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FACTORS ASSOCIATED WITH POST-CESAREAN SECTION WOUND HEALING

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Abstract

Sectio Caesarea (SC) is a surgical procedure to remove a baby from the mother's uterus. SC wound infection is a complication that can increase morbidity and mortality rates. Several factors influence SC wound healing. The purpose of this study was to determine the factors that influence SC wound healing at Bendan Hospital. This study used descriptive analytic design through cross-sectional approach by using chi-square test and logistic regression test. The population of this study were all postpartum mothers from November 17 - December 20, 2023, with a total sampling technique to obtain a sample of 70 respondents. The results of bivariate analysis showed there was a relationship between age (ρ=0.015), personal hygiene (ρ=0.015), anemia status (ρ=0.023), and fulfillment of nutrition (ρ=0.025). There was no association between BMI (ρ=0.579) and wound care knowledge (ρ=0.634). Multivariate analysis showed nutritional fulfillment had a value of ρ=0.042 and OR: 3,862. So the factor that most influences SC wound healing at Bendan Hospital is the fulfillment of nutrition. It is expected that health workers can provide education about nutrition to support SC wound healing to reduce SC wound infection.

Keywords: *Factors, Section Caesarea, Wound Treatment*

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1. Introduction

Maternal Mortality Ratio (MMR) is an important indicator reflecting community welfare and the effectiveness of maternal health programs in a country [1]. The Sustainable Development Goals (SDGs) aim to reduce the global MMR to less than 70 per 100,000 live births by 2030 [2]. However, according to the Indonesian Ministry of Health, the MMR in Indonesia in 2022 remained high at 305 per 100,000 live births. This figure has not yet met the national target of 183 per 100,000 live births set for 2024 [1] At the provincial level, data from the Central Java Provincial Health Office reported an MMR of 84.6 per 100,000 live births in 2022 [3]. Meanwhile, at the city level, the Pekalongan City Health Office recorded seven maternal deaths during the same year [4].

One of the contributing factors to maternal morbidity and mortality is childbirth through caesarean section (CS). Caesarean delivery carries a risk of complications that is approximately five times higher than vaginal delivery. The major threats faced by mothers undergoing caesarean section include anesthesia-related complications, severe

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sepsis, and thromboembolic events. Globally, nearly 75% of maternal deaths are caused by hemorrhage, infection, hypertensive disorders during pregnancy, and abortion [2]. Among these causes, surgical site infection following caesarean section contributes approximately 7.3% to maternal mortality [5]. Post-caesarean wound infection is a serious postoperative complication, as it increases maternal morbidity and mortality, prolongs hospitalization, raises healthcare costs, and may lead to legal claims from patients [6].

Worldwide, the incidence of surgical site infection ranges from 5% to 15%, while in Indonesia it is reported to be between 2% and 18% of all surgical procedures [7]. These figures indicate that the incidence of surgical site infections in Indonesia has not yet met the standards stipulated in the Regulation of the Minister of Health No. 659/Menkes/Per/VIII/2009, which sets a hospital surgical site infection attack rate of 2.5% as a benchmark for world-class hospitals [8].

Wound healing is a complex biological process that occurs in three phases: inflammation, proliferation (epithelialization), and maturation (remodeling). The inflammatory phase generally lasts up to five days after surgery and is relatively short if no infection occurs [9].

Several factors influence the wound healing process following caesarean section, including nutritional status, early mobilization, personal hygiene, maternal age, anemia, body mass index, and comorbid conditions such as diabetes mellitus [10].

In addition to physiological factors, maternal knowledge regarding wound care also plays an important role in the healing process. Insufficient knowledge may result in inadequate wound care practices, thereby increasing the risk of infection [11]. Consequently, behavioral and educational aspects should be considered alongside clinical factors in post-caesarean wound management.

Medical record data from Bendan Regional General Hospital in 2022 documented a total of 1,218 deliveries, of which 421 were caesarean sections. Among these cases, 16 mothers experienced post-caesarean wound infection, representing an incidence rate of approximately 3.8%. This rate exceeds the hospital surgical site infection attack rate standard.

Furthermore, a preliminary study conducted between January and September 2023 at Bendan Regional General Hospital involved interviews with ten mothers who experienced post-caesarean wound infection. The findings indicated that most post-caesarean mothers practiced dietary restrictions and had inadequate personal hygiene, despite having received education from healthcare providers regarding nutrition and postpartum care, particularly after caesarean delivery. Based on these conditions, this study aims to identify the factors influencing post-caesarean wound healing at Bendan Regional General Hospital.

2. Method

This study employed a quantitative research design with a descriptive analytic approach using a cross-sectional study design, in which observations were conducted at a single point in time to examine the association between risk factors and disease outcomes [12].

The study population consisted of all postpartum mothers who underwent caesarean section at Bendan Regional General Hospital between 17 November 2023 and 20 December 2023, totaling 73 individuals. A total sampling technique was applied. Following sample selection based on inclusion criteria namely postpartum post caesarean mothers who agreed to participate as respondents, those who attended wound follow-up visits at the Obstetrics and Gynecology Outpatient Clinic of Bendan Regional General Hospital, and those with vaginal

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discharge in the form of lochia sanguinolenta, a final sample of 70 respondents was obtained.

Ethical approval for this study was granted by the Health Research Ethics Committee of Poltekkes Kemenkes Semarang, as indicated by the Ethical Clearance Certificate Number 1222/EA/KEPK/2023.

The research instruments included a personal hygiene questionnaire, a nutritional intake questionnaire, a knowledge questionnaire regarding caesarean wound care, a post-caesarean hemoglobin (Hb) checklist, and direct observation of wound healing using the REEDA scale.

Bivariate analysis was conducted using the chi-square correlation test to examine the relationships between independent variables age, personal hygiene, anemia status, body mass index (BMI), nutritional intake, and knowledge of wound care and caesarean section wound healing outcomes. Subsequently, multivariate analysis using logistic regression was performed to identify the most dominant factors influencing wound healing.

3. Results and Discussion

Univariate Analysis

Table 1. Distribution of Respondent Characteristics

Variable	n (%)	ρ-value
Age		
No at risk	52 (74.3%)	ρ = 0.000
At risk	18 (25.7%)	
Personal hygiene		
Good	0	ρ = 0.000
Fair	52 (74.3%)	
Poor	18 (25.7%)	
Anemia Status		
Not anemic	21 (30%)	ρ = 0.000
Anemic	49 (70%)	
Body Mass Index		
Underweight	0	
Normal	16 (22.9%)	
Overweight	14 (20%)	ρ = 0.000
Obesity class I	22 (31.4%)	
Obesity class II	18 (25.7%)	
Nutritional intake		
Good	31 (44.3%)	ρ = 0.000
Fair	39 (55.7%)	
Poor	0	
Knowledge		
Good	46 (65.7%)	ρ = 0.000
Fair	24 (34.3%)	
Poor	0	
Caesarean wound healing		
Good	44 (62.9 %)	ρ = 0.000
Fair	26 (37.1 %)	
Poor	0	

Based on Table 1, most respondents were classified into the non-risk age group (52 respondents; 74.3%). The majority demonstrated fair personal hygiene practices (52 respondents; 74.3%), were categorized as anemic (49 respondents; 70.0%), and had a Body Mass Index (BMI) within Obesity Class I (22 respondents; 31.4%). In addition, more than half of the respondents reported fair nutritional intake (39 respondents; 55.7%), while most possessed good knowledge regarding caesarean wound care (46 respondents; 65.7%). Regarding wound healing outcomes, good wound healing was observed in 44 respondents (62.9%), while the remainder experienced fair wound healing; no respondents were classified in the poor wound healing category.

Prior to bivariate analysis, data normality was assessed using the Kolmogorov Smirnov test. The results indicated that all variables had significance values of <0.001, suggesting that the data were not normally distributed. Therefore, Chi-square correlation analysis was applied to examine the relationships between independent variables and caesarean wound healing categories.

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Bivariate Analysis

Table 2. Bivariate Analysis of Factors Associated with Caesarean Wound Healing

Variable	Wound Healing		Total	ρ-value	OR
	Good	Poor			
Age	37	15	52		
Not at risk	71,2%	28,8%	100%	0.015	3,876
	7	11	18		
At risk	38,9%	61,1%	100%		
Personal hygiene					
Fair	37	15	52	0.015	3,876
	71,2%	28,8%	100%		
Poor	7	11	18		
	38,9%	61,1%	100%		
Anemia Status					
Tidak	9	12	21		
anemia	42,9%	57,1%	100%	0,023	0,300
	35	14	49		
Anemia	71,4%	28,6%	100%		
IMT					
Normal	11	5	16		
	68,8%	31,3%	100%	0,579	1,400
Berlebih/	33	21	54		
Obesitas	61,1%	38,9%	100%		
Pemenuhan nutrisi					
Baik	24	7	31	0,025	3,257
	77,4%	22,6%	100%		
Cukup	20	19	39		
	51,3%	48,7%	100%		
Pengetahuan					
Baik	28	18	46	0,634	0,778
	60,9%	39,1%	100%		
Cukup	16	8	24		
	66,7%	33,3%	100%		

Age is an important individual factor that influences the wound-healing process after cesarean section. Based on the results of the chi-square test, the age variable showed a p-value of ρ=0.015 (<0.05), indicating a statistically significant association between age and cesarean section wound healing. This finding is consistent with the study by Murniati, Zulkarnaini, and Juwita (2020), which reported that high-risk maternal age was associated with an increased incidence of post cesarean section wound infection at Cut Meutia General Hospital, North Aceh Regency [13]. Surgical wounds in younger patients tend to heal more rapidly than in older patients because the skin of young adults provides better protection against mechanical trauma and infection. In addition, immune, cardiovascular, and respiratory system functions are generally more optimal at a younger age, thereby supporting the wound-healing process [14].

In addition to age, behavioral factors particularly personal hygiene also play a crucial role in supporting optimal wound healing. The chi-square analysis for the personal hygiene variable yielded a p-value of ρ=0.015 (<0.05), demonstrating a significant relationship between personal hygiene and cesarean section wound healing. Most respondents did not adequately maintain personal hygiene due to fear and pain when moving to the bathroom after surgery. This finding is in line with the study conducted by Nurhasanah, Wulandari, and Widyaningsih (2019), which reported that inadequate personal hygiene increases the risk of wound contamination, as microorganisms can easily enter surgical wounds when cleanliness is poorly maintained [15].

Beyond behavioral aspects, physiological conditions such as anemia also contribute significantly to the wound-healing process. The results of the chi-square test for anemia status showed a p-value of ρ=0.023 (<0.05), indicating a significant association between anemia and cesarean section wound healing. This result supports the findings of Sihotang and Yulianti (2018), who reported a significant relationship between anemia and delayed wound healing among post–cesarean section mothers at Arifin Achmad Regional General Hospital [9]. Anemia reduces oxygen delivery to tissues, impairs immune function, and increases susceptibility to infection, all of which can hinder the wound-healing process following surgery.

However, not all individual characteristics were found to be significantly associated with wound healing. The chi square test for body mass index (BMI) showed a p-value of

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ρ=0.579 (>0.05), indicating no significant relationship between BMI and cesarean section wound healing. This finding suggests that although most respondents were classified as overweight or obese, adequate management of other supportive factors such as nutritional intake, early mobilization, proper personal hygiene, and wound care in accordance with standard operating procedures may have mitigated the potential negative impact of high BMI on wound healing outcomes.

Nutritional adequacy was also found to be a significant factor influencing cesarean section wound healing. Based on the chi-square test, the nutrition variable showed a p-value of ρ=0.025 (<0.05), indicating a statistically significant relationship between nutritional adequacy and wound healing outcomes. Respondents who experienced poor wound healing were generally those with insufficient protein intake and those who continued to adhere to food restriction traditions during the postpartum period. This finding is consistent with the study by Saragih (2023), which reported that mothers with adequate nutritional intake were 14 times more likely to experience faster wound healing, as proper nutrition supports tissue repair and cellular regeneration [16]. Postpartum mothers are therefore encouraged to consume vegetables, fruits, and protein-rich foods, as protein plays a crucial role in the formation of new tissue and accelerates the healing of cesarean section wounds [17].

In contrast, knowledge regarding wound care was not significantly associated with wound healing outcomes. The chi-square analysis for the knowledge variable yielded a p-value of ρ=0.634 (>0.05), indicating no statistically significant relationship between knowledge of wound care and cesarean section wound healing. Knowledge is generally acquired through information provided by others, and during post cesarean section care at Bendan Regional General Hospital, all respondents received education related to wound care, postpartum nutrition, personal hygiene, newborn care, and other relevant topics. However, adequate knowledge does not necessarily translate into appropriate attitudes or behaviors. This finding aligns with the study by Sulistyawati et al. (2022), which reported that some postpartum mothers in the Pekalongan area continued to practice food restrictions due to fear of parental disapproval, despite having sufficient knowledge about postpartum nutrition. These findings indicate that good knowledge is not always followed by positive health behaviors, highlighting the importance of family support in enabling mothers to adopt healthy practices and avoid harmful dietary restrictions [18].

Multivariate Analysis

Table 3. Multivariate Analysis

Variable	B	S.E	Sig	Exp (B)	95% C.I for EXP (B)	
					Lower	Upper
Age	-0.697	0,817	0,393	0,498	0,100	2,470
Personal hygiene	-1.175	0,698	0,092	0,309	0,079	1,213
Anemia Status	1.491	0,874	0,088	4,442	0,801	24,622
Nutritional intake	1,351	0,664	0,042	3,862	1,051	14,189

To identify the most influential factors affecting cesarean section wound healing, multivariate analysis using logistic regression was conducted. The results demonstrated that nutritional adequacy was the only variable that remained statistically significant, with a p-value of ρ=0.042 (<0.05) and an odds ratio (OR) of 3.862. This finding indicates that mothers with adequate nutritional intake were 3.862 times more likely to experience good wound healing compared to those with inadequate nutrition.

During post–cesarean section care at Bendan Regional General Hospital, respondents received high-calorie and

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high-protein diets. Some respondents, particularly those with abnormal body mass index, were also provided with additional protein sources such as nine egg whites per day and snakehead fish. Prior to discharge, respondents were educated on nutritional strategies to support wound healing, including the consumption of nine egg whites daily and snakehead fish during the first two weeks postpartum. However, in practice, many respondents did not adhere to these recommendations after returning home. Some continued to practice food restrictions due to prevailing cultural beliefs, while others reported limited consumption of animal protein because of economic constraints.

These findings are consistent with previous studies that identified inadequate nutritional intake primarily due to food restriction practices as the dominant factor affecting wound healing, with an Exp (B) value of 15.434. In Indonesia, cultural beliefs surrounding postpartum food taboos remain prevalent and are often difficult to change, even when they lack a scientific basis. Foods commonly avoided include protein-rich sources such as eggs, fish, and meat, which are essential for wound healing [19].

Furthermore, the study by Masluroh and Puspitasari (2022) reported a significant influence of sociocultural factors on nutritional adequacy during the postpartum period, with an odds ratio (OR) of 8.077. Food restriction practices persist strongly in the community because they are passed down through generations. Therefore, postpartum mothers are encouraged to critically evaluate cultural practices and distinguish between those that are beneficial and those that may be harmful to their health. In addition, healthcare providers are expected to deliver culturally sensitive education that addresses food taboos by incorporating strong medical explanations to improve acceptance and behavioral change among postpartum mothers [20].

4. Conclusion

Based on the results of this study involving 70 respondents, it can be concluded that the most influential factor affecting cesarean section wound healing at Bendan Regional General Hospital, Pekalongan City, was nutritional adequacy (ρ=0.042; OR=3.862).

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