetes Association, 2019; Li-zhen et al., 2019). There are two GDM screening strategies: the one-step strategy and the two-step strategy. One-step strategy: the average fasting, 1-hour, and 2-hour plasma glucose assessments during a 75-g oral glucose tolerance test (OGTT) in women at 24–28 weeks of gestation were the diagnostic cut points for GDM established by the IADPSG and WHO (American Diabetes Association, 2019; Behboudi-Gandevani et al., 2019). Meanwhile, a two-step screening strategy is recommended by American Diabetes Association (ADA). Step 1: Using a non-fasting 50 g glucose challenge test (GCT), Step 2: 0-hour, 1-hour, 2-hour, and 3-hour plasma glucose measured during 100 g OGTT. Step 2 is advised if the one-hour GCT value is greater than 140 mg/dl (American Diabetes Association, 2019).

The heterogeneity of screening strategies and diagnostic criteria for GDM identification has an impact on the variation and accuracy of GDM prevalence estimates, making it challenging to estimate and compare the prevalence of GDM globally. In 2021, it was estimated that the global prevalence of GDM will reach 14%, while in low- and middle-income countries, it will reach 12.7% and 9.2%, respectively (H. Wang et al., 2022). According to Cho et al., (2018), 88% of GDM occurs in low- and middle-income countries, where access to healthcare is limited. The IADPSG diagnostic criteria for GDM have a 1.75 to 11-fold increase in prevalence over the previous diagnostic criteria (Behboudi-Gandevani et al., 2019; Saeedi et al., 2021). In addition, several barriers to the application of OGTT for GDM screening in developing countries such as high cost and lack of laboratories particularly when IADPSG criteria are applied (Mohan et al., 2014). It is a challenge for governments and health care providers in developing countries to determine a cost-effective, safe, and accurate GDM screening strategy.

Evaluation of a health-care intervention's influence on costs is necessary in addition to its clinical effectiveness. In order to improve health outcomes, healthcare providers and policymakers can make the most efficient use of limited resources by choosing which healthcare interventions to implement and/or reimburse based on the relative cost-effectiveness of those interventions, as informed by such analyses (Haque et al., 2024). Unfortunately, although there have been many studies on gestational diabetes, many studies have centred on the impact of GDM, types of care, and patient characteristics, there is a lack of studies about the cost-effectiveness of GDM screening, especially in middle-income countries. The objective of this study was to uncover scientific proof concerning the cost-effectiveness analysis of screening for gestational diabetes in middle-income countries.

2. Research Methods

This study is a systematic review that is organized based on The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline (Page et al., 2021). According to Page et al. (2021), a systematic review employs explicit and systematic methods to gather and synthesize research results by answering formulated questions.

2.1.Search Strategy

We used the PICOS framework (Population, Intervention/Exposure, Comparison, Outcomes and Study design) to help identify search terms to be used in the literature search, as shown in Table 1.

Tabel 1. PICOS Framework

PICOS Elemen	Determinants
Population	Pregnant women in middle-income countries that have been registered with the World Bank Low and Middle-Income Countries (LMIC)
Intervention /Exposure	GDM Screening
Comparison	There are no screening or other preventive measures for Gestational Diabetes Mellitus
Outcomes	Effectiveness cost of GDM screening
Study Design	Cost-Effectiveness Analysis (CEA)

An extensive literature review was conducted in the PubMed, and ScienceDirect databases to obtain English articles examining the cost-effectiveness of screening GDM. A systematic search process on June 14, 2023, then, we updated the search again on June 21, 2023. In searching for articles, we determined the following keywords: "Pregnant* OR Perinatal OR Gestation*OR Pregnancy AND Screen* OR Early detection* OR Mass screening AND Gestational diabetes mellitus AND Cost-effectiveness analysis, OR cost utility analysis." The search was expanded using word synonyms and controlled vocabulary (MESH) on Pubmed.

2.2.Studies Selection and Eligibility Criteria

Articles obtained from our search are combined into Mendeley as a reference manager to identify and eliminate duplicate articles. Following this, the four reviewers (YS, DL, PA, and AR) were further divided into two groups as follows: (YS with PA) and (DL with AR). Each group filters the title and abstract of each article using the RAYYAN application. The results of filtering articles in the application that are considered doubtful are then searched to find the full article to evaluate its relevance to the study.

Article studies can be included if they comply with the criteria for the population's eligibility in the PICOS framework in Table 1. We determined the inclusion criteria using English and Indonesian, original research, and studies discussing cost-effectiveness analysis in GDM screening and exclusion criteria, namely review studies, opinions, documents or reports, and research without full text.

2.3.Quality Appraisal of the Included Articles

Four reviewers (YS, DL, PA, and AR) assessed the quality of studies using the Consensus Health Economic Criteria (CHEC-Extended) tool, which is reported in Table 2. The CHEC-Extended tool is an assessment guide assessing the quality of the articles related to the economic assessments of health interventions (Odnoletkova et al., 2014; van Delft et al., 2023).

Table 2. Quality Appraisal of the Included Articles Using CHEC-Extended Tool

No	QUESTIONS	(Marseille et al., 2013)	(Zhang et al., 2015)	(Celen et al., 2012)
1.	Is the study population clearly described?	1	1	1
2.	Are competing alternatives clearly described?	0	0	1
3.	Is a well-defined research question posed in answerable form?	0	0	1

No	QUESTIONS	(Marseille et al., 2013)	(Zhang et al., 2015)	(Celen et al., 2012)
4.	Is the economic study design appropriate to the stated objectives?	1	1	1
5.	Are the structural assumptions and the validation methods of the model properly reported?	1	1	0
6.	Is the chosen time horizon appropriate in order to include relevant costs and consequences?	1	1	1
7.	Is the actual perspective chosen appropriate?	0	0	0
8.	Are all important and relevant costs for each alternative identified?	0	0	1
9.	Are all costs measured appropriately in physical units?	1	1	1
10.	Are costs worth appropriately?	1	1	1
11.	Are all important and relevant outcomes for each alternative identified?	1	1	1
12.	Are all outcomes measured appropriately?	1	1	1
13.	Are outcomes valued appropriately?	1	1	1
14.	Is an appropriate incremental analysis of costs and outcomes of alternatives performed?	1	1	1
15.	Are all future costs and outcomes discounted appropriately?	1	1	1
16.	Are all important variables, whose values are uncertain, appropriately subjected to sensitivity analysis?	1	1	0
17.	Do the conclusions follow from the data reported?	1	1	1
18.	Does the study discuss the generalizability of the results to other settings and patient/client groups?	1	1	1
19.	Does the article/report indicate that there is no potential conflict of interest of the study researcher(s) and funder(s)?	0	0	1
20.	Are ethical and distributional issues discussed appropriately?	0	0	0
		14	**14**	**16**
	TOTAL "YES" ANSWER			
	TOTAL SCORE (%)	**70**	**70**	**80**
	EVALUATION	**Moderate**	**Moderate**	**Good**

Assessment Grade:
Low <50
Moderate 51-75
Good 76-95
Excellent >95

2.4.Extracted Information

We extracted the features of the studies reviewed based on countries classified as middle-income countries, population, and interventions reported in Table 3. In addition, we also documented the studies reviewed based on sensitivity analysis such as time horizon, perspective, discount rate, probabilistic sensitivity analysis, one-way sensitivity analysis, scenario analysis, and model validation, which have been reported in Table 4.

Table 3. Characteristics of the Studies Reviewed

Author Year	Country (Income level)	Study design	Economical	Population	Intervention
(Marseille et al., 2013)	**India** (Middle income)	Model-based	CEA	1,000 pregnant women	Screening with a glucose tolerance test or Oral Glucose Tolerance Test (OGTT)
(Zhang et al., 2015)	**China** (Middle income)	Observation	CEA	1,000 pregnant women	IADPSG guidelines, one-step OGTT
(Celen et al., 2012)	**Türkiye** (Middle income)	Observation	CEA	2,724 pregnant women in the first procedure and the second step of the procedure in 185 pregnant women.	One and two-step OGTT GDM screening.

Table 4. Study Characteristics Reviewed by Sensitivity Analysis

Author Year	Time Horizons	Perspective	Discount Rate	Probabilistic sensitivity analysis	One-Way Sensitivity Analysis	Scenario Analysis	Model Validation
(Marseille et al., 2013)	**Life–years**	**Society**	**3.0%**	**Yes**	**No**	**No**	**No**
(Zhang et al., 2015)	**Life-year**	**Society**	**3.0%**	**No**	**Yes**	**No**	**No**
(Celen et al., 2012)	**-**	**Health care**	**4.2%**	**No**	**No**	**No**	**No**

Finally, we document the results of the cost-effectiveness of the study based on the author, the effectiveness of the results of measuring parameters, currency and year, ICER, and conclusions by the author (quality of study CHEC-Extended Tool), which have been reported in Table 5.

Table 5. Article Cost-effectiveness Results

Author Year	Effectiveness of parameter measurement results	Currency, Year	ICER	Conclusion by the author (Quality of study according to check)
(Marseille et al., 2013)	**DALY**	**$ (2014)**	**cost-effectiveness of $1626**	GDM screening, taking into account perinatal adverse events and future diabetes, demonstrated a moderate incremental cost-effectiveness of $1626.
(Zhang et al., 2015)	**DALY**	**$ (2015)**	**cost-effectiveness of $1,329,671**	Based on IADPSG standards, interventions for GDM are cost-effective in China's urban areas. As the prevention of DALYs is mainly due to the prevention of T2DM, China should focus more on postnatal care for women with GDM in the future.

Author Year	Effectiveness of parameter measurement results	Currency, Year	ICER	Conclusion by the author (Quality of study according to check)
(Celen et al., 2012)	Unclear	Lira (2012)	-	The one-step approach test cost per woman was 0.75 Turkish Lira lower than the two-step approach test; however, the test took 18.6 minutes longer and required 1.08 times more blood sample procedures (Good)

3. Results and Discussion

The search for articles we carried out in stages according to the selection is reported in Figure 1. The search process with two databases produced a total 1240 articles. The PubMed database produced 257 articles, and ScienceDirect produced 983 articles. We used Mendeley to see duplicates, and we got 1 duplicate article, so the number of articles was 1239. Then, we filtered these articles based on the title and abstract using RAYYAN, excluding 1202 articles, so the number of articles became 37. Then, 37 articles were viewed in full text. Eleven articles were excluded because they could not be accessed in full text, bringing the total number of articles to 26. We reviewed 26 articles in detail, so we excluded 23 articles again because they failed to satisfy the criteria for inclusion. There are 3 articles used in this systematic review.

3.1.Article Characteristics

The studies obtained came from middle-income countries, including India (Marseille et al., 2013), China (Zhang et al., 2015), and Turkey (Celen et al., 2012). Based on study design, there are two type of study desain: model-based study design (Marseille et al., 2013) and observations (Celen et al., 2012; Zhang et al., 2015). Both of these studies use cost-effectiveness analysis to calculate costs.

In healthcare, cost-effectiveness analysis (CEA) is a crucial and frequently applied method for establishing such priorities. The incremental cost-effectiveness ratio (ICER), which is the ratio of incremental costs to incremental outcomes, is a common way to express CEA results. Generic efficacy measurements, such disability-adjusted life-years (DALYs) and quality-adjusted life-years (QALYs), are frequently used in CEA investigations (Daroudi et al., 2021).

The population in this systematic review was carried out on 1,000 pregnant women (Marseille et al., 2013; Zhang et al., 2015), and on 2,909 pregnant women (Celen et al., 2012). Then, interventions were carried out on IADPSG OGTT screening (Marseille et al., 2013; Zhang et al., 2015), as well as one-step and two-step OGTT screening strategy (Celen et al., 2012). IADPSG and WHO recommend a one-step strategy: fasting, 75-g OGTT, plasma glucose measured after 1 hour, and 2 hours of glucose administration (American Diabetes Association, 2019; Behboudi-Gandevani et al., 2019). Two-step screening strategy is recommended by American Diabetes Association (ADA). Step 1 is glucose challenge test (GCT) use 50 g glucose. If after 1 hour plasma glucose shows abnormal results (more than 140 mg/dl), then continue step 2 by giving of 100 g of glucose, and plasma glucose is measures at 0, 1, 2, and 3 hours (American Diabetes Association, 2019). Currently, the majority countries of the world applies the one-step approach, but the United States and a few other countries use two-step approach (Behboudi-Gandevani et al., 2019).

There is time limit (time horizon) in implementing screening, there was no age limit (Marseille et al., 2013) and no a time limit for implementation (Celen et al., 2012; Zhang et al., 2015) (Table 4). From the cost perspective: a social or general view (Marseille et al., 2013; Zhang et al., 2015), and a view of one's own health (Celen et al., 2012). The discount rate obtained in financing GDM screening was 3.0% (Marseille et al., 2013; Zhang et al., 2015) and 4.2% (Celen et al., 2012). The sensitivity

analysis: sensitivity probability analysis (Marseille et al., 2013), and one-way sensitivity analysis (Zhang et al., 2015). In this study, an assessment was carried out on three articles using the CHEC-Extended tool. The results obtained were scores 70 (moderate grade) (Marseille et al., 2013; Zhang et al., 2015), and a score of 80 (good grades) (Celen et al., 2012).

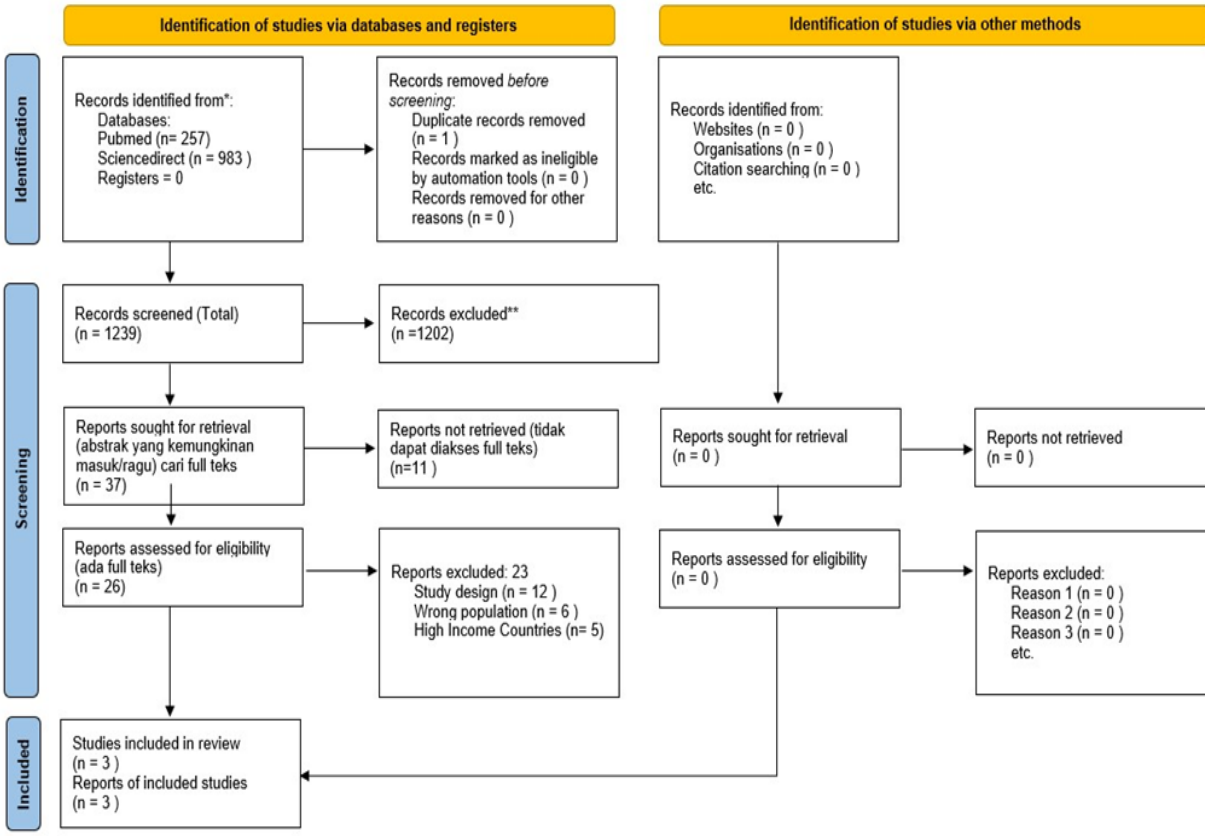

Figure 1. PRISMA Flowchart 2020

3.2.Cost-Effectiveness Screening GDM

A glucose challenge test using 50 g of glucose was performed on 2,724 pregnant women, of whom 628 continued step two, with the administration 100 g of glucose. While a one-step approach test with 75 g of glucose was performed on 185 pregnant women (Celen et al., 2012). The result of this study has shown that the one-step approach test cost per woman was 0.75 Turkish Lira lower than the two-step approach test; however, the test took 18.6 minutes longer and required 1.08 times more blood sample procedures (Celen et al., 2012). A screening program is more cost-effective than no screening. Compared to two-step screening, one-step screening is more likely to be cost-effective since it detects more cases. This result is the same as the results of Mo et al., (2021) study. Several studies have proven that the one-step method of IADPSG has the potential to increase the prevalence of GDM by 1.75 to 11-fold compared to others (Behboudi-Gandevani et al., 2019; Ramezani Tehrani et al., 2023; Saeedi et al., 2021). Due to its potential to detect and treat GDM sooner, the IADPSG criteria is the only outcome-based criteria that can reduce the complication related GDM in maternal and fetal (Rani & Begum, 2016). If GDM is detected early, treatment can be taken immediately to prevent worse impacts including preventing Type 2 DM in mothers and babies in the future. This will have an effect on reducing health costs due to DALYs.

The "WHO-CHOICE threshold" of 1-3× Gross Domestic Product (GDP) per capita has been frequently mentioned as a criterion for cost-effectiveness in the majority of research carried out in

LMICs (Leech et al., 2018; Ochalek et al., 2015). The WHO-CHOICE criterion states that if an intervention's ICER is less than 1× GDP per capita (highly cost-effective), less than 3× GDP per capita (cost-effective), and 3× GDP per capita or higher (not cost-effective) (Daroudi et al., 2021; Neumann et al., 2016). The GDM screening in India, taking into account such as perinatal adverse events and future diabetes, demonstrated a moderate incremental cost-effectiveness ratio (ICER) of $1626 (Marseille et al., 2013). Meanwhile, India's GDP per capita in 2013 was $1,438.1 (World Bank, 2016). This shows that the ICER value is less than 3x GDP per capita, which indicates that the intervention is cost-effective.

Zhang et al. (2015) found that in the GDM screening group, the overall expenditures of GDM screening, intervention, and lifetime treatment for 1000 pregnant women came to $7,092,398; this represents a savings of $1,329,671 when compared to the non-screening group. In the screening group, 277.4 DALYs were avoided, primarily due to GDM postpartum therapy for the prevention of type 2 diabetes. Sensitivity studies proved how reliable the findings were. Y.-Y. Wang et al. (2019) reported that 55% of women with a history of GDM in a previous pregnancy who had recurrent GDM in subsequent pregnancies. In addition, the risk of developing type 2 diabetes mellitus increases up to 10 times within 8 to 10 years after pregnancy (Eades et al., 2015; Herath et al., 2017). This will certainly have an impact on increasing the economic burden associated with diabetes, as DM is one of the non-communicable diseases that is the largest contributor to morbidity and mortality globally. Follow-up postnatal screening for mothers with a history of GDM is a major concern. Some high-income countries have implemented this intervention, but in low- and middle-income countries, it has not been widely implemented. Barriers to follow-up screening for GDM in low- and middle-income countries include the absence of guidelines, patients' and providers' lack of knowledge about GDM, the cost and distance of accessing regular monitoring and follow-up care, the unavailability of services, the lack of adequate testing equipment, patients' lack of motivation and adherence to recommended therapy, and a lack of communication (Utz & De Brouwere, 2016).

Short-term maternal and neonatal outcomes can be improved by GDM screening using IADPSG guidelines (a 2-hour 75 g OGTT) in 24-28 gestational weeks (He et al., 2020; Ramezani Tehrani et al., 2023). The risk of preterm delivery, cesarean section, macrosomia, neonatal hypoglycemia, and admission to the neonate intensive care unit (NICU) was significantly lower for women who were screened using the one-stage approach than for those a two-step screening method (Saccone et al., 2019). According to Rani & Begum (2016), the advantage of the one-step method is ease of implementation, more patient-friendly, more accurate diagnosis and nearly to international consensus.

4. Conclusion

This systematic review study found that GDM screening. A screening program is more cost-effective than no screening, this represents a savings of $1,329,671. The ICER value is less than 3x GDP per capita, which indicates that the intervention is cost-effective. Compared to two-step screening, one-step screening is more likely to be cost-effective since it detects more cases. As the prevention of DALYs is mainly due to the prevention of T2DM, the middle income countries should focus more on postnatal care for women with GDM in the future. It is advised that long-term follow-up studies be a major focus of future research in order to evaluate the follow-up GDM screening intervention's possible long-term health benefits and financial effects.

Acknowledgment

We also thank the Aisyiyah Yogyakarta Midwifery Masters Study Program for enabling us to procure research materials from a variety of online databases.

Reference

Akinyemi, O. A., Weldeslase, T. A., Odusanya, E., Akueme, N. T., Omokhodion, O. V., Fasokun, M. E., Makanjuola, D., Fakorede, M., & Ogundipe, T. (2023). Profiles and Outcomes of Women with Gestational Diabetes Mellitus in the United States. *Cureus*, *15*(7), e41360. https://doi.org/10.7759/cureus.41360

American Diabetes Association. (2019). 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2020. *Diabetes Care*, *43*(Supplement_1), S14–S31. https://doi.org/10.2337/dc20-S002

Bai, W., Wang, H., Fang, R., Lin, M., Qin, Y., Han, H., Cui, J., Zhang, R., Ma, Y., Chen, D., Zhang, W., Wang, L., & Yu, H. (2023). Evaluating the effect of gestational diabetes mellitus on macrosomia based on the characteristics of oral glucose tolerance test. *Clinica Chimica Acta*, *544*, 117362. https://doi.org/10.1016/j.cca.2023.117362

Behboudi-Gandevani, S., Amiri, M., Bidhendi Yarandi, R., & Ramezani Tehrani, F. (2019). The impact of diagnostic criteria for gestational diabetes on its prevalence: A systematic review and meta-analysis. *Diabetology & Metabolic Syndrome*, *11*(1), 11. https://doi.org/10.1186/s13098-019-0406-1

Bhandiwad, A., Divyasree, B., & Gowda, S. L. (2015). Adverse maternal and perinatal outcomes in gestational diabetes mellitus. *International Journal of Medical Research & Health Sciences*, *4*(4), 775. https://doi.org/10.5958/2319-5886.2015.00152.6

Celen, S., Yildiz, Y., Kahyaoglu, S., Kaymak, O., Ozel, M., Timur, H., & Danisman, N. (2012). Cost-Effectivity Analysis of One-Step Versus Two-Step Screening for Gestational Diabetes. *The Eurasian Journal of Medicine*, *44*(2), 84–87. https://doi.org/10.5152/eajm.2012.20

Cho, N. H., Shaw, J. E., Karuranga, S., Huang, Y., da Rocha Fernandes, J. D., Ohlrogge, A. W., & Malanda, B. (2018). IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Research and Clinical Practice*, *138*, 271–281. https://doi.org/10.1016/j.diabres.2018.02.023

Daroudi, R., Akbari Sari, A., Nahvijou, A., & Faramarzi, A. (2021). Cost per DALY averted in low, middle- and high-income countries: Evidence from the global burden of disease study to estimate the cost-effectiveness thresholds. *Cost Effectiveness and Resource Allocation*, *19*(1), 7. https://doi.org/10.1186/s12962-021-00260-0

Eades, C. E., Styles, M., Leese, G. P., Cheyne, H., & Evans, J. M. (2015). Progression from gestational diabetes to type 2 diabetes in one region of Scotland: An observational follow-up study. *BMC Pregnancy and Childbirth*, *15*(1), 1–6. https://doi.org/10.1186/s12884-015-0457-8

Haque, M. M., Tannous, W. K., Herman, W. H., Immanuel, J., Hague, W. M., Teede, H., Enticott, J., Cheung, N. W., Hibbert, E., Nolan, C. J., Peek, M. J., Wong, V. W., Flack, J. R., Mclean, M., Sweeting, A., Gianatti, E., Kautzky-Willer, A., Harreiter, J., Mohan, V., … Simmons, D. (2024). Cost-effectiveness of diagnosis and treatment of early gestational diabetes mellitus: Economic evaluation of the TOBOGM study, an international multicenter randomized controlled trial. *EClinicalMedicine*, *71*. https://doi.org/10.1016/j.eclinm.2024.102610

He, Z., Tang, Y., Xie, H., Lin, Y., Liang, S., Xu, Y., Chen, Z., Wu, L., Sheng, J., Bi, X., Pang, M., Akinwunmi, B., Xiao, X., & Ming, W. (2020). Economic burden of IADPSG gestational diabetes diagnostic criteria in China: Propensity score matching analysis from a 7-year retrospective cohort. *BMJ Open Diabetes Research & Care*, *8*(1), e001538. https://doi.org/10.1136/bmjdrc-2020-001538

Herath, H., Herath, R., & Wickremasinghe, R. (2017). Gestational diabetes mellitus and risk of type 2 diabetes 10 years after the index pregnancy in Sri Lankan women—A community based

retrospective cohort study. *PLOS ONE*, *12*(6), e0179647. https://doi.org/10.1371/journal.pone.0179647

Jafari-Shobeiri, M., Ghojazadeh, M., Azami-Aghdash, S., Naghavi-Behzad, M., Piri, R., Pourali-Akbar, Y., Nasrollah-Zadeh, R., Bayat-Khajeh, P., & Mohammadi, M. (2015). Prevalence and Risk Factors of Gestational Diabetes in Iran: A Systematic Review and Meta-Analysis. *Iranian Journal of Public Health*, *44*(8), 1036–1044.

Lee, J., Ouh, Y., Ahn, K. H., Hong, S. C., Oh, M.-J., Kim, H.-J., & Cho, G. J. (2017). Preeclampsia: A risk factor for gestational diabetes mellitus in subsequent pregnancy. *PLoS ONE*, *12*(5), e0178150. https://doi.org/10.1371/journal.pone.0178150

Leech, A. A., Kim, D. D., Cohen, J. T., & Neumann, P. J. (2018). Use and Misuse of Cost-Effectiveness Analysis Thresholds in Low- and Middle-Income Countries: Trends in Cost-per-DALY Studies. *Value in Health*, *21*(7), 759–761. https://doi.org/10.1016/j.jval.2017.12.016

Li-zhen, L., Yun, X., Xiao-Dong, Z., Shu-bin, H., Zi-lian, W., Adrian Sandra, D., & Bin, L. (2019). Evaluation of guidelines on the screening and diagnosis of gestational diabetes mellitus: Systematic review. *BMJ Open*, *9*(5), e023014. https://doi.org/10.1136/bmjopen-2018-023014

Marseille, E., Lohse, N., Jiwani, A., Hod, M., Seshiah, V., Yajnik, C. S., Arora, G. P., Balaji, V., Henriksen, O., Lieberman, N., Chen, R., Damm, P., Metzger, B. E., & Kahn, J. G. (2013). The cost-effectiveness of gestational diabetes screening including prevention of type 2 diabetes: Application of a new model in India and Israel. *The Journal of Maternal-Fetal & Neonatal Medicine: The Official Journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians*, *26*(8), 802–810. https://doi.org/10.3109/14767058.2013.765845

Meregaglia, M., Dainelli, L., Banks, H., Benedetto, C., Detzel, P., & Fattore, G. (2018). The short-term economic burden of gestational diabetes mellitus in Italy. *BMC Pregnancy and Childbirth*, *18*(1), 58. https://doi.org/10.1186/s12884-018-1689-1

Mo, X., Gai Tobe, R., Takahashi, Y., Arata, N., Liabsuetrakul, T., Nakayama, T., & Mori, R. (2021). Economic Evaluations of Gestational Diabetes Mellitus Screening: A Systematic Review. *Journal of Epidemiology*, *31*(3), 220–230. https://doi.org/10.2188/jea.JE20190338

Mohan, V., Mahalakshmi, M. M., Bhavadharini, B., Maheswari, K., Kalaiyarasi, G., Anjana, R. M., Uma, R., Usha, S., Deepa, M., Unnikrishnan, R., Pastakia, S. D., Malanda, B., Belton, A., & Kayal, A. (2014). Comparison of screening for gestational diabetes mellitus by oral glucose tolerance tests done in the non-fasting (random) and fasting states. *Acta Diabetologica*, *51*(6), 1007–1013. https://doi.org/10.1007/s00592-014-0660-5

Neumann, P. J., Thorat, T., Zhong, Y., Anderson, J., Farquhar, M., Salem, M., Sandberg, E., Saret, C. J., Wilkinson, C., & Cohen, J. T. (2016). A Systematic Review of Cost-Effectiveness Studies Reporting Cost-per-DALY Averted. *PLOS ONE*, *11*(12), e0168512. https://doi.org/10.1371/journal.pone.0168512

Ochalek, J. M., Lomas, J., & Claxton, K. P. (2015). Cost per DALY averted thresholds for low- and middle-income countries: Evidence from cross country data. *Cost per DALY Averted Thresholds for Low- and Middle-Income Countries*, 1–50.

Odnoletkova, I., Goderis, G., Pil, L., Nobels, F., Aertgeerts, B., Annemans, L., & Ramaekers, D. (2014). Cost-effectiveness of therapeutic education to prevent the development and progression of type 2 diabetes. Systematic review. *Journal of Diabetes & Metabolism*, *05*. https://doi.org/10.4172/2155-6156.1000438

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher,

D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Ramezani Tehrani, F., Rahmati, M., Farzadfar, F., Abedini, M., Farahmand, M., Hosseinpanah, F., Hadaegh, F., Torkestani, F., Valizadeh, M., Azizi, F., & Behboudi-Gandevani, S. (2023). One-step versus two-step screening for diagnosis of gestational diabetes mellitus in Iranian population: A randomized community trial. *Frontiers in Endocrinology*, *13*. https://doi.org/10.3389/fendo.2022.1039643

Rani, P. R., & Begum, J. (2016). Screening and Diagnosis of Gestational Diabetes Mellitus, Where Do We Stand. *Journal of Clinical and Diagnostic Research : JCDR*, *10*(4), QE01–QE04. https://doi.org/10.7860/JCDR/2016/17588.7689

Saccone, G., Caissutti, C., Khalifeh, A., Meltzer, S., Scifres, C., Simhan, H. N., Kelekci, S., Sevket, O., & Berghella, V. (2019). One step versus two step approach for gestational diabetes screening: Systematic review and meta-analysis of the randomized trials. *The Journal of Maternal-Fetal & Neonatal Medicine: The Official Journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians*, *32*(9), 1547–1555. https://doi.org/10.1080/14767058.2017.1408068

Saeedi, M., Cao, Y., Fadl, H., Gustafson, H., & Simmons, D. (2021). Increasing prevalence of gestational diabetes mellitus when implementing the IADPSG criteria: A systematic review and meta-analysis. *Diabetes Research and Clinical Practice*, *172*. https://doi.org/10.1016/j.diabres.2020.108642

Sweeting, A., Wong, J., Murphy, H. R., & Ross, G. P. (2022). A Clinical Update on Gestational Diabetes Mellitus. *Endocrine Reviews*, *43*(5), 763–793. https://doi.org/10.1210/endrev/bnac003

Utz, B., & De Brouwere, V. (2016). "Why screen if we cannot follow-up and manage?" Challenges for gestational diabetes screening and management in low and lower-middle income countries: Results of a cross-sectional survey. *BMC Pregnancy and Childbirth*, *16*(1), 341. https://doi.org/10.1186/s12884-016-1143-1

van Delft, L. C. J., Kelleners-Smeets, N. W. J., Peeters, A., Mosterd, K., & Essers, B. A. B. (2023). A systematic review of economic evaluations for the interventions of superficial basal cell carcinoma. *EJC Skin Cancer*, *1*, 100008. https://doi.org/10.1016/j.ejcskn.2023.100008

Wang, H., Li, N., Chivese, T., Werfalli, M., Sun, H., Yuen, L., Hoegfeldt, C. A., Elise Powe, C., Immanuel, J., Karuranga, S., Divakar, H., Levitt, Na., Li, C., Simmons, D., Yang, X., & IDF Diabetes Atlas Committee Hyperglycaemia in Pregnancy Special Interest Group. (2022). IDF Diabetes Atlas: Estimation of Global and Regional Gestational Diabetes Mellitus Prevalence for 2021 by International Association of Diabetes in Pregnancy Study Group's Criteria. *Diabetes Research and Clinical Practice*, *183*, 109050. https://doi.org/10.1016/j.diabres.2021.109050

Wang, Y.-Y., Liu, Y., Li, C., Lin, J., Liu, X.-M., Sheng, J.-Z., & Huang, H.-F. (2019). Frequency and risk factors for recurrent gestational diabetes mellitus in primiparous women: A case control study. *BMC Endocrine Disorders*, *19*(1), 22. https://doi.org/10.1186/s12902-019-0349-4

WHO. (2024, April 26). *Maternal mortality*. https://www.who.int/news-room/fact-sheets/detail/maternal-mortality

World Bank. (2016). *GDP per capita (current US$)—India*. World Bank Open Data. https://data.worldbank.org

Yang, Y., & Wu, N. (2022). Gestational Diabetes Mellitus and Preeclampsia: Correlation and Influencing Factors. *Frontiers in Cardiovascular Medicine*, *9*, 831297. https://doi.org/10.3389/fcvm.2022.831297

Ye, W., Luo, C., Huang, J., Li, C., Liu, Z., & Liu, F. (2022). Gestational diabetes mellitus and adverse pregnancy outcomes: Systematic review and meta-analysis. *BMJ*, *377*, e067946. https://doi.org/10.1136/bmj-2021-067946

Zhang, L., Chen, W., Wang, Y., Ma, R., Du, M., & Xu, X. (2015). Cost-Effectiveness Analysis of Gestational Diabetes Mellitus Screening in Urban Chinese Setting. *Value in Health*, *18*(7), A607–A608. https://doi.org/10.1016/j.jval.2015.09.2099

Zhuang, W., Lv, J., Liang, Q., Chen, W., Zhang, S., & Sun, X. (2020). Adverse effects of gestational diabetes-related risk factors on pregnancy outcomes and intervention measures. *Experimental and Therapeutic Medicine*, *20*(4), 3361–3367. https://doi.org/10.3892/etm.2020.9050

Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (39-53)
e-ISSN 2477-8184
p-ISSN 1858-0610
https://doi.org/10.31101/jkk.3403

Original Research Paper

Using prevention guidance of common physiological symptoms in pregnancy: a qualitative study

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Submitted: October 25, 2023 Revised: February 24, 2024 Accepted: June, 21, 2024

Abstract
Information about pregnancy is widely accessed by pregnant women, ranging from electronic media, print media, and even social media. One of them is the guide to the prevention of common physiological symptoms in pregnancy (PGCPSP). This guide quantitatively has a very positive impact on the success of preventing pregnancy complaints. However, independent attitudes related to the experience of using this guide have not been measured. The satisfaction and success of pregnant women in using this media is a benchmark for researchers to develop this educational media. This study aims to explore in depth the experiences of pregnant women in preventing and managing pregnancy complaints using the PGCPSP. This research is a qualitative study with a phenomenological approach. Data was collected through in-depth interviews with six pregnant women and four midwives. Participants were selected by purposive sampling. Interviews were recorded, transcribed, translated, and thematically analyzed using NVivo 12 trial version software. We identified three themes and eight sub-themes related to the experience of using PGCPSP: personal condition before using PGCPSP, experience of using PGCPSP, and recommendations for PGCPSP development. Literacy media such as PGCPSP positively impact pregnant women's experiences in overcoming various complaints. Health service providers must develop strategies using educational media. so that pregnant women have the knowledge and foster self-confidence for a satisfying pregnancy experience. In addition, efforts to develop forms of educational media through digital platforms are needed for the development of digital literacy for pregnant women in the future.

Keywords: common complaints; complaints in pregnancy; prenatal education; qualitative study

1. Introduction

Pregnant women both primigravida and multigravida often experience complaints during pregnancy or common physiological symptoms of pregnancy (CPSP). Pregnancy complaints sometimes can be accepted and handled well. However, there are still many pregnant women who have difficulty overcoming the complaints they feel, especially in primigravida (Ertmann et al., 2020). Common symptoms include nausea and vomiting (65.5%) (Tinti et al., 2023), leg cramps (30-50%) (Liu et al., 2021), back pain (40.5%-68%) (Carvalho et al., 2017; Manyozo et al., 2019; Salari et al., 2023), pruritus (38%) (Rudder et al., 2021), heartburn (20%) (Ali et al., 2022), gingivitis (40%) (Erchick et al., 2019), carpal tunel syndrome (31-62%-67.4%) (Afshar & Tabrizi, 2021; Balık et al., 2014), insomnia (20.23%-42.4%) (Salari et al., 2021; Silvestri & Aricò, 2019; Smyka et al., 2020), sleep problems (77.9%) (Smyka et al., 2020).

Pregnancy symptoms may cause discomfort in women, reduce the quality of life (Bai et al., 2016; Boutib et al., 2022; Kazemi et al., 2017; Lagadec et al., 2018), and result in higher socioeconomic costs due to being longer sick off (Brekke et al., 2019; Malmqvist et al., 2015; Truong et al., 2017). In addition, hyperemesis gravidarum is associated with higher rates of hospitalisation and adverse outcomes (dehydration, malnutrition, ketonuria, and significant weight loss) (MacGibbon & Mullin, 2015). Insomnia and sleep disturbances are associated with a higher incidence of maternal depression,

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preterm delivery, and caesarean sections (Felder et al., 2017; Haney et al., 2014; Li et al., 2017; Sedov et al., 2021).

The ability of each pregnant woman to manage pain and discomfort is different; some can endure the symptoms, some can prevent them, and some do not know and cannot handle these pregnancy complaints. In managing these symptoms, some can express their complaints during ANC contact with health workers like midwives, doctors, nurses, and others. However, many also try to handle it by seeking information on Google, asking parents or relatives, or even believing in myths explained by others (Bogaerts et al., 2017). Sometimes, pregnant women do not consider the validity of the information related to proper and correct ways to handle CPSP, according to the scientific, evidence-based health condition of the pregnant woman.

Many pregnant women access information on preventing CPSP through accurate literacy media. They trust these media as sources or guides that can direct them to get health services, consultation facilities, and information media to increase their knowledge (Vogels-Broeke et al., 2022). The media mentioned include pregnancy guidebooks (World Health Organization, 2016). Maternal and Child Health (MCH) books, leaflets, flashcards, and the latest ones, like the digital media prevention guidance for common physiological symptoms of pregnancy (PGCPSP).

Print media have the advantage of being easily obtained or accessed by pregnant women, but they also have drawbacks such as sometimes forgetting to store, difficulty understanding when read, and no consultation facilities, making them less attractive. However, with the development of technology, a guide has been published in digital media form, namely the prevention guidance for common physiological symptom pregnancy (PGCPSP) in video format, which all pregnant women and health workers can now access on the YouTube channel (Vogels-Broeke et al., 2022) This media was developed to provide knowledge and increase the independence of pregnant women in preventing complaints during pregnancy. The PGCPCSP also provides education so that pregnant women learn to anticipate complaints before they occur. When experiencing certain complaints, they can independently increase their self-confidence to overcome them.

Quantitatively, the PGCPSP has a very positive impact on the success of preventing pregnancy complaints (Asih et al., 2023). However, independent attitudes related to the experience of using this guide have not been measured. The level of satisfaction and success through the experience of pregnant women in using this media becomes a benchmark for researchers to develop this educational media. This study aims to explore in depth the experiences of pregnant women in preventing and managing pregnancy complaints using the PGCPSP.

2. Methods Research

This research used qualitative methods with a phenomenological approach. Participant recruitment in this study used purposive sampling, totaling 10 participants (six pregnant women and four midwives). Data about participants were obtained from the Midwifery Independent Center Care Register Book, data from August to September 2023. One midwife was involved to assist in the selection of research participants. Participant selection was based on the following inclusion and exclusion criteria:

2.1.Pregnant Women

The inclusion criteria are: 1) pregnant women in early trimester I, II, or III; 2) pregnant women with CPSP; 3) pregnant women who get CPSP prevention guidance; and 4) pregnant women who are willing to be research subjects. The exclusion criteria are: 1) have a history of disease before pregnancy or substance or drug abuse; 2) experience and have a history of conditions such as stillbirth and/or severe fetal malformations; and 3) have multiple pregnancies.

2.2.Midwife

The inclusion criteria are: 1) have a minimum working period of two years; 2) provide ANC services; and 3) are willing to participate in this research. The exclusion criteria are: 1) on work leave; 2) are willing to participate in this research.

A pilot interview was conducted in this study to maintain research trust by giving a trial of the interview guide to pregnant women who have the same characteristics as the research subjects. The results of the pilot interview show that the participants understood the list of questions from the interview guide, and the answers provided are adequate to answer these questions. The STIKes Banyuwangi Health Research Ethics Committee approved this research with No. 115/02/KEPK-STIKESBWI/VII/2023.

Interviews were conducted online and offline at the midwifery independent center, with a previously agreed-upon time contract. Semi-structured interviews were conducted after participants agreed and signed the informed consent form. The interviews were recorded using an audio recorder and conducted for approximately 40-60 minutes. After interviewing 10 participants, the researcher reached data saturation, where no new ideas or themes emerged.

The recorded interviews then transcribed using the verbatim technique, and checked by participants through member checking to maintain the validity of this research. Transcripts were made by creating a clear and transparent description of the research process and presenting participant evidence and quotes. The researcher also used field notes and regularly discussed research progress with external reviewers/peer exams. To maintain the confidentiality of participants identity, we provide code P (for pregnant women) and B (for midwives). Data was analyzed with thematic analysis using the collaizi's framework (Praveena, 2022). The researcher used the NVivo 12 trial version software for data analysis.

3. Result and Discussion

Ten participants (Table 1) participated in in-depth interviews to describe their experiences using the prevention guidance of CPSP. From these interviews, we identified three themes and eight sub-themes related to the experience of using PGCPSP: personal condition before using PGCPSP, experience of using PGCPSP, and recommendations for PGCPSP development.

Table 1. Participant Characteristics

Characteristics	Participant	
	Pregnant Women	**Midwife**
Age (min-max (Year))	23-37	31-48
Gestational Age		
Early 1st trimester	1	
Early 2nd trimester	3	
Early 3rd trimester	2	
Gravida		
Primigravida	2	
Multigravida	4	
Level of Education		
Elementary School-Junior High School	1	-
Senior High School	4	-
University	1	4

Characteristics	Participant	
	Pregnant Women	Midwife
Job-status		
Work	2	4
Jobless	4	-
Health Service Location		
Primary Clinic		1
Midwifery Independent Practice		1
Public Health Center		2

Source: Primary Data, 2023

3.1.Theme 1: Personal Condition Before Using PGCPSP

The conditions before using PGCPSP describe the knowledge of pregnant women about CPSPs include how to prevent and overcome pregnancy complaints, their ability and self-confidence in overcoming CPSPs, and the source of information sought before accessing CPSP prevention guidance.

Sub-thema 1: The Knowledge of Pregnant Women about CPSPs

Although CPSPs are common and cause discomfort for pregnant women, we found that pregnant women do not have adequate knowledge about CPSPs, including how to prevent and manage them.

> "Yeah, I did not know how to handle it before, maybe after watching the video, I'll know the treatment." (P3, 24 years old)
>
> "If we're talking about the previous one, dealing with leg cramps. Initially, I didn't know how to handle it." (P4, 23 years old)

Previous studies have shown that having sufficient knowledge is necessary to develop prevention beliefs, a positive attitude, and the promotion of healthy behaviors in response to illness (Khoramabadi et al., 2016; Zhong et al., 2020). Based on a good knowledge of the individual, the right attitudes and behaviors can be adopted to reduce stress and anxiety during pregnancy (Kiftia et al., 2022). Strategies for health education based on the model of health promotion are more effective in improving pregnant women's knowledge, understanding, and cognition (Khoramabadi et al., 2016). It can reduce the risks and barriers to healthy lifestyle habits.

Sub-thema 2: Pregnant Women's Ability and Self-Confidence in Overcoming CPSP

Some participants also felt confused, worried, scared, and less confident about their pregnancy complaints.

> "Previously, it was really difficult with these complaints. But after watching the video, we learned that there are preventive measures for these complaints. So now, we are less afraid because we know that these are just mild complaints, not serious ones. We believe that we should handle them in a certain way, and now we are not worried anymore." (P1, 26 years old)
>
> "Initially, I lacked confidence because yesterday there were some experiences that I had never encountered before, such as back pain. ….So, I decided to practice the techniques shown in the YouTube video. I followed the instructions in the video and realized, "Oh, this is how it's done." (P1, 26 years old)

Discomfort that arises from CPSP, accompanied by feeling confused, worried, scared, and lacking confidence with her pregnancy complaints, can cause anxiety, and it will certainly impact the pregnant woman's well-being. Antenatal anxiety is characterized by intense stresses, worries, and uncertainties over the pregnancy, labor, delivery, and the couple's future roles as parents and caregiving responsibilities (Chauhan & Potdar, 2022). To have a positive pregnancy and delivery experience,

pregnant women must have access to trustworthy information; sufficient information promotes self-esteem and internal control, reduces tension and anxiety, and offers support (Vogels-Broeke et al., 2022).

Sub-Thema 3: The Source of Information Sought before Accessing CPSP Prevention Guidance

Participants still need to be convinced about preventing and managing their pregnancy complaints. The results of the interviews suggest that the need for more confidence is likely due to participants relying on others, especially their parents, and not seeking information from health-care professionals (midwives).

> "Yes, what I felt previously was that I only asked my parents and didn't directly consult with a midwife. But after attending the class, I realized that we need to be independent and understand our own feelings. So when we have complaint, we know how to assiist it, how to handle it properl. We must remain calm and relaxed." (P3, 32 years old)

The participants not only sought information or help from their parents, but they also often received information from others, the accuracy of which needed to be improved.

> "It's very important because at first, when I was having morning sickness, people told me to do this and that. But I was skeptical because people usually have different opinions, some negative, some otherwise. However, after watching the video, I became more confident in how to cope with it." (P1, 26 years old)

Pregnant women who obtain health information have greater health knowledge, which improves their capacity to adopt preventative health behaviours, boosts their capacity for self-care, and lessens their anxiety when confronted with stressful situations or new health difficulties (Hamzehei et al., 2018). The information's most crucial component was that it came from a reputable and trustworthy source (Hay et al., 2022). Unfortunetely, even though pregnant women had come to the health service to check their pregnancies, but the information related to CPSP was obtained by pregnant women from their parents and not from midwives. They perceive that parents are more experienced, so they use them as a source of information about their pregnancy.

Some participants' statements also indicate that their lack of knowledge and confidence in prevention and pregnancy complaint management is due to other information sources like Google searches, where the accuracy of the information still needs to be determined.

> "Oh, it's very important for me. Sometimes when we search on google, the answers can vary. So once i find one answer, that's the only one i use." (P4, 23 years old)

The previous studies showed that the majority of pregnant women (77.9%-95%) used the internet as a source of information; finding information and reading about others in similar circumstances was their primary motivation (Bjelke et al., 2016; Vogels-Broeke et al., 2022). Younger age, nulliparous, and higher education were characteristics of pregnant women who accessed more pregnancy information via the internet (Narasimhulu et al., 2016). Higher-educated pregnant women were three times more likely to seek pregnancy information than less educated women (below high school) (Sayakhot & Carolan-Olah, 2016). Higher levels of education may be associated with critical thinking skills, higher reasoning, and easier access to information, as possible reasons why this is the case.

During pregnancy and the early stages of parenthood, women and their partners want to have access to accurate, consistent, dependable, and easily accessible information (Hay et al., 2022; Kennedy et al., 2017). Information on the internet can be accesed from anywhere at any time. The pregnant women feel more in charge and confident as a result of the information, but it can also be overwhelming due to the abundance of information available. Another issue is that the quality of information sources varies greatly, while women's capacity to distinguish between trustworthy and reputable sources is

inadequate (Hay et al., 2022), so there is concern that the information is misleading and harmful to the health of pregnant women.

In addition, the majority of women did not talk to their healthcare providers about the information they had found on the internet (Jacobs et al., 2019; Sayakhot & Carolan-Olah, 2016). Pregnant women have the opportunity to access health information using the internet, especially about CPSP, but healthcare providers still have the responsibility to direct mothers to choose sources of information from the internet that are trustworthy and evidence-based (Javanmardi et al., 2020; Sayakhot & Carolan-Olah, 2016). Javanmardi et al., (2019) reported the main obstacles to getting health information during pregnancy: a lot of household responsibilities for women, education and work outside the home, the inability to distinguish between accurate and inaccurate information, inadequate interactions between women and healthcare providers, a lack of access to a variety of information resources, common pregnancy complaints, and stress and anxiety from facing pregnancy-related issues.

3.2.Theme 2: Experience of Using PGCPSP

Sub-theme 1: Benefits of PGCPSP

The participants in this study stated that their knowledge and confidence in the prevention and handling of pregnancy complaints increased, as seen from their various answers to the interview questions. Some participants felt that their knowledge and confidence had increased after accessing the PGCPSP.

> “We have more knowledge about how to handle things like that. It is more able to calm myself down; there is no need to be confused; it is already in the video; sometimes the answers from one person to another are different, so it makes me confused.” (P4, 23 years old)

Some participants stated that in addition to the increased knowledge, they also practiced the contents of the prevention guidance.

> “I experienced back pain; I practiced how to handle it from the video, and I am satisfied with the video." (P1, 26 years old)

Based on participants' experience statements after using the PGCPSP, the increase in knowledge made participants feel more confident to find out the truth about the solution to their previous complaints.

> "I think it's important, especially if you're pregnant with your first child. Most people just listen to what other people say. This video can help pregnant women become more informed and confident. If they have complaints about early pregnancy, they know that they don't last long." (P2, 36 years old).

The majority of participants explained the positive impact experienced when using PGCPSP. Increased self-confidence in participants made changes to habit patterns during pregnancy.

> "I only experienced a few, thank God. According to the complaints I experienced, usually after sleeping, I have to tilt my body first. I can't get up right away." (P2, 36 years old)

> “Yes, God willing, it is true, considering that, like yesterday, I think I have to move a lot and do a lot of activities. So, don't be lazy." (P6, 31 years old)

> "Yes, usually now, when I sleep at night. Not like before. ... I also feel that I sleep better. There are positive changes after attending this pregnancy class." (P5, 37 years old)

Previous study by Serçekuş & Başkale (2016) have shown that antenatal education increases mothers' self-efficacy in relation to childbirth and decreases their fear of giving birth. In line with the study, we found that increased knowledge, confidence, satisfaction, and changes in good life patterns

or habits are some of the positive things pregnant women feel after accessing the prevention guidance of CPSP. It is important for a pregnant woman to understand her pregnancy, the new condition, and maternal prenatal care (Shahry et al., 2016). A mother's transition into parenthood is significantly influenced by her level of self-efficacy (Shorey et al., 2015). According to Hashmi et al. (2020) the concept of self-efficacy is complex, dynamic, and situational; it is influenced by a pregnant woman's emotional state, her prior experiences, her knowledge, the existence of family empowerment, and professional support. Pregnant women who have high levels of self-efficacy make better decisions, have realistic objectives, and have strategies in place to get beyond obstacles and hurdles (Hashmi et al., 2020).

Providing antenatal education in the form of animated video prevention guidance from CPSP is considered by pregnant women to be easier to understand because there are animated images, sound, and supporting text, so there is no need to read like when reading an MCH book and only need to see and listen. Research by Pushpaven (2018) revealed a significant increase in knowledge and positive pregnancy outcomes in pregnant women who received antenatal education modules using videos. Participants felt that video education media was more effective than books. They tended to be too lazy to read books due to time constraints.

> "It's good for those who like to read, but I don't have time. People must always hold their mobile phones, even though they have little time. I am happy if there is education like yesterday. I no longer need to read and imagine like this." (P3, 32 years old)

> "Alhamdulillah, it is useful. I can handle it myself. I don't need to ask. Before class, I asked why I was like this and how to overcome it. It seems like it could be a lot of work. So if I have watched the video and there is education, I know what to do" (P6, 31 years old).

> "Yes,.... if it's just from the KIA book, we are too lazy to read, but if it's an educational video like that, I want to see it; there's already someone talking in the video. We don't need to read it ourselves. Good for lazy moms, eehhehee" (P3, 32 years old).

Sub-theme 2 Successful Management and Prevention of CPSP

After the use of the prevention guidance of CPSP, pregnant women can overcome various pregnancy complaints experienced such as back pain, gastrointestinal problem (constipation, nausea, and vomiting), insomnia and leg cramps. Back pain is one of the most commonly reported pregnancy complaints. This complaint usually appears in the 3rd trimester of pregnancy. Participants explained that they made various efforts as contained in PGCPSP.

> “I experienced back pain; I practiced how to handle it from the video, and I am satisfied with the video." (p1, 26 years old)
>
> "I used to have back pain...Then I saw the video. Thank God, until now it has not happened again because I have applied the recommendations in the video.” (p5, 37 years old)

Participants know how to overcome complaints about their digestion, such as constipation, nausea and vomiting

> "I have frequent constipation. Finally, I know how to prevent and overcome it, namely to eat more fruits and drinking water, squatting or sitting position but the legs are propped using a chair.”(p2, 36 years old)

The use of PGCPSP can prevent the occurrence of insomnia and leg cramps in pregnant women.

> "I once got insomnia, so finally, I practiced ways to prevent it. Alhamdulillah the insomnia is reduced, so now I can sleep.” (p1, 26 years old)

"Emmm, for almost a week, my legs have been cramping every night. After watching the video, I know what to do to overcome and prevent this. I tried it every day, now it is better, Alhamdulillah" (p4, 23 years old)

Some complaints, such as back pain, nausea and vomiting, constipation, leg cramps, and constipation, can be prevented and overcome. This may occur due to changes in pregnant women's knowledge about preventing CPSP, so they are motivated to practice CPSP prevention measures. The research findings of Yikar & Nazik (2019) state that providing prenatal education about pregnancy complaints can reduce CPSP. The prevention guidance of CPSP is a guideline that contains standardized and evidence-based prevention measures. This can be an effective and reliable educational media for pregnant women. Systematic reviews and meta-analyses suggest that antenatal education can reduce maternal stress, increase self-efficacy, reduce caesarean delivery rates, and decrease the use of epidural anaesthesia; however, there is little evidence of its effect on maternal physical condition. Therefore, antenatal education should be standardized to explain its true impact on mental and physical health (Hong et al., 2021).

3.3 Theme 3: Recommendations for PGCPSP Development

Sub-theme 1: Addition of PGCPSP Content Material

The material contained in the PGCPSP video can be developed according to needs. As expressed by the midwife participant, she hoped for the addition of material on vaginal discharge for pregnant women. In addition to causing discomfort, vaginal discharge can also pose a health risk to pregnant women.

"...from the existing materials, I have not found material about vaginal discharge in pregnant women. Vaginal discharge is often experienced by pregnant women, which is very disturbing and certainly a risk to the health of pregnant women themselves, so I think it is necessary to add the material." (b2, 43 years old)

In addition to the addition of material, the addition of a more detailed series related to complaints commonly experienced by pregnant women was also explained by midwife participants.

"... like nausea and vomiting, it needs to be more detailed, and low back pain also needs to be discussed in more detail because almost all pregnant women must experience it. So if it is discussed more, automatically pregnant women have many ways to overcome all their complaints, so they are not confused anymore." (b1, 31 years old)

The topic of prevention guidance for CPSP in this study consists of 10 complaints, including nausea and vomiting, heartburn, constipation, insomnia (sleep disturbance), gingivitis, leg cramps, rest leg syndrome, varicose veins and oedema, carpal tunnel syndrome, pruritus, and back pain. Based on the assessment of midwives as caregivers, it is necessary to add material about vaginal discharge for improvement and the development of prevention guidance for CPSP. Vaginal discharge is a complaint that often occurs in women during their reproductive years and especially during pregnancy (Rao & Mahmood, 2020; von Glehn et al., 2017). In general, women cannot distinguish between normal (physiological) and abnormal (pathological) vaginal discharge (Ilankoon et al., 2018), so it is necessary to provide education on the steps to prevent pathological discharge in the prevention guidance of CPSP.

Sub-theme 2: PGCPSP media development

Participants in this study said that there is a need to develop educational media to improve pregnant women's experience in preventing pregnancy complaints, one of which is through digital platforms such as TikTok, Instagram, and YouTube. They considered it more flexible.

"Yes, the video can be developed through TikTok or Instagram, which is shorter. The plan is to develop each complaint, so each complaint took fifteen minutes yesterday; there were ten complaints; it has not been explored in more detail, only briefly." (b4, 48 years old).

"Yes, but the video is spliced into many parts, ..., so I usually share it with patients. Now patients want it on TikTok. Then, if it's on YouTube, I just give the link, ma'am. Actually, you can download it too, ma'am, but sometimes it's not possible to share it with patients. It's more flexible on Tik Tok." (b3, 35 years old)

Recent technological and social media advancements have led to a rise in the use of social media by young women of reproductive age (18–25 years old) for health-related information, including lifestyle advice, which was previously only available through direct contact with medical professionals, family, peers, or printed media (McCarthy et al., 2020). We found that media development is needed to broadly reach pregnant women based on their characteristics, such as pregnant women who use social media (TikTok, Instagram or Facebook) more often than YouTube. For pregnant women seeking knowledge and support, social media has emerged as one of the most convenient, time-saving, easy, and easily available resources (Harpel, 2018; Zhu et al., 2019).

Pregnant women can receive extremely effective individualized information and social support through midwife-mediated social media groups. Perceptions of relational continuity can also be strongly impacted by one's ability to access a group. The groups provide a secure environment for the exchange and validation of essential information about maternity. Members relied on their midwife moderators to vouch for the accuracy of the information. For numerous participants, the group has become their go-to resource for information about pregnancy (McCarthy et al., 2020). Research by Zhu et al. (2019) states that in the current era, it cannot be denied that social media has played an important role in supporting pregnancy. The search for information about pregnancy has even increased and experienced a shift regarding safe pregnancy and promoting a more pleasant pregnancy. It emphasizes that the provision of antenatal care in the future must be balanced with information circulating on social media, thus reducing the gap in social media-based services caused by the digital divide (Zhu et al., 2019).

Sub-theme 3: PGCPSP animation video

Participants revealed that the existing PGCPSP video media was sufficient, but the development of evidence-based educational media using animated videos would make the video more interesting.

"No, I think it is very detailed, so it is not too boring or too long. The pictures on the slides are in line with what is discussed, easy to understand, and can be practiced too." (p1,26 years old).

"There are no shortcomings eehehehhh, in my opinion, it's quite short and clear and easy to understand. However, if it was only in written form, maybe I would protest. This video covers everything—the practices and procedures, not just the writing, so we don't have to imagine it ourselves." (p3, 32 years old)

"Yes, if we only read the text, we will get bored quickly; if there is animation, it will be more interesting." (p4, 23 years old)

"It looks good and interesting, ma'am. The colours are also good. The sound quality is good. The sound is clear and easy to hear." (b2, 43 years old)

Midwives, as health workers providing pregnancy care services, must provide relevant and timely information following WHO recommendations for a positive pregnancy experience (World Health Organization, 2016). In this study, midwives and pregnant women strongly support the prevention guidance of CPSP in animated videos. Pregnant women stated that animated videos are the most suitable media for the prevention guidance of CPSP. The animated video on the prevention guidance of CPSP is interesting, not boring, and easy to understand because it is explained in detail in one step, one slide. Previous research has shown that animated educational videos can convey complex information in a

simple way, expand patients' knowledge, and increase satisfaction levels (Feeley et al., 2023; Moe-Byrne et al., 2022; Nintao et al., 2023). Turkdogan et al., (2022) conducted research on the effect of educational animated videos on preoperative patients and found that patients who received education in the form of animated videos felt satisfied, had a positive experience and wanted to share the animated video with colleagues and relatives with the same case.

Midwives in this study also stated that the prevention guidance animation video had good and interesting quality of content, sound, images, and text, and even the prevention steps discussed many complementary therapies.

> "For me, there are no shortcomings because it is more complementary too. So everything is in accordance with the existing ingredients and then added with the latest complementary, so patients who, for example, start vomiting not only use this food, but some also use ginger and peppermint; this is the latest too. So I think everything is enough." (b1, 31 years old)

The use of complementary and alternative medicine during pregnancy is popular in many countries. Based on qualitative research by Bowman et al. (2018), there are three motivations for pregnant women to use complementary therapies: fighting for their destiny, the desire to give birth safely and naturally, and agreeing with and holding to the principles of the philosophical foundation of complementary therapies. H. G. Hall et al. (2015) stated that many pregnant women do not convey to midwives during antenatal care regarding the use of complementary therapies. It is very concerning if women continue to use complementary therapies without the knowledge or input of midwives. Lack of communication about using complementary therapies with health professionals is problematic, as it can increase risk and weaken the therapeutic relationship (H. R. Hall & Jolly, 2014). Therefore, complementary therapies in the prevention guidance of CPSP can indirectly solve this imbalance. Thus, midwives do not need to worry about whether pregnant women use complementary therapies. In addition, pregnant women do not need to doubt the complementary therapy to be practiced because it is available in the prevention guidance of CPSP.

This study has the strength that the prevention guidance of CPSP is based on WHO recommendations on positive pregnancy experiences, namely providing information and education in a relevant and timely manner that has not been initiated before. Thus, this qualitative research on exploring the experience of using the prevention guidance of CPSP is the first of its kind. Although it has advantages, this study also has limitations. The interview technique is only an in-depth interview, which may have different results if the interview technique is carried out with several methods, namely in-depth interviews and focus group discussions. In addition, this study was conducted in one of the midwifery independent care centers with the highest number of patient visits in Banyuwangi; therefore, the generalizability of the results may be limited.

4. Conclusion

In this study, before using the prevention guidance of CPSP, pregnant women do not have adequate knowledge about CPSPs, including how to prevent and manage them. Pregnant women feel worried and not confident in overcoming pregnancy complaints. Increased knowledge, confidence, satisfaction, and changes in good life patterns or habits are some of the positive things that pregnant women feel after accessing the prevention guidance of CPSP. The successful management and prevention of CPSP includes back pain, gastrointestinal complaints, insomnia, and leg cramps. Development recommendations include content, media development and PGCPSP animation videos. Healthcare providers have a major challenge in developing strategies to improve antenatal care through educational media so that pregnant women have the knowledge and confidence to have a satisfying pregnancy experience. One of them is through the use of social media platforms as a means to distribute evidence-

based antenatal health advice, support, and education in the context of health promotion and preventive care for pregnant women.

Acknowledgement

We want to thank DRTPM Kemendikbudristek for funding this research (project number 183/E5/PG.02.00.PL/2023). We would also like to thank midwife Susiani, the owner of the research site who has permitted this research, and pregnant women and midwives who have been willing to participate in this study.

References

Afshar, A., & Tabrizi, A. (2021). Pregnancy-related hand and wrist problems. *PubMed*, *9*(3), 345–349. https://doi.org/10.22038/abjs.2020.50995.2531

Ali, R. A. R., Hassan, J., & Egan, L. J. (2022). Review of recent evidence on the management of heartburn in pregnant and breastfeeding women. *BMC Gastroenterology*, 22(1), 219. https://doi.org/10.1186/s12876-022-02287-w

Asih, F. R., Danti, R. R., & Winarna, N. B. A. (2023). A Non-Randomized Controlled Trial of Prevention Guidance of Common Physiological Symptoms in Pregnancy for Self-Efficacy in Pregnant Women. Jurnal Aisyah : *Jurnal Ilmu Kesehatan*, 8(4). https://doi.org/10.30604/jika.v8i4.2516

Bai, G., Korfage, I. J., Groen, E. H., Jaddoe, V. W. V., Mautner, E., & Raat, H. (2016). Associations between Nausea, Vomiting, Fatigue and Health-Related Quality of Life of Women in Early Pregnancy: The Generation R Study. *PLOS ONE*, 11(11), e0166133. https://doi.org/10.1371/journal.pone.0166133

Balık, G., Sabri Balık, M., Ustüner, I., Kağıtcı, M., Sahin, F. K., & Güven, E. S. G. (2014). Hand and wrist complaints in pregnancy. *Archives of Gynecology and Obstetrics*, 290(3), 479–483. https://doi.org/10.1007/s00404-014-3244-2

Bjelke, M., Martinsson, A.-K., Lendahls, L., & Oscarsson, M. (2016). Using the Internet as a source of information during pregnancy—A descriptive cross-sectional study in Sweden. *Midwifery*, 40, 187–191. https://doi.org/10.1016/j.midw.2016.06.020

Bogaerts, A., Ameye, L., Bijlholt, M., Amuli, K., Heynickx, D., & Devlieger, R. (2017). INTER-ACT: Prevention of pregnancy complications through an e-health driven interpregnancy lifestyle intervention – study protocol of a multicentre randomised controlled trial. *BMC Pregnancy and Childbirth*, 17(1), 154. https://doi.org/10.1186/s12884-017-1336-2

Boutib, A., Chergaoui, S., Marfak, A., Hilali, A., & Youlyouz-Marfak, I. (2022). Quality of Life During Pregnancy from 2011 to 2021: Systematic Review. *International Journal of Women's Health*, 14, 975–1005. https://doi.org/10.2147/IJWH.S361643

Bowman, R. L., Davis, D. L., Ferguson, S., & Taylor, J. (2018). Women's motivation, perception and experience of complementary and alternative medicine in pregnancy: A meta-synthesis. *Midwifery*, 59, 81–87. https://doi.org/10.1016/j.midw.2017.11.007

Brekke, I., Richardsen, K. R., & Jenum, A. K. (2019). Sickness absence in pregnancy and sedentary behavior: A population-based cohort study from Norway. *BMC Public Health*, 19(1), 71. https://doi.org/10.1186/s12889-018-6379-4

Carvalho, M. E. C. C., Lima, L. C., de Lira Terceiro, C. A., Pinto, D. R. L., Silva, M. N., Cozer, G. A., & Couceiro, T. C. de M. (2017). Low back pain during pregnancy. *Brazilian Journal of Anesthesiology*, 67(3), 266–270. https://doi.org/10.1016/j.bjan.2016.03.002

Chauhan, A., & Potdar, J. (2022). Maternal Mental Health During Pregnancy: A Critical Review. *Cureus*, 14(10), e30656. https://doi.org/10.7759/cureus.30656

Erchick, D. J., Rai, B., Agrawal, N. K., Khatry, S. K., Katz, J., LeClerq, S. C., Reynolds, M. A., & Mullany, L. C. (2019). Oral hygiene, prevalence of gingivitis, and associated risk factors among pregnant women in Sarlahi District, Nepal. *BMC Oral Health*, 19(1), 2. https://doi.org/10.1186/s12903-018-0681-5

Ertmann, R. K., Nicolaisdottir, D. R., Kragstrup, J., Siersma, V., & Lutterodt, M. C. (2020). Sleep complaints in early pregnancy. A cross-sectional study among women attending prenatal care in general practice. *BMC Pregnancy and Childbirth*, 20(1), 123. https://doi.org/10.1186/s12884-020-2813-6

Feeley, T. H., Keller, M., & Kayler, L. (2023). Using Animated Videos to Increase Patient Knowledge: A Meta-Analytic Review. *Health Education & Behavior: The Official Publication of the Society for Public Health Education*, 50(2), 240–249. https://doi.org/10.1177/10901981221116791

Felder, J. N., Baer, R. J., Rand, L., Jelliffe-Pawlowski, L. L., & Prather, A. A. (2017). Sleep Disorder Diagnosis During Pregnancy and Risk of Preterm Birth. *Obstetrics & Gynecology*, 130(3), 573. https://doi.org/10.1097/AOG.0000000000002132

Hall, H. G., Griffiths, D., & McKenna, L. G. (2015). Complementary and alternative medicine: Interaction and communication between midwives and women. *Women and Birth: Journal of the Australian College of Midwives*, 28(2), 137–142. https://doi.org/10.1016/j.wombi.2014.12.003

Hall, H. R., & Jolly, K. (2014). Women's use of complementary and alternative medicines during pregnancy: A cross-sectional study. *Midwifery*, 30(5), 499–505. https://doi.org/10.1016/j.midw.2013.06.001

Hamzehei, R., Kazerani, M., Shekofteh, M., & Karami, M. (2018). Online Health Information Seeking Behavior among Iranian Pregnant Women: A Case Study.

Haney, A., Buysse, D. J., Rosario, B. L., Chen, Y.-F., & Okun, M. L. (2014). Sleep disturbance and cardiometabolic risk factors in early pregnancy: A preliminary study. *Sleep Medicine*, 15(4), 444–450. https://doi.org/10.1016/j.sleep.2014.01.003

Harpel, T. (2018). Pregnant Women Sharing Pregnancy-Related Information on Facebook: Web-Based Survey Study. *Journal of Medical Internet Research*, 20(3), e115. https://doi.org/10.2196/jmir.7753

Hashmi, N., Ullah, I., El Hayek, S., & Shakoor, N. (2020). The impact of the COVID-19 pandemic on mental health and service delivery during pregnancy: Role of telepsychiatry. *Asian Journal of Psychiatry*, 54, 102461. https://doi.org/10.1016/j.ajp.2020.102461

Hay, S. J., McLachlan, H. L., Newton, M., Forster, D. A., & Shafiei, T. (2022). Sources of information during pregnancy and the early parenting period: Exploring the views of women and their partners. *Midwifery*, 105, 103236. https://doi.org/10.1016/j.midw.2021.103236

Hong, K., Hwang, H., Han, H., Chae, J., Choi, J., Jeong, Y., Lee, J., & Lee, K. J. (2021). Perspectives on antenatal education associated with pregnancy outcomes: Systematic review and meta-analysis. *Women and Birth: Journal of the Australian College of Midwives*, 34(3), 219–230. https://doi.org/10.1016/j.wombi.2020.04.002

Ilankoon, P., Goonewardena, C., Fernandopulle, R., & Perera, P. P. R. (2018). Women's understanding and cultural practices related to vaginal discharge: A qualitative study. *Nursing and Midwifery Studies*, 7, 74. https://doi.org/10.4103/nms.nms_60_17

Jacobs, E. J. A., van Steijn, M. E., & van Pampus, M. G. (2019). Internet usage of women attempting pregnancy and pregnant women in the Netherlands. *Sexual & Reproductive Healthcare*, 21, 9–14. https://doi.org/10.1016/j.srhc.2019.04.005

Javanmardi, M., Noroozi, M., Mostafavi, F., & Ashrafi-rizi, H. (2019). Challenges to access health information during pregnancy in Iran: A qualitative study from the perspective of pregnant women, midwives and obstetricians. *Reproductive Health*, 16(1), 128. https://doi.org/10.1186/s12978-019-0789-3

Javanmardi, M., Noroozi, M., Mostafavi, F., & Ashrafi-Rizi, H. (2020). Exploring Women's Health Information Needs During Pregnancy: A Qualitative Study. J*ournal of Family & Reproductive Health*, 14(4), 252–258. https://doi.org/10.18502/jfrh.v14i4.5209

Kazemi, F., Nahidi, F., & Kariman, N. (2017). Disorders Affecting Quality of Life During Pregnancy: A Qualitative Study. *Journal of Clinical and Diagnostic Research : JCDR*, 11(4), QC06-QC10. https://doi.org/10.7860/JCDR/2017/23703.9560

Kennedy, R. A. K., Mullaney, L., Reynolds, C. M. E., Cawley, S., McCartney, D. M. A., & Turner, M. J. (2017). Preferences of women for web-based nutritional information in pregnancy. *Public Health*, 143, 71–77. https://doi.org/10.1016/j.puhe.2016.10.028

Khoramabadi, M., Dolatian, M., Hajian, S., Zamanian, M., Taheripanah, R., Sheikhan, Z., Mahmoodi, Z., & Seyedi-Moghadam, A. (2016). Effects of Education Based on Health Belief Model on Dietary Behaviors of Iranian Pregnant Women. *Global Journal of Health Science*, 8(2), 230–239. https://doi.org/10.5539/gjhs.v8n2p230

Kiftia, M., Rizkia, M., Ardhia, D., & Darmawati. (2022). The correlation among pregnant woman's education level with knowledge and behaviour on readiness toward COVID-19 pandemic. *Enfermeria Clinica*, 32, S35–S38. https://doi.org/10.1016/j.enfcli.2022.03.014

Lagadec, N., Steinecker, M., Kapassi, A., Magnier, A. M., Chastang, J., Robert, S., Gaouaou, N., & Ibanez, G. (2018). Factors influencing the quality of life of pregnant women: A systematic review. *BMC Pregnancy and Childbirth*, 18(1), 455. https://doi.org/10.1186/s12884-018-2087-4

Li, R., Zhang, J., Zhou, R., Liu, J., Dai, Z., Liu, D., Wang, Y., Zhang, H., Li, Y., & Zeng, G. (2017). Sleep disturbances during pregnancy are associated with cesarean delivery and preterm birth. *The Journal of Maternal-Fetal & Neonatal Medicine*, 30(6), 733–738. https://doi.org/10.1080/14767058.2016.1183637

Liu, J., Song, G., Zhao, G., & Meng, T. (2021). Effect of oral magnesium supplementation for relieving leg cramps during pregnancy: A meta-analysis of randomized controlled trials. *Taiwanese Journal of Obstetrics & Gynecology*, 60(4), 609–614. https://doi.org/10.1016/j.tjog.2021.05.006

MacGibbon, K., & Mullin, P. (2015). Mortality Secondary to Hyperemesis Gravidarum: A Case Report. *Women's Health & Gynecology*, 1(2).

Malmqvist, S., Kjaermann, I., Andersen, K., Økland, I., Larsen, J. P., & Brønnick, K. (2015). The association between pelvic girdle pain and sick leave during pregnancy; a retrospective study of a Norwegian population. *BMC Pregnancy and Childbirth*, 15(1), 237. https://doi.org/10.1186/s12884-015-0667-0

Manyozo, S. D., Nesto, T., Bonongwe, P., & Muula, A. S. (2019). Low back pain during pregnancy: Prevalence, risk factors and association with daily activities among pregnant women in urban Blantyre, Malawi. Malawi Medical Journal, 31(1), 71–76. https://doi.org/10.4314/mmj.v31i1.12

McCarthy, R., Byrne, G., Brettle, A., Choucri, L., Ormandy, P., & Chatwin, J. (2020). Midwife-moderated social media groups as a validated information source for women during pregnancy. *Midwifery*, 88, 102710. https://doi.org/10.1016/j.midw.2020.102710

Moe-Byrne, T., Evans, E., Benhebil, N., & Knapp, P. (2022). The effectiveness of video animations as information tools for patients and the general public: A systematic review. *Frontiers in Digital Health*, 4, 1010779. https://doi.org/10.3389/fdgth.2022.1010779

Narasimhulu, D. M., Karakash, S., Weedon, J., & Minkoff, H. (2016). Patterns of Internet Use by Pregnant Women, and Reliability of Pregnancy-Related Searches. *Maternal and Child Health Journal*, 20(12), 2502–2509. https://doi.org/10.1007/s10995-016-2075-0

Nintao, N., Manonai, J., Wattanayingcharoenchai, R., Bumrungphuet, S., Hansahiranwadee, W., Dulyaphat, W., Somchit, W., Wattanasirichaigoon, D., Prakobpanich, M., & Tangshewinsirikul, C. (2023). Effects of an animated educational video on knowledge of cell-free DNA screening among Thai pregnant women: A randomized control trial. *BMC Pregnancy and Childbirth*, 23(1), 853. https://doi.org/10.1186/s12884-023-06170-8

Praveena. (2022). Application of Colaizzi's Method of Data Analysis in Phenomenological Research. *Medico Legal Update*, 21. https://doi.org/10.37506/mlu.v21i2.2800

Pushpaven. (2018). Effectiveness of video Assisted Instructional Module on Antenatal Care on the Pregnancy outcome of pregnant women attending Maternity Hospitals, Bangalore. *Asian Journal of Nursing Education and Research*, 8(4). https://doi.org/10.5958/2349-2996.2018.00103.9

Rao, V. L., & Mahmood, T. (2020). Vaginal discharge. *Obstetrics, Gynaecology and Reproductive Medicine*, 30(1), 11–18. https://doi.org/10.1016/j.ogrm.2019.10.004

Rudder, M., Lefkowitz, E. G., Ruhama, T., & Firoz, E. (2021). A review of pruritus in pregnancy. *Obstetric Medicine*, 14(4), 204–210. https://doi.org/10.1177/1753495X20985366

Salari, N., Darvishi, N., Khaledi-Paveh, B., Vaisi-Raygani, A., Jalali, R., Daneshkhah, A., Bartina, Y., & Mohammadi, M. (2021). A systematic review and meta-analysis of prevalence of insomnia in the third trimester of pregnancy. *BMC Pregnancy and Childbirth*, 21(1), 284. https://doi.org/10.1186/s12884-021-03755-z

Salari, N., Mohammadi, A., Hemmati, M., Hasheminezhad, R., Kani, S., Shohaimi, S., & Mohammadi, M. (2023). The global prevalence of low back pain in pregnancy: A comprehensive systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, 23(1), 830. https://doi.org/10.1186/s12884-023-06151-x

Sayakhot, P., & Carolan-Olah, M. (2016). Internet use by pregnant women seeking pregnancy-related information: A systematic review. BMC Pregnancy and Childbirth, 16(1), 65. https://doi.org/10.1186/s12884-016-0856-5

Sedov, I. D., Anderson, N. J., Dhillon, A. K., & Tomfohr-Madsen, L. M. (2021). Insomnia symptoms during pregnancy: A meta-analysis. *Journal of Sleep Research*, 30(1), e13207. https://doi.org/10.1111/jsr.13207

Serçekuş, P., & Başkale, H. (2016). Effects of antenatal education on fear of childbirth, maternal self-efficacy and parental attachment. *Midwifery*, 34, 166–172. https://doi.org/10.1016/j.midw.2015.11.016

Shahry, P., Kalhori, S. R. N., Esfandiyari, A., & Zamani-Alavijeh, F. (2016). A Comparative Study of Perceived Social Support and Self-Efficacy among Women with Wanted and Unwanted Pregnancy. *International Journal of Community Based Nursing and Midwifery*, 4(2), 176–185.

Silvestri, R., & Aricò, I. (2019). Sleep disorders in pregnancy. Sleep Science, 12(3), 232–239. https://doi.org/10.5935/1984-0063.20190098

Smyka, M., Kosińska-Kaczyńska, K., Sochacki-Wójcicka, N., Zgliczyńska, M., & Wielgoś, M. (2020). Sleep Problems in Pregnancy—A Cross-Sectional Study in over 7000 Pregnant Women in Poland. *International Journal of Environmental Research and Public Health*, 17(15), 5306. https://doi.org/10.3390/ijerph17155306

Tinti, S., Praticò, F., Bonaldo, V., Rovetto, M. Y., Barattini, D. F., Casolati, E., Piccolo, E., Piazza, R., Liberati, M., Locci, M., & Cetin, I. (2023). Prevalence and burden of nausea and vomiting in pregnant women: Interim analysis of the PURITY survey. *European Journal of Obstetrics &*

Gynecology and Reproductive Biology, 290, 135–142. https://doi.org/10.1016/j.ejogrb.2023.09.016

Truong, B. T., Lupattelli, A., Kristensen, P., & Nordeng, H. (2017). Sick leave and medication use in pregnancy: A European web-based study. *BMJ Open*, 7(8), e014934. https://doi.org/10.1136/bmjopen-2016-014934

Turkdogan, S., Roy, C. F., Chartier, G., Payne, R., Mlynarek, A., Forest, V.-I., & Hier, M. (2022). Effect of Perioperative Patient Education via Animated Videos in Patients Undergoing Head and Neck Surgery: A Randomized Clinical Trial. JAMA Otolaryngology–Head & Neck Surgery, 148(2), 173–179. https://doi.org/10.1001/jamaoto.2021.3765

Vogels-Broeke, M., Daemers, D., Budé, L., de Vries, R., & Nieuwenhuijze, M. (2022). Sources of information used by women during pregnancy and the perceived quality. *BMC Pregnancy and Childbirth*, 22(1), 109. https://doi.org/10.1186/s12884-022-04422-7

von Glehn, M. de P., Sidon, L. U., & Machado, E. R. (2017). Gynecological complaints and their associated factors among women in a family health-care clinic. *Journal of Family Medicine and Primary Care*, 6(1), 88. https://doi.org/10.4103/2249-4863.214982

World Health Organization. (2016). WHO recommendations on antenatal care for a positive pregnancy experience. World Health Organization. https://iris.who.int/handle/10665/250796

Yikar, S. K., & Nazik, E. (2019). Effects of prenatal education on complaints during pregnancy and on quality of life. *Patient Education and Counseling*, 102(1), 119–125. https://doi.org/10.1016/j.pec.2018.08.023

Zhong, B.-L., Luo, W., Li, H.-M., Zhang, Q.-Q., Liu, X.-G., Li, W.-T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: A quick online cross-sectional survey. *International Journal of Biological Sciences*, 16(10), 1745–1752. https://doi.org/10.7150/ijbs.45221

Zhu, C., Zeng, R., Zhang, W., Evans, R., & He, R. (2019). Pregnancy-Related Information Seeking and Sharing in the Social Media Era Among Expectant Mothers: Qualitative Study. *Journal of Medical Internet Research*, 21(12), e13694. https://doi.org/10.2196/13694

Jurnal Kebidanan dan Keperawatan Aisyiyah
Vol. 20, No. 1 (2024), pp. (54-62)
e-ISSN 2477-8184
p-ISSN 1858-0610
http://doi.org/10.31101/jkk.3708

Original Research Paper

The effectiveness of family-centered maternity care education on attitudes and behaviours of pregnant women

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Submitted: January 14, 2024 Revised: April 2, 2024 Accepted: June 6, 2024

Abstract
Stunting is a state of failure to grow experienced by children under five due to chronic malnutrition, especially in the first 1,000 days of life (HPK). The impact caused by stunting can vary, including physical growth disorders, body metabolic disorders, brain growth and development disorders. In addition, stunting is also at a higher risk of suffering from chronic diseases in adulthood. This study aims to analyze the influence of Family Centered Maternity Care education on the attitude and behavior of pregnant women in stunting prevention. This quantitative research uses a quasi-experimental design with a one-group pre-test and post-test design. Sampling for this study uses a purposive sampling technique. The sample of this study is 38 people who have met the inclusion and exclusion criteria. The instrument used was in the form of a questionnaire for measuring attitudes and behaviors that were tested for validity and reliability. Data analysis using univariate analysis, bivariate analysis using Wilcoxon Test. The results of the study showed that there was an influence of Family Centered Maternity Care education on the attitude and behavior of pregnant women in stunting prevention in the Kebumen area. Family Centered Maternity Care education has been proven to increase the knowledge of pregnant women which ultimately changes the attitude and behavior of pregnant women in stunting prevention. The application of Family Centered Maternity Care education should be considered as a health education method in providing continuous midwifery care as an effort to reduce stunting rates.

Keywords: stunting; behaviour; attitudes; family centered maternity care

1. Introduction

Stunting is still one of the global health problems to this day, including in Indonesia (Rahut et al., 2024). In 2021, the World Health Organization (WHO) placed Indonesia in sixth place as a country with a prevalence rate in Southeast Asia of 36.4%. The results of the Indonesian Toddler Nutrition Status (SSGBI) study show that there has been a decrease in the prevalence of stunting from 24.4% in 2021 to 21.6% in 2022 (Ministry of Health of the Republic of Indonesia, 2022). Despite the decrease, the number is still considered not to have reached the target, because the WHO tolerance rate for stunting prevalence is 20% (Beal et al., 2018).

Stunting is a condition of failure to grow experienced by in children under five caused by chronic malnutrition, especially in the first 1,000 days of life (HPK) (Vaivada et al., 2020). The problem of stunting occurs since the child is in the womb. However it is only seen when he is two years old (Ministry of Health, 2018). The short-term impacts caused by stunting are impaired physical growth, impaired body metabolism, impaired growth and brain development. In the long-term, stunting can result a decrease in learning achievement, a higher risk of suffering from chronic diseases in adulthood, and a decrease in work quality that has an impact on economic productivity (Huriah & Nurjannah, 2020; Linda Richter, 2016; Abdillah, 2022).

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The nutritional status of pregnant women hugely affects the state of health and development of the fetus. Impaired growth in the womb can lead to low birth weight. This low birth weight can increase the risk of stunting in toddlers. Good nutritional knowledge from parents is needed so that parents are able to provide a balanced menu. Lack of nutritional knowledge in applying nutritional knowledge in daily life can cause nutritional problems (Rosa, 2011). Lack of nutrition in children can be caused by the attitude or behavior of parents, especially mothers, who are factors in choosing inappropriate foods. The choice of food ingredients, the availability of sufficient amounts of food and the diversity of food types are influenced by the level of mother's knowledge about food and nutrition. Mistakes in food choices can occur as a result of mother's ignorance. Therefore, nutrition education for pregnant women is very important in preventing stunting as a preparation for improvement efforts focused on the First 1,000 Days of Life (HPK) (West et al., 2018; Saleh et al., 2021; Beal et al., 2018; Wati et al., 2022).

Family Centered Maternity Care (FCMC) is one of the solutions that can be applied to provide comprehensive information related to nutrition and health during pregnancy (Ecenroad & Zwelling, 2000). This method is carried out by conducting home visits, through a family approach and providing education on the importance of social support in providing motivation to pregnant women using the following methods: lectures, questions and answers, and practice. As a result of increasing understanding of this important matter, the pregnant woman will have competent mothering optimally. This will contribute to optimizing the health status of babies born, so that it can reduce stunting rates (Dewi, 2022; Sutarto et al., 2018; Lundgren et al., 2015).

Kretek Village is part of Rowokele sub-district, Kebumen Regency, Central Java. According to the Kretek village midwife, the target of pregnant women in Kretek village is 70 pregnant women. Meanwhile, the target of toddlers aged 0-23 months is 61 (66.7%) and those who are stunted are 27 toddlers (33.3%). This makes Kretek village the highest number one for stunting prevalence in Rowokele District in 2023.

Based on Anjani's research (2020), pregnant women who receive education related to stunting prevention during pregnancy can increase their knowledge and attitudes about stunting by 3.1 times compared to those who do not receive education during pregnancy. In addition, family involvement can increase maternal motivation towards stunting prevention (Fabusoro & Mejia, 2021; Ekayanthi & Suryani, 2019; Sukmawati et al., 2021).

Based on these facts, researchers are interested in researching Family Centered Maternity Care education for pregnant women as an effort to prevent stunting. The purpose of this study is to determine the influence of Family Centered Maternity Care education on the attitude and behavior of pregnant women in stunting prevention.

2. Research Methods

2.1.Research Design

This quantitative research uses the Quasi Experimental type which carries out a one group pre and post-test design. Before being given the Family Centered Maternity Care educational intervention, pregnant women will be given a pretest using a questionnaire about attitudes and behaviors towards stunting prevention. Furthermore, the research was carried out by providing Family Centered Maternity Care educational interventions which were carried out for 3 times a month involving families. After the intervention, pregnant women were given a post-test to see differences in attitudes and behaviors after being given education. The population in this study is all pregnant women in Kretek village, Kebumen Regency.

2.2.Period and Sample

This research was conducted from May to June 2024 in Kretek Village, Kebumen Regency. The sample in this study is pregnant women in Kretek Village, Kebumen Regency. The determination of the sample in this study uses the purposive sampling method, which is a sampling technique by considering inclusion and exclusion criteria. The inclusion criteria are pregnant women with a gestational age of 28 weeks, able to communicate well. Meanwhile, the exclusion criteria are pregnant women who are sick and have a history of health problems and chronic diseases before and during pregnancy. A sample was obtained in this study that met the inclusion and exclusion criteria of 38 respondents.

2.3.Intervention

This study was conducted on pregnant women in Kretek village, Kebumen Regency with a total of 38 respondents. The researcher then explained the objectives, benefits, procedures for conducting the research and provided informed consent with the consent of the respondents. Before providing intervention, the researcher conducted a pretest using a questionnaire about attitudes and behaviors in stunting prevention. Furthermore, the researcher provides healthy nutrition education interventions and stunting prevention using the Family Centered Maternity Care (FCMC) model by involving families and cadres for 3 times in 1 month. At the end of the 3rd meeting, posttest measurements were carried out by filling out a questionnaire to measure attitudes and behaviors.

2.4.Measurement and Data Obtaining

The research data was measured using an attitude and behavior questionnaire. Before the dissemination of the instrument, a test of the research instrument was carried out. In this study, a validity test was carried out using a product moment correlation test and a validity test using Alpha Cronbach. The test results of the research instrument were all declared valid with a calculated r value greater than 0.456 and reliable with a coefficient of more than 0.6.

The questionnaire consisted of 10 items of attitude statements. Attitude data analysis using the Likert scale, where the favorable questions: strongly agree to get a score of 4, agree to get a score of 3, disagree to get a score of 2 and strongly disagree to get a score of 1. And for unfavorable questions, the opposite score is given. Each respondent's score is summed up and the maximum score is 40. After that, the percentage of the number is calculated and included in the objective criteria including: 80-100% of the categories support and >80% of the categories do not support.

As for the behavior questionnaire, it consists of 10 behavioral statements. Behavioral data analysis uses the Likert scale, where the favorable statement, “No” gets a score of 1 and “Yes” gets a score of 2. And for unfavorable statements, the opposite score is given. Each respondent's score is summed up and the maximum score is 20. Then the percentage of the amount is calculated and included in the objective criteria including: 76-100% of the good category, 51-75% of the good category and ≤50% of the poor category.

2.5.Data Analysis

Data of this research is analyzed by using Univariate and Bivariate analysis. Univariate analysis only describes each variable. The data analyzed were age, education, occupation and parity. Bivariate analysis is used to test hypotheses. Bivariate analysis was used to test the hypothesis with the Wilcoxon Test. The Wilcoxon Test is to show the influence of the Family Centered Maternity Care (FCMC) Model on attitudes and behaviors about stunting prevention. The data was then analyzed using a stata.

2.6.Ethical Considerations

The research are based on six basic principles of research: beneficence, non-maleficence, fidelity and responsibility, integrity, justice, respect for person and ethical clearence. This ethical clerance is a written statement from the ethics commission for research involving living things. This research has received ethical approval from the Ethics Commission of the University of Muhammadiyah Gombong, with certificate number No: 095.6/II.3.AU/F/KEPK/V/2024 issued on May 8, 2024, valid until August 8, 2024.

3. Results and Discussion

3.1. Results

After one month of research in the Kebumen regency, data was obtained and processed through editing, coding, scoring, tabulation, entry and cleaning. The results of the study were presented in univariate and bivariate analyses using stata.

Table 1. Frequency Distribution of Respondent Characteristics

Variable	Frequency (f)	Percentage (%)
Age		
20-35	28	73.68
<20 or >35	10	26.32
Gravida Status		
Mutigravida	30	78.95
Primigravida	8	21.05
Employment Status		
Working	24	63.16
Not Working	14	36.84
Education Status		
Higher	2	5.26
Secondary	23	60.53
Primary	13	34.21

Source: Primary Data, 2024

Table 1 above explains the respondent characteristics. Based on the table, it can be clearly seen that respondents have characteristics, namely age, gravida status, employment status and educational status. The distribution showed that the average age of 20-35 years was 28 respondents (73.68%). The characteristics of gravida status are mostly multigravida categories as many as 30 respondents (78.95%). Based on the characteristics of job status, most of them worked as many as 24 respondents (63.16%). The average educational status of the respondents was secondary education with 23 respondents (60.53%).

Table 2 provides an illustration of the results of a chi-square homogeneity test that examines whether distributions within groups are consistent.Such a consistent, even distribution across test items for all variables of pregnant women's attitudes is significant; all figures are greater than 0.05 threshold.Thus, based on this judgment, the attitudes of pregnant women in this research are not much different among groups compared.ID: Similarly to the previous point. Repetition of a word (group) from the previous sentence. Change "being compared" to "compared with each another" to add variety.This homogeneity can be traced to a number of hidden factors among pregnant women participants. For example, the respondents may have similar sociodemographic characteristics, access to information and environmental factors that all contribute to consistent attitudes about pregnancy -

related issues. Such shared characteristics lead to consistent perceptions and behavior. And they in turn keep in place the observed homogeneity.

Table 2. Homogeneity Test on Attitude Variables

Variable	Attitude (Pre-test)				p-value
	Supporting		Not Supporting		
	f	%	f	%	
Age					
20-35	1	25.0	27	79.4	0.019
<20 or >35	3	75.0	7	20.6	
Gravida Status					
Mutigravida	3	75.0	30	88.2	0.459
Primigravida	1	25.0	4	11.8	
Employement Status					
Working	4	100.0	20	58.8	0.106
Not Working	0	0.0	14	41.2	
Education Status					
Higher	0	0.0	2	5.9	0.063
Secondary	0	0.0	19	55.9	
Primary	4	100	13	38.2	

Moreover, this homogeneity indicates that interventions/polices aimed at pregnant women can be made and conducted in a standard fashion without needing to cater make adjustments for different groups.Further research may look into Test pregnant women exactly why there are such uniform attitudes.These findings can have significant repercussions for the design of health education projects. They reveal in particular how to prepare services directed at pregnant women so that they address, are sensitive to, and meet those women´s needs/ expectations in a variety of settings.

Table 3. Homogeneity Test on Behavioral Variable

Variable	Behaviour (Pre test)						p value
	Good		Medium		Less		
	f	%	f	%	f	%	
Age							
20-35	5	83.3	21	72.4	2	66.7	0.823
<20 or >35	1	16.7	8	27.6	1	33.3	
Gravida Status							
Mutigravida	5	83.3	25	86.2	3	100.0	0.767
Primigravida	1	16.7	4	13.8	0	0.0	
Employment Status							
Working	3	50.0	18	62.1	3	100.0	0.331
Not Working	3	50.0	11	37.9	0	0.0	
Education Status							
Higher	1	16.7	1	3.4	0	0.0	0.434
Secondary	4	66.6	14	48.3	1	33.3	
Primary	1	16.7	14	48.3	2	66.7	

Source: Primary Data, 2024

Based on Table 3, the significance value in the results of the Chi-Square homogeneity test shows that all variables on the behavior of pregnant women are homogeneous because the significance value is more than 0.05.

Table 4. Differences in Attitudes of Pregnant Women Before and After Being Given FCMC Education

Variable	Intervention Group		P-value
	Sign	Obs	
Attitudes	Positive	12	**<0.01**
	Negative	0	
	Zero	26	
*p<-0.05			

Source: Primary Data, 2024

Table 4 clearly explains that the results of the pre and post-test after the intervention in providing education for Family Centered Maternity Care experienced a change in attitude for the better as many as 12 respondents, while those who did not have a change in attitude as many as 26 respondents. The results of the Wilcoxon test on pregnant women's attitudes towards stunting prevention showed significant results with a p value of <0.001, which means that there was a change in attitude after being given Family Centered Maternity Care education on stunting prevention.

Table 5. Differences in Behaviour of Pregnant Women Before and After FCMC Education

Variable	Intervention Group		P-value
	Sign	Obs	
Attitudes	Positive	16	**<0.001**
	Negative	1	
	Zero	21	
*p<-0.05			

Source: Primary Data, 2024

Based on Table 5 above, it is shown that the results of the pre and post-test analysis after the intervention in providing education for Family Centered Maternity Care experienced a change in behavior for the better as many as 16 respondents, who experienced a negative change of 1 respondent and who did not change as many as 21 respondents. The results of the Wilcoxon test on pregnant women's behavior towards stunting prevention showed significant results with a p value of <0.001, which means that there is a change in behavior after being given Family Centered Maternity Care education on stunting prevention.

3.2.Discussion

Pregnant women who got involved in this study are more aged 20-35 years. Results of some researches reveal that the age of 20-35 years is a mature age and has enough knowledge in addition to experience both in terms of maturity in thinking and mentality to run a household. This study confirmed that there was a significant relationship between family centered maternity care education on attitudes and behaviors of pregnant women and stunting prevention (p value <0.05). The majority of this study has a good attitude and agrees that stunting prevention efforts such as pregnancy planning, routine check-ups during pregnancy, healthy diet during pregnancy, exclusive breastfeeding, and stimulation of children are important things to do.

A research by Sudhinaraset et al (2021) on the effect of FCMC on maternal and newborn health confirmed that it showed significant results (p value <0.05). In particular, this study shows that the

provision of information involving families can affect autonomy in obtaining health services. The existing literature shows the importance of counseling and appropriate information for women to improve the health status of mothers and children.

This is in line with research conducted by Liu et al (2021) that pregnancy is a time for women who need social support and support from their environment. Social support can reduce stress levels and improve the emotional and physical well-being of pregnant women. Pregnant women who receive low social support during pregnancy are at risk of mental illnesses such as baby blues, postpartum depression and suboptimal self-care and their babies. Social support is a driving factor for faster behavior change, especially the support of husbands, family, friends and health workers. Social support can be in the form of providing support and sentences in a positive way.

Providing education plays an important role in determining a person's behavior and attitude, because knowledge will lead a person to think and try to take the right action so that they can make the right decision (Rahmayanti et al., 2023). To improve attitudes and behaviors towards stunting prevention, it can be done by providing education so that it can raise awareness in mothers and families to change their behavior in accordance with their knowledge. One of the efforts to increase knowledge about the attitudes and behaviors of pregnant women towards stunting prevention is to provide education on the importance of stunting prevention with the role of Family Centered Maternity Care (FCMC). Family Centered Maternity Care (FCMC) is a family-centered care that provides care to mothers and families that integrate pregnancy, childbirth, and baby care on an ongoing basis with individual care prioritizing family support, participation, and choice (Mayasari et al., 2018).

According to Lawrence Green in Notoatmojo (2014), health behavior is influenced by 3 factors, namely predisposing factors such as knowledge, attitude, belief, values, beliefs, and so on. The second factor is supporting factors, namely the environment, facilities, health infrastructure facilities and factors driving the attitude and behavior of health workers which are a reference group of community behavior. The behavior of respondents in preventing stunting was very good. Respondents have made efforts such as checking their pregnancy regularly, during pregnancy consuming folic acid and iron supplements regularly, being willing to breastfeed exclusively, consuming a variety of foods containing carbohydrates, vitamins and proteins as well as maintaining hygiene and implementing PHBS in childcare. It can be concluded that respondents' behavior is not only influenced by knowledge, but can be due to the respondents' good attitude and supported by the environment and access to health services as well as posyandu activities that run well and routinely.

After being given health education on the importance of preventing stunting from pregnancy, pregnant women can find out the impact if they do not anticipate stunting such as not knowing a healthy lifestyle in pregnant women, not paying attention to nutritional intake and not understanding the impact of stunting. (Shariff et al., 2023).

Education with the role of Family Centered Maternity Care (FCMC) carried out in the family-based Kebumen area to improve attitudes and behaviors towards the prevention of pregnant women has been successfully carried out. With this activity, pregnant women increase their knowledge about stunting prevention so that they can change health behavior during pregnancy optimally. In addition, pregnant women are committed to being obedient and regular in maintaining their pregnancy by visiting health services and families to improve their ability to provide assistance. The hope of this study is that pregnant women can prevent stunting starting from pregnancy.

4. Conclusion

The implementation of FCMC education further improves the attitude of pregnant women to make healthier behavior changes, especially for stunting prevention. It is hoped that FCMC education can be

a health education method that can be carried out in the provision of obstetric services, especially when providing continuous obstetric care as an effort to prevent stunting since pregnancy.

Acknowledgement

Our deep gratitude to the Head of Kretek Village, the Midwife of Kretek Village, Kebumen Regency and the respondents. We also thanked the Grant Team of the Higher Education Council for Research and Development of the Central Executive of Muhammadiyah for the support of research funds.

Reference

Abdillah, S. (2022). The Effect of Maternal and Child Factors on Stunting in Children Under Five Years in Rural Indonesia. *KnE Life Sciences*. https://doi.org/10.18502/kls.v7i2.10382

Anjani, R. D. (2021). Kebutuhan Gizi Ibu Hamil pada Masa Pandemi Covid-19. Jurnal Pangan Dan Gizi, 11(1), 42–49. DOI: https://doi.org/10.26714/jpg.11.1.2021.42-49

Beal, T., Tumilowicz, A., Sutrisna, A., Izwardy, D., & Neufeld, L. M. (2018). A Review of Child Stunting Determinants in Indonesia. In *Maternal and Child Nutrition*. https://doi.org/10.1111/mcn.12617

Dewi, A. P. S. (2022). Faktor-Faktor yang Mempengaruhi Kejadian Stunting pada Anak Balita. *Jurnal Ilmu Keperawatan Dan Kebidanan*, *13*, 549–555.

Ecenroad, D., & Zwelling, E. (2000). A Journal to Family-Centered Maternity Care. *MCN The American Journal of Maternal Child Nursing*. https://doi.org/10.1097/00005721-200007000-00004

Ekayanthi, N. W. D., & Suryani, P. (2019). Edukasi Gizi pada Ibu Hamil Mencegah Stunting pada Kelas Ibu Hamil. *Jurnal Kesehatan*. https://doi.org/10.26630/jk.v10i3.1389

Fabusoro, O. K., & Mejia, L. A. (2021). Nutrition in HIV-Infected Infants and Children: Current Knowledge, Existing Challenges, and New Dietary Management Opportunities. In *Advances in Nutrition*. https://doi.org/10.1093/advances/nmaa163

Huriah, T., & Nurjannah, N. (2020). Risk Factors of Stunting in Developing Countries: A Scoping Review. *Open Access Macedonian Journal of Medical Sciences*. https://doi.org/10.3889/oamjms.2020.4466

Kemenkes, 2018. (2018). Kementrian Kesehatan 2018. *Science as Culture*. https://layanandata.kemkes.go.id/katalog-data/riskesdas/ketersediaan-data/riskesdas-2018

Linda Richter. (2016). Economies Grow When Early Childhood Development is a Priority. *Mail & Guardian*. https://theconversation.com/economies-grow-when-early-childhood-development-is-a-priority-69660

Liu, Y., Li, T., Guo, N., Jiang, H., Li, Y., Xu, C., & Yao, X. (2021). Women's Experience and Satisfaction with Midwife-led Maternity Care: a Cross-Sectional Survey in China. *BMC Pregnancy and Childbirth*. https://doi.org/10.1186/s12884-021-03638-3

Lundgren, I., Smith, V., Nilsson, C., Vehvilainen-Julkunen, K., Nicoletti, J., Devane, D., Bernloehr, A., van Limbeek, E., Lalor, J., & Begley, C. (2015). Clinician-Centred Interventions to Increase Vaginal Birth After Caesarean Section (VBAC): A Systematic Review. *BMC Pregnancy and Childbirth*. https://doi.org/10.1186/s12884-015-0441-3

Mayasari, S. I., Suhita, B. M., & Indasah. (2018). The Effectiveness of Family Centered Maternity Care (FCMC) Education to Increase The Independence of Pospartum Mother. *Health Notoins*. DOI: https://doi.org/10.33846/hn.v2i5.205

Notoatmodjo, S., 2014, Promosi Kesehatan dan Perilaku Kesehatan. Jakarta:Rineka Cipta.

Rahmayanti, N. M. (2023). Pengembangan E-Modul Pembelajaran Berbasis Flipbook Pada Kompetensi Dasar Menerapkan Teknik Kerja Aseptis Di Smkn 1 Kuningan. Jurnal Pendidikan, 14(1), 34–47. https://jp.ejournal.unri.ac.id/index.php/JP/index. DOI: http://dx.doi.org/10.31258/jp.14.1.34-47

Rahut, D. B., Mishra, R., & Bera, S. (2024). Geospatial and Environmental Determinants of Stunting, Wasting and Underweight: Empirical Evidence from Rural South and Southeast Asia. *Nutrition*. https://doi.org/10.1016/j.nut.2023.112346

Rosa & Shalahuddin, M. (2011). Rekayasa Perangkat Lunak Terstruktur dan Berorientasi Objek. Modul. Bandung.

Saleh, A., Syahrul, S., Hadju, V., Andriani, I., & Restika, I. (2021). Role of Maternal in Preventing Stunting: a Systematic Review. *Gaceta Sanitaria*. https://doi.org/10.1016/j.gaceta.2021.10.087

Shariff, F. O., Prameswari, K. A. S., & Carolia, I. (2023). The Influence of Education by Using 5J Pregnancy Nutrition Guidebook for The Prevention of Fetal Growth Restriction and Maternal Nutritional Sufficiency. *Malahayati International Journal of Nursing and Health Science*. https://doi.org/10.33024/minh.v6i4.12820

Sudhinaraset, M., Landrian, A., Golub, G. M., Cotter, S. Y., & Afulani, P. A. (2021). Person-Centered Maternity Care and Postnatal Health: Associations With Maternal and Newborn Health Outcomes. *AJOG Global Reports*. https://doi.org/10.1016/j.xagr.2021.100005

Sukmawati, S., Hermayanti, Y., Nurhakim, F., DA, I. A., & Mediani, H. S. (2021). Edukasi Pada Ibu Hamil, Keluarga dan Kader Posyandu Tentang Pencegahan Stunting. *Dharmakarya*. https://doi.org/10.24198/dharmakarya.v10i4.33400

Sutarto, Mayasari, D., & Indriyani, R. (2018). Stunting, Faktor Resiko dan Pencegahanya. *Fossil Behavior Compendium*. 5, 540–545. https://doi.org/10.1201/9781439810590-c34

Vaivada, T., Akseer, N., Akseer, S., Somaskandan, A., Stefopulos, M., & Bhutta, Z. A. (2020). Stunting in Childhood: An Overview of Global Burden, Trends, Determinants, and Drivers of Decline. In *American Journal of Clinical Nutrition*. https://doi.org/10.1093/ajcn/nqaa159

Wati, K., Kartini, A., & Rahfiludin, M. Z. (2022). Determinant Factors: Literature Review Study on Stunting Incidence in Toddlers. *The International Journal of Health, Education and Social*. DOI: https://doi.org/10.1234/ijhes.v5i2.223

West, J., Syafiq, A., Crookston, B., Bennett, C., Hasan, M. R., Dearden, K., Linehan, M., Hall, C., & Torres, S. (2018). Stunting-Related Knowledge: Exploring Sources of and Factors Associated with Accessing Stunting-Related Knowledge among Mothers in Rural Indonesia. *Health*. https://doi.org/10.4236/health.2018.109096