Oshada; Jurnal Kesehatan
https://nawalaeducation.com/index.php/O/index
Volume 1 Nomor 5 October 2024
e-ISSN : 3047-017X
DOI : https://doi.org/10.62872/bty3pr04

Optimization of Childbirth Time Phase I Using Microcontroller-Based Nipple Stimulation

Yanik Purwanti[1], Arief Wicaksono[2], Muhammad Iqbal[3]
[1]Department of Midwery , Faculty of Health Sciences, Universitas Muhammadiyah Sidoarjo, Jalan Mojopahit 666 Sidoarjo, Indonesia
[2,3] Department of Electrical Enginering, Universitas Muhammadiyah Sidoarjo, Jalan Mojopahit 666 Sidoarjo, Indonesia
e-mail : yanik1@umsida.ac.id

Input	: September 27, 2024	Revised	: October 12, 2024
Accepted	: October 18, 2024	Published	: October 31, 2024

ABSTRACT

The first stage of labor often takes a long time and causes discomfort for the mother, so methods are needed to accelerate it. This study aims to evaluate the effectiveness of microcontroller-based nipple stimulation in accelerating the labor process by stimulating the release of the hormone oxytocin which increases uterine contractions and accelerates cervical opening. Microcontroller technology is used to ensure the stimulation is done automatically and measured according to the mother's physiological needs. This study involved two groups, namely the group that received stimulation and the control group that did not receive stimulation. The results showed that the stimulated group experienced shorter labor times than the control group and were less likely to require medical interventions such as induction with drugs. Close monitoring is still required to ensure safety, especially regarding the risk of uterine hyperstimulation that may affect the condition of the mother and fetus. Further research is needed to test the long-term effectiveness and safety of this method before it is widely applied in obstetric practice. Based on the total library, 600 were identified and as many as 100 additional articles were identified. A total of 630 studies failed to meet the inclusion criteria and 70 articles were read in their entirety, so that as many as 11 publications were used as references. Microcontroller-based nipple stimulation offers an innovative solution that can improve the efficiency of labor while providing a better quality of health care.

Keywords : *First Period of Labor, Medical Technology, Microcontroller, Nipple Stimulation, Time Efficiency*

BACKGROUND

Labor is a crucial and challenging physiological process, especially for mothers who are going through their first labor (Power et al., 2019). The initial stage of labour, stage I, is characterized by the opening of the cervix to 10 cm. This phase often takes a long time, causing discomfort, fatigue and anxiety for the mother. Labor that lasts too long can increase the risk of complications such as bleeding and uterine fatigue, and increase the likelihood of medical

interventions such as induction or cesarean section (Safitri et al., 2020). This condition not only affects the well-being of the mother, but also increases the workload for medical personnel who handle several patients at once (Alexsander., 2019). Efforts to safely and effectively expedite labor are needed to minimize risks to the mother and fetus and provide a more comfortable delivery experience.

A natural approach through nipple stimulation has been shown to accelerate labor by stimulating the release of the hormone oxytocin, which increases the frequency and intensity of uterine contractions (Nouh et al., 2024). Effective contractions help accelerate cervical opening and shorten labor time. However, manual execution of stimulation is often inconsistent and difficult to monitor, so its effectiveness may be reduced (Cohen., 2021). Microcontroller-based technology offers a solution to perform stimulation automatically and measurably, adjusting the intensity to the physiological needs of the mother during the labor process. With proper monitoring, this method can increase efficiency without adding risk to the mother and fetus. Maternal mortality during labor is one of the benchmark indicators of health service capability (Ministry of Health of the Republic of Indonesia, 2022). Deaths are caused by bleeding during the labor process (Musa, 2019). This is seen from the Maternal Mortality Rate (MMR), according to the *Millennium Declaration Goals* (MDG) Indonesia sets a target of reducing maternal mortality.(Rohati & Siregar, 2023) Apart from bleeding, other causes cannot be avoided such as prolonged labor.(Susilowati et al., 2021) Prevention of prolonged labor by stimulating the hormone oxytocin early so that the uterine muscles or uterus can contract quickly and more strongly.(Pratiwi & Mualifah, 2023).

Oxytocin hormone is one of the hormones produced by the hypothalamus (Yeğen, 2010). This hormone is very important and is responsible for the process of childbirth by stimulating contractions in the uterus, especially in the smooth muscle. Oxytocin hormone is also important after childbirth because it can stimulate the uterus to contract to produce placenta to prevent bleeding in the baby's mother (Sari & Sunarsih, 2020). In addition to the labor process, this hormone can produce breast milk (breast milk) for the baby by the way when the baby sucks the mother's breast the oxytocin hormone will cause contractions in myoepithelial cells in the uterus or uterine organs.

Various ways of releasing the oxytocin hormone include massage. This massage is done along the spine from the 5th-6th ribs (costae) to the shoulder blades (scapula), this massage is to stimulate the hormones oxytocin and prolactin which will cause contractions in the uterine muscles (Yosepin et al., 2020). Nipple massage can affect the baby's weight. Another way is to add the hormone oxytocin through infusion (Drip) which has become commonplace in medicine (Regen & Yanuarti, 2022). This method has an impact on the baby who will be born, especially damage to the brain organs. A well-known reason why mothers choose to breastfeed their babies is that breast milk provides unparalleled nutrition and immune support for their babies.

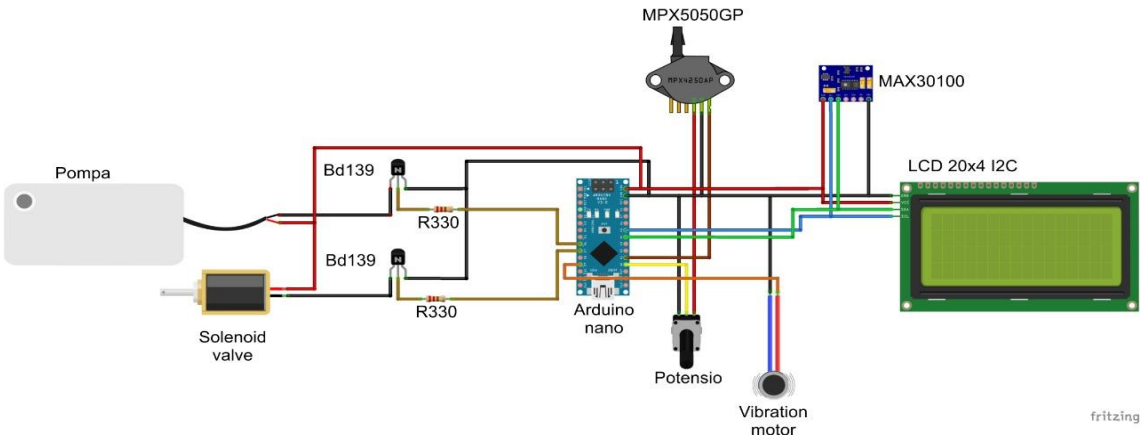
Regardless of the intention of the Based on the above background, this study aims to evaluate the effectiveness of microcontroller-based nipple stimulation in accelerating the first stage of labor. In addition, this method is expected to reduce the need for medical interventions such as the administration of induction drugs that often cause side effects. This approach has the potential to provide a better labor experience for the mother and improve the efficiency of health services for medical personnel. With the potential to be widely applied in obstetric practice, this method could become part of the standard protocol in safe, effective, and quality delivery services. Further research is needed to confirm the effectiveness and safety of this method in various clinical conditions.

METHODOLOGY

The research was conducted comprehensively by covering various important aspects, including experimental design, sample population selection, data collection and data analysis. One of the technical steps taken was the design of a microcontroller system for nipple stimulation, which involved selecting appropriate hardware and software and testing the system to ensure optimal integration. Data collection was conducted through experiments with the research subjects, namely pregnant women, to obtain information regarding labor duration, contraction patterns, comfort levels, and other relevant variables. Further data analysis was conducted to assess the significant impact of using microcontrollers in nipple stimulation on the efficiency of the labor process. The novelty of this study lies in the application of microcontrollers that are not only used for nipple stimulation, but are also equipped with blood pressure, pulse, and oxygen saturation measurement features, which are important for monitoring the health conditions of the mother and fetus in real-time. By integrating this technology into the practice of nipple stimulation, this research aims to improve the overall labor experience and provide better outcomes for both mother and baby. In addition, this innovation is expected to serve as a reference for the development of more advanced medical devices in obstetrics and gynecology, thereby contributing to the improvement of prenatal care standards. The research was conducted comprehensively by covering various important aspects, including experimental design, sample population selection, data collection and data analysis. One of the technical steps taken was the design of a microcontroller system for nipple stimulation, which involved selecting appropriate hardware and software and testing the system to ensure optimal integration. Data collection was conducted through experiments with the research subjects, namely pregnant women, to obtain information regarding labor duration, contraction patterns, comfort levels, and other relevant variables. Further data analysis was conducted to assess the significant impact of using microcontrollers in nipple stimulation on the efficiency of the labor process. The novelty of this study lies in the application of microcontrollers that are not only used for nipple stimulation, but are also equipped with blood pressure, pulse, and oxygen saturation measurement features, which are important for monitoring the health conditions of the mother and fetus in real-time. By

integrating this technology into the practice of nipple stimulation, this research aims to improve the overall labor experience and provide better outcomes for both mother and baby. In addition, this innovation is expected to serve as a reference for the development of more advanced medical devices in obstetrics and gynecology, thereby contributing to the improvement of prenatal care standards.

RESULT AND DISCUSSION



Tool Description
Main Components:

- *MPX5050* Pressure Sensor *:* To detect and adjust the patient's blood pressure(Pramujianto, n.d.)
- Motor Vibrator: To perform stimulation based on input from the operator's setting manual.
- Microcontroller Unit (Arduino Nano): The brain of the system that controls the entire operation based on a pre-programmed algorithm.

2. Additional Features:

- Intensity Settings: Users can select the level of stimulation intensity.
- Programming Time: Allows users to set the duration and interval of stimulation.
- Blood Pressure: The use of this tool is also able to display the patient's blood pressure
- Oxygen saturation: This device also displays the oxygen saturation of the patient
- Heart Rate : The patient's heart rate is also displayed
- Data Collector: Collects data on the mother's physiological response during stimulation for further analysis.

The circuit scheme utilizes the Arduino Nano as the main microcontroller to control various electronic components and sensors in an integrated manner. The Arduino Nano was chosen because of its compact size and ability to connect a number of devices through digital and analog input and output interfaces. The two main sensors used in this system are MPX5050GP and MAX30100, each of

which has an essential function. MPX5050GP is used to measure air or liquid pressure, making it relevant in a variety of applications such as monitoring hydraulic systems, breathing, or fluid flow control. Meanwhile, MAX30100 is an optical sensor that functions to detect heart rate and blood oxygen levels (SpO2), which is very useful in the health field, such as self-monitoring devices or portable medical devices. The data from both sensors is processed by the Arduino Nano and displayed in real-time on the 20x4 I2C LCD.

The use of LCDs with I2C interfaces was chosen to simplify the circuitry, as it requires only two communication lines, namely SDA and SCL, thereby reducing the number of pins required. This not only saves space on the microcontroller but also makes the circuit neater and simplifies the wiring process. With a display capable of displaying four lines of information at once, this LCD allows users to monitor multiple important parameters simultaneously. This integration between the pressure sensor and the health sensor allows the system to be used in a variety of contexts, both in fluid flow control and medical condition monitoring. This system can provide early warning in the event of abnormal conditions, such as excessive pressure or heart rate and oxygen levels that are outside safe limits. With an easy-to-access information display via LCD, users can quickly and accurately monitor pressure status and health conditions without the need for additional devices, making this system efficient and reliable in its operations.

Measurement Results by Treatment

Table 1. Data on Patients with Treatment at Rahman-Rahim Hospital Date: June 22 -July 12, 2024

No	TGL	Name	Address	Age	Diagnosis	Duration of Period I	Vital signs
1	22/06/2024	Ny. Su	Wahyu Taman Sarirogo AH-26	29 th	G1 P0-0 uk 40 mgg	5 hours	TD : 138/90
2	22/06/2024	Ny. Sa	Gesing 3-1, Banjarsari, Buduran	36 th	G6 P12020 uk 37 mgg	6 hours	TD : 108/70
3	23/06/2024	Ny. Ni	Kebun agung 5/4 Sukodono	38 th	G4P3-3 uk 39 mgg	6 hours	TD : 115/70
4	01/07/2024	Ny. Sh	Citra harmoni	23 th	G1P0 UK 41 mgg	6 hours	TD: 112/68
5	01/07/2024	Ny. Ro	Buduran	28 th	G4P2A1 UK 39 mgg	5 hours	TD: 134/88

6	06/07/2024	Ny. Nu	Lambangan1-3 Wonoayu	30 th	G2P1-1 UK 39 mgg	4 hours	TD: 105/60
7	12/07/2024	Ny. In	Krian	37 th	G1P0A0 UK 38 mgg	6 hours	TD: 112/73

Table 1 shows the results that the average length of kala 1 in primi was 5.6 hours while in multi the average length of kala I was 5.2 after the treatment of stimulation of the nipples during the first stage. The table contains data on patients who received treatment at Rahman-Rahim Hospital during the period June 22 to July 12, 2024, including important information such as date of arrival, name, address, age, diagnosis, duration of kala I, and blood pressure. The registered patients ranged in age from 23 to 38 years with varying pregnancy diagnoses, ranging from first to sixth pregnancy. The length of the first stage, which indicates the duration of the first phase of labor, varied from 4 to 6 hours, while the recorded blood pressure ranged from 105/60 mmHg to 138/90 mmHg. This data shows that the health conditions of pregnant women are considered in detail, and also shows that the hospital serves patients from different regions, reflecting the diversity of conditions and medical needs during labor.

Results withut treatment

Table 2. Untreated Patient Data at Siti Fatimah Tulangan Hospital
Date: March 18 - April 6, 2024

No	TGL	Name	Address	Age	Diagnosis	Duration of Period I	Vital signs
1	18/03/2024	Ny. Ma	Sidotopo Jaya Lebar 29 B	42 th	G4P3-3 uk40 mgg	9 hours	TD : 143/83
2	18/03/2024	Ny. Em	kalianak timur	37 th	G4P2A1 uk 39 mgg	8 hours	TD : 120/80
3	21/03/2024	Ny. R	Jl. Sulung Utara 1/37 A	20 th	G1P0A0 uk 40 mgg	8 hours	TD : 120/85
4	27-03-2024	Ny. I	Sidokapasan 5/29	31 th	G2P1A0 Uk	6 hours	TD : 109/70
5	27-03-2024	Ny. Er	pragoto 2/4	34 th	G3P2A0 uk 40mgg	8 hours	TD : 116/71
6	27-03-2024	Ny. Ii	Kunti 1 no 3	19 tah	G1P0A0 uk 39mgg	8 hours	TD : 115/73
7	22/03/2024	Ny. S	Kapas Baru 7/ll4	23 th	G1P0A0 UK 38mgg	6 hours	TD: 120/80

The table records data on untreated patients at Siti Fatimah Tulangan Hospital during the period March 18 to April 6, 2024, presenting key information such as date of arrival, patient name, address, age, diagnosis, length of first stage, and vital signs with a focus on blood pressure. The age of the patients ranged from 19 to 42 years old, with diagnoses showing a diverse pregnancy history, ranging from G1P0A0 (first pregnancy with no previous deliveries) to G4P3-3 (fourth pregnancy with three previous deliveries). The length of the first stage, which indicates the duration of the first phase of labor, ranged from 6 to 9 hours, with most patients experiencing a length of the first stage of labor of around 8 hours. Vital signs, especially blood pressure, were recorded between 109/70 mmHg to 143/83 mmHg, reflecting the different health conditions among patients which is important for monitoring the stability of maternal health during labor. Overall, this table provides a clear picture of the health condition of untreated pregnant women, emphasizing the importance of monitoring vital signs in every pregnancy.

Result Analysis

The results showed that nipple stimulation treatment for pregnant women who gave birth in the first stage had a significant impact on the length of the first stage. The average length of kala I in primiparous pregnant women who received nipple stimulation was recorded to be around 5.6 hours, while in multiparous pregnant women, the average length of kala I reached 5.2 hours after stimulation treatment. In contrast, primiparous pregnant women who did not receive treatment showed an average duration of kala I of 7.3 hours, and multiparous pregnant women without treatment had an average duration of kala I of 7.7 hours. These findings confirm the effectiveness of nipple stimulation in accelerating the labor process, which can reduce the risk of morbidity and mortality in mothers and babies. The use of nipple stimulation tools plays an important role in preventing prolonged labor, which is one of the main contributing factors to complications during labor and can increase the chances of safety for both mother and baby. Manual stimulation using fingers as a method to increase uterine contractions is often uncomfortable and risks causing injury to sensitive areas. Therefore, the use of nipple stimulation devices provides a better approach to increase uterine contractions without causing excess discomfort to the mother. With the application of this technology, it is expected that the labor process can take place more efficiently and safely, and reduce the risks that may be experienced by both mother and baby during this critical period. The success of this method may also provide a more practical and convenient solution for medical personnel in supporting a better labor process.

Challenges in Manual Stimulation

The use of manual stimulation methods to promote uterine contractions often leads to problems such as blisters and pain due to repeated friction and pressure on the nipples. These issues not only decrease the mother's comfort, but also increase the risk of infections that can jeopardize the health of both mother and baby. This discomfort can interfere with the mother's focus during labor, which is crucial for a smooth delivery. Manual stimulation is also often

inefficient, time-consuming and results are not always consistent. The discomfort felt by the mother during the stimulation process can inhibit the production of oxytocin, a key hormone that supports uterine contractions, which in turn can slow down the progress of labor. Given such challenges, there is an urgent need for alternative methods that are more effective and comfortable. Microcontroller-based technology is emerging as an innovative solution to overcome the drawbacks of manual stimulation methods. With the use of microcontrollers, stimulation can be performed consistently and effectively, with precise intensity and frequency settings, so as to trigger optimal oxytocin release.

The ergonomically designed device serves to minimize direct contact that could potentially cause nipple chafing and pain. Maternal comfort is a top priority in the design of the device, where adjustment of stimulation settings according to individual preferences aims to minimize discomfort. A real-time monitoring feature that allows stimulation adjustments based on the mother's body response provides additional support for better comfort during labor. The device is also equipped with a vital sign detection scanner feature, such as blood pressure, pulse, and oxygen level measurements, which enables comprehensive monitoring of the mother's health condition. This innovation not only aims to improve the efficiency of the delivery process, but also to ensure the health and safety of both mother and baby, making it an important step in the development of obstetric technology.

DISCUSSION

In a study comparing labor time between a group that received microcontroller-based nipple stimulation and a control group that did not receive stimulation, significant differences in labor duration were found. The stimulated group generally experienced shorter labor times, especially in the cervical opening phase. This was due to the increased frequency of contractions triggered by nipple stimulation, which contributed to the acceleration of cervical opening and reduction in the duration of the first stage of labor. In contrast, the group that did not receive stimulation tended to experience longer labor times, which may increase discomfort for the mother as well as the potential need for greater medical intervention. The effectiveness of nipple stimulation as a method to accelerate labor is evident through the mechanism by which the hormone oxytocin is released (Takahata et al., 2018). Microcontroller technology allows stimulation to be performed in a measured and controlled manner, providing a better response to the patient's needs during the labor process.

The main advantage of using this method is the reduction of labor time and the possibility to reduce medical interventions (Simkin., 2022). The method is non-invasive, so it can minimize the risk of complications often associated with the use of drugs or other medical procedures, as well as improve the delivery experience for the patient. The use of nipple stimulation also has some risks that need to be considered. One of the main risks is the potential for uterine hyperstimulation, where contractions become too strong or too frequent, which can cause stress to the fetus or complications for the mother (Sukumaran et al.,

2021). Careful monitoring and adjustment of stimulation is essential to ensure patient safety. Further research is needed to evaluate the long-term effects of this method and to ensure that its use is widely acceptable in clinical practice. With a good understanding of the benefits and risks, microcontroller-based nipple stimulation can be an effective alternative in improving the efficiency of the labor process. Microcontroller-based nipple stimulation provides a number of significant benefits to medical personnel and patients in the labor process (Manickam et al., 2022). For the patient, this method has the potential to speed up labor time by increasing the frequency of contractions and accelerating cervical opening, thereby reducing the discomfort felt during labor. As such, the overall birth experience is improved, and the likelihood of the need for medical interventions, such as induction or the use of drugs to stimulate contractions, is minimized (Thomson et al., 2019). For medical personnel, accelerating the labor process allows them to handle multiple patients more efficiently, thus providing more optimal attention to each patient.

The use of this technology can also improve the quality of care provided. Patients will feel more involved and empowered in the birthing process, while medical personnel can enhance the reputation of healthcare services through the implementation of safe and technology-based methods. The potential for using these methods in obstetric practice is huge, with the possibility of integration as part of standard care protocols for pregnant women (Papageorghiou et al., 2018). Medical personnel can be trained to apply this technique effectively, as well as conduct further research to explore the effectiveness and safety of nipple stimulation in various labor situations. Increased awareness and education regarding this method is expected to contribute to better acceptance in the field, with the hope of improving health outcomes for mothers and babies, reducing cesarean section rates, and improving the overall delivery experience (Sumati et al., 2024).

CONCLUSSION

This innovation not only offers a solution to the effectiveness of the first stage of labor as well as monitoring vital signs and oxygen saturation, but also paves the way for further research in the field of medical technology, especially in facilitating a safer and more comfortable labor process for mothers. The use of microcontrollers in nipple stimulation is expected to be an important breakthrough in improving the quality of care during labor, especially in the early phase. By utilizing a microcontroller, the device is able to provide more consistent and precise stimulation, thereby increasing the chance of the release of the hormone oxytocin which is essential for optimal uterine contractions. This is expected to reduce the duration of the first stage of labor, which is often the deciding factor in a smooth delivery. The application of this technology also contributes significantly to improving the quality of care during labor, especially in the early phase. The tool's ability to monitor the mother's vitals in real-time allows medical personnel to quickly respond to changes that may occur, thereby improving maternal safety and

comfort. In addition, this approach encourages the development of new tools and technologies in the field of obstetrics, which can address the various challenges faced during labor. Thus, the use of microcontrollers in nipple stimulation can be considered an important breakthrough that not only facilitates a more efficient delivery process, but also contributes to further research and development in medical practice, ensuring the health and safety of mothers and babies.

BIBLIOGRAPHY

Alexsander, A. (2019). POLA DETERMINASI PILIHAN DAN NILAI PADA TINDAKAN DISKRESI BIDAN; STUDI PELAYANAN KESEHATAN IBU DAN ANAK. *Mimbar: Jurnal Penelitian Sosial Dan Politik*, *8*(2), 55-71. https://doi.org/10.32663/jpsp.v7i1.416

Cohen, W. R., & Friedman, E. A. (2021). Clinical evaluation of labor: an evidence- and experience-based approach. *Journal of Perinatal Medicine*, *49*(3), 241-253. https://doi.org/10.1515/jpm-2020-0256

Damsyik, D., & Lazuardi, L. (2021). mHealth intervention to knowledge level and family planning participation of unmet need women in Sleman District: Randomized Controlled Trial (RCT). *Journal of Information Systems for Public Health*, *6*(2), 1. https://doi.org/10.22146/jisph.46310

Ijabah, N., Achyar, K., & Kusuma, I. R. (2023). Efektifitas Pemberian Perlakuan Posisi Miring Kiri dan Upright Position terhadap Percepatan Kemajuan Persalinan Kala I Fase Aktif pada Ibu Inpartu. *Jurnal Riset Kesehatan Masyarakat*, *3*(4), 171–183. https://doi.org/10.14710/jrkm.2023.18715

Kementerian Kesehatan Republik Indonesia. (2022). Indikator nasional mutu pelayanan kesehatan tempat praktik mandiri dokter dan dokter gigi. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 30 Tahun 2022*, 89–91.

Manickam, P., Mariappan, S. A., Murugesan, S. M., Hansda, S., Kaushik, A., Shinde, R., & Thipperudraswamy, S. P. (2022). Artificial Intelligence (AI) and Internet of Medical Things (IoMT) Assisted Biomedical Systems for Intelligent Healthcare. Biosensors, 12(8), 562. https://doi.org/10.3390/bios12080562

Musa, S. M. (2019). Insiden Dan Faktor Risiko Perdarahan Postpartum Pada Persalinan Pervaginam: Studi Literatur. *Jurnal JKFT*, *4*(2), 28. https://doi.org/10.31000/jkft.v4i2.2413

Nouh Ibrahim El Galada, H., Aly Mohamed Abd-Elrahman, D., & Mansour Lamadah, S. (2024). Effect of Lavender Oil Drops Application on Perineal Pain Intensity and Episiotomy Wound Healing Among Primiparous Women. Alexandria Scientific Nursing Journal, 26(1), 75–86. https://doi.org/10.21608/asalexu.2024.354343

Papageorghiou, A. T., Kennedy, S. H., Salomon, L. J., Altman, D. G., Ohuma, E. O., Stones, W., Gravett, M. G., Barros, F. C., Victora, C., Purwar, M., Jaffer, Y., Noble, J. A., Bertino, E., Pang, R., Cheikh Ismail, L., Lambert, A., Bhutta, Z. A., & Villar, J. (2018). The INTERGROWTH-21st fetal growth standards: toward the global integration of pregnancy and pediatric care. American

Journal of Obstetrics and Gynecology, 218(2), S630–S640. https://doi.org/10.1016/j.ajog.2018.01.011

Pramujianto, M. A. (n.d.). *Gluterma Meter*.

Pratiwi, S. V., & Mualifah, L. (2023). Penerapan Pijat Oksitosin Dalam Menstimulus Produksi Asi Pada Ibu Post Sectio Caesarea. *Jurnal Kesehatan Karya Husada*, *11*(2, Juni), 94–100.

Regen, S., & Yanuarti, T. (2022). Efektifitas Penggunaan Misoprostol Dan Oksitosin Pada Penanganan Perdarahan Post Partum Di BPM Suryati Bekasi. *Malahayati Nursing Journal*, *4*(4), 840–852. https://doi.org/10.33024/mnj.v4i4.5996

Rohati, E., & Siregar, R. U. P. (2023). Faktor-Faktor yang Berhubungan dengan Kejadian Kematian Ibu pada Masa Kehamilan, Persalinan dan Nifas di Kota Depok Tahun 2021. *Jenggala: Jurnal Riset Pengembangan Dan Pelayanan Kesehatan*, *2*(1), 72–82.

Safitri, M., Sulistyaningsih, S. K. M., Kes, M. H., Rosida, L., ST, S., & Kes, M. K. (2020). Indikasi Persalinan Sectio Caesarea dan Komplikasi Pasca Persalinan Sectio Caesarea: Narrative Review. https://doi.org/10.31000/jkft.v2i1.690

Sari, Y., & Sunarsih, S. (2020). Pengaruh Inisiasi Menyusu Dini (IMD) Terhadap Lama Pelepasan Plasenta Pada Ibu Bersalin Kala III. *Cendekia Medika*, *5*(1), 59–66. https://doi.org/10.52235/cendekiamedika.v5i1.7

SIMKIN, P. (2022). Nonpharmacologic relief of pain during labor: Systematic reviews of five methods. American Journal of Obstetrics and Gynecology, 186(5), S131–S159. https://doi.org/10.1067/mob.2002.122382

Sumiati, E., Purnamasari, K. D., & Ningrum, W. M. (2024). Penyuluhan kepada Suami sebagai Pendamping Persalinan: Menguatkan Peran Keluarga dalam Mendukung Kesehatan Ibu dan Bayi. JPKMU: Jurnal Pengabdian Kepada Masyarakat Kesehatan Galuh, 1(2), 155-162. https://doi.org/10.30651/aks.v7i1.4616

Susilowati, D., Prastika, D. A., & Martanti, L. E. (2021). Faktor Persalinan Kala 1 Lama Di Puskesmas Ketuwan Blora. *Midwifery Care Journal*, *2*(4), 146–155. https://doi.org/10.31983/micajo.v2i4.7878

Takahata, K., Horiuchi, S., Tadokoro, Y., Shuo, T., Sawano, E., & Shinohara, K. (2018). Effects of breast stimulation for spontaneous onset of labor on salivary oxytocin levels in low-risk pregnant women: A feasibility study. PLOS ONE, 13(2), e0192757. https://doi.org/10.1371/journal.pone.0192757

Tambuwun, S. R., Engkeng, S., & Akili, R. H. (2019). Pengaruh Promosi Kesehatan Terhadap Pengetahuan Ibu Hamil Tentang 1000 Hpk Di Kelurahan Molas Kecamatan Bunaken Kota Manado. *Kesmas*, *8*(6), 371–377.

Thomson, G., Feeley, C., Moran, V. H., Downe, S., & Oladapo, O. T. (2019). Women's experiences of pharmacological and non-pharmacological pain relief methods for labour and childbirth: a qualitative systematic review. Reproductive Health, 16(1). https://doi.org/10.1186/s12978-019-0735-4

Yeğen, B. Ç. (2010). Oksitosin ve hipotalamus-hipofiz-adrenal bez ekseni. *Marmara Pharmaceutical Journal*, *14*(2), 61–66. https://doi.org/10.12991/201014450

Yosepin, B., Elly, N., & Dewi, R. (2020). *Media Informasi kesehatan Poltekes Kemenkes Bengkulu*.