

Risk Factors for Stress Urinary Incontinence in Postpartum Women: A Cross-Sectional Study in Ubud Village

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Abstract

Introduction: The postpartum period is a critical recovery phase for women, during which the reproductive system undergoes substantial physiological changes, including alterations in the pelvic floor muscles. These changes can predispose women to stress urinary incontinence (SUI), a prevalent yet underrecognized condition that negatively affects quality of life. Previous studies have reported a prevalence of 8.8% in Indonesia, with multiple risk factors contributing to its occurrence. This study aimed to identify risk factors associated with SUI in postpartum women in Ubud Village.

Methods: A cross-sectional analytical study was conducted among 93 postpartum women within one year after delivery who were registered in Ubud Village. Data collection employed the Questionnaire for Urinary Incontinence Diagnosis (QUID), which demonstrates high reliability (Cronbach's $\alpha=0.97$) and sensitivity for diagnosing SUI. Additional structured questions assessed relevant risk factors. Statistical analysis included chi-square tests and multivariate logistic regression.

Results: Chi-square analysis revealed significant associations between several risk factors and SUI. Multivariate analysis demonstrated that engaging in exercise for ≥ 12 weeks before delivery (OR=8.5, 95% CI=2.3–31.7), delivery before 40 weeks' gestation (OR=6.8, 95% CI=1.8–26.7), and high pre-pregnancy body mass index (OR=2.3, 95% CI=1.0–5.0) were independent predictors of SUI. Cesarean delivery showed a protective effect (OR=0.21, 95% CI=0.1–0.8).

Conclusion: All examined risk factors demonstrated significant associations with SUI, with pre-delivery exercise of ≥ 12 weeks emerging as the most influential predictor. These findings highlight the need for preventive strategies and targeted physiotherapy interventions to mitigate SUI risk in postpartum women.

Keywords: postpartum period, risk factors, stress urinary incontinence, pelvic floor disorders, cross-sectional studies

Introduction

The postpartum period, also known as the puerperium, is a time for a woman's body to recover and restore the reproductive organs to their pre-pregnancy state following childbirth.¹ This period is characterized by physiological changes affecting the pelvic floor muscles, which serve as the primary support for organs within the pelvic cavity, including the bladder, uterus, and rectum. Additionally, the pelvic floor muscles play a crucial role in controlling the urethral and anal sphincter functions.² Changes occurring during pregnancy and postpartum can lead to muscle weakening or injury, which may result in urinary issues such as pelvic organ prolapse, dysuria, sexual dysfunction, and urinary incontinence.³

Urinary incontinence is the involuntary leakage of urine through the external urethral opening. One common type of incontinence among postpartum women is Stress Urinary Incontinence (SUI), defined as the unintentional leakage of urine due to increased intra-abdominal pressure caused by activities such as coughing, sneezing, or laughing.⁴ The prevailing theory explaining postpartum SUI attributes it to damage to the connective tissue supporting the bladder and urethra, along with weakening of the pelvic floor muscles, bladder neck, and urethral sphincter. This results in reduced urethral closure pressure, ultimately leading to urine leakage.⁵

The prevalence of SUI in Indonesia remains uncertain. A 2014 study conducted in Riau involving 400 primiparous women three months postpartum reported an SUI incidence of 8.8%.⁶ Globally, the prevalence of SUI in postpartum women has been reported to reach 26%.⁷ No specific prevalence data is available in Southeast Asia, a region with geographical similarities to Indonesia. However, in 1998, the Asia Pacific Continence Advisor Board (APCAB) estimated that the incidence of urinary incontinence among Asian women was 14.6%, though they did not specify which type was most prevalent.⁸ This limited data highlights the lack of research on postpartum SUI. Additionally, the condition is often overlooked due to societal perceptions that consider SUI an everyday postpartum occurrence or because women feel embarrassed to seek medical attention.⁹

Furthermore, within the first year postpartum, the prevalence of SUI has been observed to increase from 18% during pregnancy to 21%.¹⁰ Therefore, the prevention and treatment of SUI are crucial in improving postpartum women's quality of life and reducing the risk of further complications. Failure to identify risk factors early in pregnancy and to implement timely interventions can lead to severe complications, negatively impacting maternal well-being and increasing healthcare costs, which ultimately burden not only the mother but also the family and society. Additionally, SUI in women can affect sexual relationships, contributing to decreased quality of life, depression, and feelings of humiliation.¹¹

One significant risk factor for SUI is the lack of pre-delivery exercise. Pelvic floor muscle exercises, in particular, play a vital role in preventing postpartum SUI. A 2021 study found that engaging in pelvic floor muscle training for at least 12 weeks significantly reduced the risk of SUI. These exercises help strengthen the pelvic floor muscles, particularly the pubococcygeus muscle, essential for urinary control and maintaining continence.¹²

The limited number of studies investigating SUI risk factors in postpartum women in Indonesia, particularly in Bali, is the primary reason for conducting this research in Ubud Village. Community health volunteers (cadres) in each *banjar* (local neighborhood) of Ubud Village facilitate the routine collection of postpartum health data, making subject recruitment and data collection more efficient. Additionally, according to the Central Bureau of Statistics (BPS), in 2020, Ubud Village ranked third in terms of the highest female population in Gianyar Regency, making it a representative location for estimating SUI prevalence in the area.¹³

We hypothesize that vaginal delivery, gestational age ≥ 40 weeks, high pre-pregnancy BMI, and lack of or insufficient (<12 weeks) pre-delivery exercise are significant risk factors associated with SUI in postpartum women. Additionally, we hypothesize that women who did not exercise or exercised for less than 12 weeks before delivery are the most strongly affected group, making this the most influential factor in the occurrence of SUI among postpartum women.

Methods

This study employed an analytical observational design with a cross-sectional approach, conducted in April 2024 in Ubud Village. This design was chosen to identify the relationship between predetermined risk factors and the occurrence of stress urinary incontinence (SUI) in postpartum women. The study subjects included postpartum women within one year after childbirth, from March 2023 to March 2024, registered through Ubud I Community Health Center (*Puskesmas Ubud I*) and reported by *posyandu* (integrated health post) cadres from each *banjar* (local neighborhood) in Ubud Village. Data collection was carried out throughout April 2024 using routine child *posyandu* sessions scheduled by the health center, a door-to-door approach on the same day for subjects unable to attend *posyandu*, and an online method for those unavailable during door-to-door visits. This multi-method approach ensured comprehensive subject coverage and enhanced data representativeness.

A total of 93 subjects were selected based on inclusion criteria, encompassing all women within a maximum of one year postpartum, registered through *posyandu* cadres in each *Banjar*. Subjects who agreed to participate had to sign an informed consent form, either directly during *posyandu* activities or door-to-door visits or by providing consent through a designated section in the online form. This study also implemented exclusion criteria, which included women with abnormalities or diseases related to the urinary tract, pelvic disorders, or pregnancy complications such as diabetes mellitus and hypertension, as these conditions could directly influence study outcomes and act as confounding variables.¹⁴ Additionally, subjects with incomplete secondary data, subjects who withdrew from the study or were difficult to contact during data collection via *posyandu*, door-to-door visits, or online methods were excluded. Dropout criteria applied to subjects who refused to participate during data collection, those who did not follow research instructions properly, or who voluntarily withdrew from the study.

Stress urinary incontinence (SUI), classified as the dependent variable in this study, was measured using the Questionnaire for Urinary Incontinence Diagnosis (QUID), validated in Indonesian.¹⁵ The questionnaire was translated and validated by an urogynecology consultant at Cipto Mangunkusumo Hospital (RSCM) Jakarta, using a sample of 30 randomly selected participants. Validity testing showed high reliability, with a Cronbach's alpha of 0.97 for SUI and 0.96 for urgency urinary incontinence (UUI). The questionnaire consists of six items, but subjects were only required to answer questions 1–3 to determine an SUI diagnosis, while questions 4–6 pertained to UUI diagnosis. Each question was scored from 0 to 5, with zero indicating "never," 1 "rarely," 2 "occasionally," 3 "often," 4 "almost always," and 5 "always".⁶

Independent variable data on risk factors were collected through structured interviews using pre-designed questionnaires. Competent healthcare professionals assisted in data collection and were trained in standardized interview guidelines to minimize reporting bias. This study received approval from the Gianyar Regency Investment and One-Stop Integrated Services Agency (Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kabupaten Gianyar) under permit number 070/1499/IP/DPM PTSP/2024. Ethical clearance was also obtained from the Research Ethics Committee of the Faculty of Medicine, Udayana University/Sanglah General Hospital, under approval number 0540/UN14.2.2.VII.14/LT/2024.

Collected data were processed and analyzed. Before analysis, all quantitative variables were categorized to facilitate interpretation. SUI diagnosis was confirmed if the QUID score was ≥ 4 . Pre-pregnancy BMI was classified based on Ministry of Health standards (low, regular, and high BMI). According to obstetric standards, gestational age was categorized as <40 weeks and ≥ 40 weeks. The delivery method was divided into cesarean section and vaginal delivery, while pre-delivery exercise was classified as "performed for at least 12 weeks" and "not performed or performed for <12 weeks."

Univariate analysis was conducted to describe characteristics and identify each study variable. Bivariate analysis using the chi-square test was performed to determine the relationship between each risk factor and SUI

incidence. If a significant association was found, multivariate logistic regression analysis was conducted to identify the most dominant risk factor influencing SUI occurrence. Logistic regression analysis was performed if bivariate analysis results met the significance threshold (p -value <0.25).¹⁵

For handling missing data, subjects with more than 20% missing values in key variables were excluded from the analysis. In cases of minor missing data, mean imputation was applied, replacing missing values with the average value of available data for the respective variable.

Results

Subject Characteristics

A total of 93 postpartum mothers within a one-year range were included in the following study. The following figure and table present the research flow and the characteristics of the study sample. Figure 1 illustrates the systematic flow of the study procedures, while Table 1 summarizes the demographic and clinical characteristics of the participants.

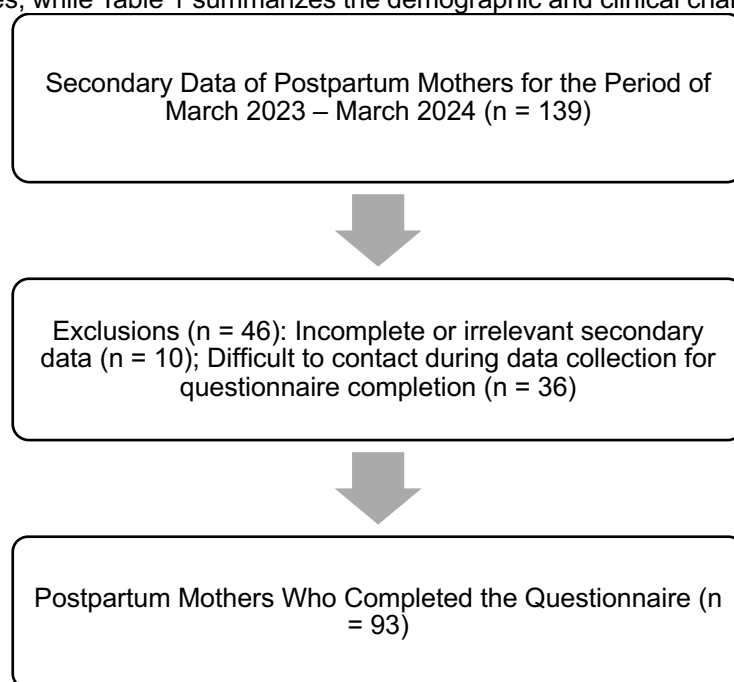


Figure 1. Flowchart

Table 1. Sample Characteristics

Variable	Frequency (n)	Percentage (%)
Diagnosis		
Stress Urinary Incontinence (SUI)	31	33.3
Normal	62	66.7
Delivery Method		
Vaginal (Spontaneous)	25	26.9
Cesarean	68	73.1
Gestational Age		
< 40 weeks	69	74.2
≥ 40 weeks	24	25.8
Pre-Pregnancy Body Mass Index (BMI)		
Low BMI	15	16.1
Normal BMI	38	40.9
High BMI	40	43.0
Exercise Before Delivery		
Yes, for ≥ 12 weeks before delivery	41	44.1
No or < 12 weeks before delivery	52	55.9
Total	93	100

As shown in Table 1, the prevalence of Stress Urinary Incontinence (SUI) among postpartum mothers in Ubud village was 31 subjects (33.3%), while 62 subjects (66.7%) were classified as usual. The most common delivery method was cesarean section (73.1%), compared to vaginal delivery (26.9%). Regarding gestational age, 69 subjects (74.2%) delivered before 40 weeks, while 24 subjects (25.8%) delivered at or beyond 40 weeks. Regarding pre-pregnancy BMI, 15 subjects (16.1%) had a low BMI, 38 subjects (40.9%) had a normal BMI, and 40 subjects (43.0%) had a high BMI. Additionally, based on interviews, 41 subjects (44.1%) performed pelvic floor muscle exercises for at least 12 weeks before delivery, while 52 subjects (55.9%) either did not exercise or exercised for less than 12 weeks before delivery.

The following tables present the statistical associations between stress urinary incontinence (SUI) and several maternal factors. Table 2 shows the relationship between SUI and the method of delivery, Table 3 presents the

association between SUI and gestational age, and Table 4 outlines the association between SUI and pre-pregnancy body mass index (BMI).

Table 2. Association Between Stress Urinary Incontinence (SUI) and Delivery Method

Diagnosis	Delivery Method	Total	p-value
	Vaginal	Cesarean	
SUI	14 (56%)	17 (25%)	31 (33%)
Normal	11 (44%)	51 (75%)	62 (67%)
Total	25 (100%)	68 (100%)	93 (100%)

Table 2 shows that SUI was more common in subjects who had a vaginal delivery (56%) compared to those who had a cesarean section (25%). Vaginal delivery in this study includes both spontaneous vaginal delivery and assisted vaginal delivery (forceps or vacuum). The statistical test result showed a p-value of 0.005 ($p < 0.05$), indicating a significant association between SUI and delivery method.

Table 3. Association Between Stress Urinary Incontinence (SUI) and Gestational Age

Diagnosis	Gestational Age	Total	p-value
	< 40 weeks	≥ 40 weeks	
SUI	17 (25%)	14 (58%)	31 (33%)
Normal	52 (75%)	10 (42%)	62 (67%)
Total	69 (100%)	24 (100%)	93 (100%)

Table 3 shows that 58% of subjects who delivered at ≥ 40 weeks experienced SUI, compared to 25% of those who delivered before 40 weeks. The statistical test result showed a p-value of 0.003 ($p < 0.05$), indicating a significant association between SUI and gestational age.

Table 4. Association Between Stress Urinary Incontinence (SUI) and Pre-Pregnancy Body Mass Index (BMI)

Diagnosis	Pre-Pregnancy BMI	Total	p-value
	Low	Normal	High
SUI	7 (47%)	3 (8%)	21 (52%)
Normal	8 (53%)	35 (92%)	19 (48%)
Total	15 (100%)	38 (100%)	40 (100%)

Table 4 indicates that the majority of subjects with SUI had a high pre-pregnancy BMI ($> 22.9 \text{ kg/m}^2$) (52%), followed by those with a low BMI (47%), and those with a normal BMI (8%). The statistical test result showed a p-value of < 0.001 ($p < 0.05$), indicating a significant association between SUI and pre-pregnancy BMI.

Table 5. Association Between Stress Urinary Incontinence (SUI) and Exercise Before Delivery

Diagnosis	Pelvic Floor Muscle Exercise	Total	p-value
	≥ 12 weeks	< 12 weeks or none	
SUI	8 (20%)	23 (44%)	31 (33%)
Normal	33 (80%)	29 (56%)	62 (67%)
Total	41 (100%)	52 (100%)	93 (100%)

Table 5 shows that SUI was more common among those who did not perform pelvic floor exercises or exercised for less than 12 weeks before delivery (44%) compared to those who exercised for ≥ 12 weeks (20%). The statistical test result showed a p-value of 0.012 ($p < 0.05$), indicating a significant association between SUI and pelvic floor muscle exercises.

Table 6. Logistic Regression Results

Variable	Coefficient	S.E.	Wald	df	p-value	Exp.(B)	95% Confidence Interval
						Lower	Upper
Delivery Method	1.552	0.657	5.582	1	0.018	0.212	0.058
Gestational Age	1.923	0.695	7.651	1	0.006	6.838	1.751
Pre-Pregnancy BMI	0.852	0.395	4.658	1	0.031	2.344	1.081
Exercise Before Delivery	2.136	0.674	10.029	1	0.002	8.462	2.257

Table 6 presents the logistic regression results, showing that the most influential risk factor for SUI was lack of pelvic floor exercise before delivery ($OR=8.462$), followed by gestational age ≥ 40 weeks ($OR=6.838$), high pre-pregnancy BMI ($OR=2.344$), and vaginal delivery ($OR=0.212$).

Discussion

Based on this study, the incidence rate of Stress Urinary Incontinence (SUI) over one year from March 2023 to March 2024 among postpartum mothers in Kelurahan Ubud was 31 subjects (33.3%) out of 93 participants. Furthermore, the risk factors examined—delivery method, gestational age, pre-delivery BMI, and pelvic floor muscle exercises—showed a significant association with SUI according to the chi-square test. Logistic regression analysis identified engaging in pelvic floor muscle exercises for ≥ 12 weeks before delivery as the most influential risk factor in the

postpartum population of Kelurahan Ubud. The incidence rate of SUI in Kelurahan Ubud is higher compared to a previous study conducted in 2014 in Riau, which reported only 35 cases (8.8%) out of 400 subjects.

This discrepancy may be attributed to differences in study duration, as the previous research only measured SUI incidence over three months, while this study assessed cases over one year. Additionally, the 2014 study focused exclusively on a primiparous population, whereas this research included multiparous mothers who may have a higher likelihood of experiencing SUI. Another contributing factor is the measurement method: the 2014 study employed a cough test, which provides a more definitive diagnosis than a self-reported questionnaire.⁶

This study is limited to postpartum mothers within one year, as SUI diagnosis is more easily identifiable during this timeframe, yielding more accurate data. Additionally, this research utilized the Questionnaire Urinary Incontinence Diagnosis (QUID), which relies heavily on subject honesty and memory, potentially influencing the study's outcomes. Another limitation is the study's focus solely on postpartum mothers in Kelurahan Ubud, which was done for practical data collection purposes, facilitated by collaboration with the local health center (puskesmas) and the active cadre system in each banjar, which helped identify and recruit study participants.

Delivery Method

The findings indicate that the most common delivery method among subjects in Kelurahan Ubud was Cesarean section (C-section), accounting for 68 subjects. However, when examining its relationship with Stress Urinary Incontinence (SUI), a higher incidence was observed among those who underwent vaginal delivery, with 14 out of 25 subjects (56%) experiencing SUI. Bivariate analysis revealed a significant association between vaginal delivery and SUI, with a p-value of 0.005 ($p < 0.050$). Furthermore, multivariate analysis indicated that vaginal delivery posed a 0.2 times greater risk of developing SUI compared to other delivery methods, such as C-section, as evidenced by an odds ratio (OR) of 0.212.

A recent study by Liu et al. (2024) supports these findings, reporting that vaginal delivery—significantly when assisted by forceps or vacuum extraction—triples the risk of SUI compared to C-sections. This is attributed to the potential damage to the pelvic floor muscles during vaginal delivery. During childbirth, fetal head pressure on the pelvic floor can cause excessive stretching and elongation of pelvic tissues. If the pressure exceeds the elastic threshold of the tissue, permanent damage to the connective tissue and pelvic floor muscles may occur.¹⁶

This aligns with a 2016 study, which also found that vaginal delivery contributes to SUI, with assisted vaginal delivery (forceps or vacuum) further increasing the risk. The use of assistive devices is often associated with prolonged and difficult labor, which exerts additional force on the pelvic muscles and tissues, leading to tears and trauma in the surrounding structures. The study also highlighted that vaginal delivery increases the risk of trauma to other soft tissues in the pelvic floor due to excessive stretching and potential damage.⁶

Gestational Age

Gestational age in this study was classified into < 40 weeks and ≥ 40 weeks. Among postpartum mothers, 58% of those with a gestational age of ≥ 40 weeks experienced SUI, compared to 25% in those with a gestational age of < 40 weeks. Bivariate analysis revealed a p-value of 0.003 ($p < 0.05$), indicating a significant association between gestational age and SUI. Additionally, multivariate analysis yielded an odds ratio (OR) of 6.838, suggesting that a gestational age of ≥ 40 weeks increases the likelihood of SUI by 6.8 times.

A 2023 study by Chang et al. corroborates these findings, stating that the longer the gestational period, the greater the pressure exerted by the uterus on the pelvic floor, thereby increasing the risk of SUI. The study also noted that a gestational age of > 40 weeks is associated with larger fetal size, including increased birth weight and head circumference, which heightens the risk of severe stretching and trauma to the pelvic floor muscles and tissues during delivery. Furthermore, prolonged gestational age may lead to extended labor duration, which in turn weakens the pelvic floor muscles and elevates the risk of SUI.¹⁷

Similarly, a 2016 study by Lgia da Silva Leroy et al. found that gestational age ≥ 40 weeks is linked to a higher incidence of SUI. This aligns with the theory that prolonged gestation beyond the standard 36 weeks increases bladder pressure, which in turn compromises urinary retention and ultimately leads to SUI.¹⁸

Pre-Pregnancy Body Mass Index (BMI)

The study findings indicate that postpartum mothers with a pre-pregnancy BMI > 22.9 kg/m² (classified as high BMI) had the highest incidence of Stress Urinary Incontinence (SUI) at 52%, compared to 47% in the low BMI category and only 8% in the normal BMI category. Bivariate analysis showed a significant association between pre-pregnancy BMI and SUI, with a p-value of < 0.001 ($p < 0.05$). Furthermore, the multivariate analysis yielded an odds ratio (OR) of 2.344, indicating that a pre-pregnancy BMI > 22.9 kg/m² increases the likelihood of developing SUI by 2.3 times.

This finding aligns with Suparwati's theory, which states that a higher BMI before childbirth correlates with increased intra-abdominal pressure, consequently affecting pelvic floor pressure. Elevated pelvic floor pressure can impair urethral and bladder function, leading to reduced urinary control and a higher risk of SUI. Additionally, high BMI is often associated with obesity, which results in excess fat accumulation, including in the pelvic region. This excess fat weakens the functional integrity and strength of pelvic floor muscles. The risk is further exacerbated by a lack of physical activity, which aggravates muscle weakness, making individuals more susceptible to SUI.¹⁹

This finding is consistent with a 2021 study by Jiejun Gao et al., which investigated risk factors for SUI in primiparous women. Using multivariate regression analysis, the study confirmed that pre-pregnancy BMI was a significant risk factor for SUI. It also noted that lifestyle changes leading to increased processed and fast food

consumption contribute to higher BMI levels.⁴ According to Indonesia's Ministry of Health, a BMI exceeding 27 kg/m² is categorized as severe obesity, which is strongly linked to a higher incidence of SUI.²⁰

Exercise Before Childbirth

Postpartum mothers in Ubud Village who experienced Stress Urinary Incontinence (SUI) were assessed based on their type of pelvic floor muscle training. It was found that the majority of subjects, 44%, either did not engage in exercise or practiced for less than 12 weeks before childbirth. Bivariate analysis results indicated a significant relationship between prenatal exercise and the occurrence of SUI, with a p-value of 0.012 ($p < 0.05$). Multivariate analysis revealed that not engaging in pelvic floor muscle training or exercising for less than 12 weeks increased the risk by 8.5 times compared to those who exercised for 12 weeks or more, as indicated by an odds ratio (OR) of 8.462. Interview data revealed that 12 subjects (12.9%) engaged in pelvic floor muscle strengthening exercises, 19 subjects (20.4%) practiced yoga directed toward pelvic floor muscle strengthening, and 14 subjects (15.1%) participated in jogging or walking exercises classified as aerobic. In comparison, 48 subjects (51.6%) did not exercise during pregnancy. In a recent study by Toloza et al., prenatal exercise, particularly pelvic floor muscle training, was recommended to be initiated at 20 weeks of gestation. This recommendation is supported by findings that exercising over a period of 22 weeks with a frequency of three sessions per week significantly enhances pelvic floor muscle strength and helps prevent the occurrence of postpartum Stress Urinary Incontinence (SUI).²¹

In another study conducted by Johannessen et al. in 2021, it was explained that the intervention group receiving Pelvic Floor Muscle Training (PFMT) for 12 weeks effectively prevented urinary incontinence after childbirth. The intervention included regular exercises accompanied by pelvic floor muscle-strengthening activities.²² Providing exercise during the antenatal period is considered beneficial for the postpartum phase, as it facilitates vaginal recovery and perineal healing and strengthens the tone of the pelvic floor muscles through increased circulation and isometric muscle activity.²³

Another study conducted by Wang et al. also noted that providing Pelvic Floor Muscle Training (PFMT) for at least three months had a significant impact on women with Stress Urinary Incontinence (SUI). Pelvic floor muscle training was deemed effective because it strengthened the associated muscles, particularly the pubococcygeus, which plays a role in urinary function. Additionally, the pelvic floor muscles help limit downward movement during activities, so when these muscles are trained, it enhances the ability of the urethra and urinary bladder to maintain their position under abdominal pressure.¹²

Pelvic floor muscle training can be conducted not only with the assistance of professionals but also through mobile applications or videos. Research by Asklund et al. demonstrated a significant relationship, suggesting that these methods can be a cost-effective alternative for preventing Stress Urinary Incontinence (SUI).²⁴ Additionally, a study by Brennen evaluated three groups: individual Pelvic Floor Muscle Training (PFMT) during pregnancy (Group 1), group-based PFMT during pregnancy (Group 2), and individual postnatal PFMT (Group 3). Among these groups, the most cost-efficient option was the group-based PFMT during pregnancy (Group 2), which cost \$754 compared to \$768 for Group 1 and \$1,970 for Group 3.²⁵

In addition to pelvic floor muscle strengthening exercises, low-intensity aerobic activities such as jogging or walking can be performed before childbirth. In a 2018 study by Jean et al. that compared CrossFit (high-intensity strength training) with aerobic exercise, it was found that a majority of women participating in CrossFit, particularly during movements such as double-unders, jumping rope, and box jumps, experienced urinary leakage during exercise. In contrast, no cases of urinary leakage were reported in the aerobic exercise group.²⁶

This was attributed to high-intensity training, which, as measured by ultrasonography, showed increased intra-abdominal pressure. When intra-abdominal pressure rises, additional support from the pelvic floor muscles is needed, as indicated by the increased diameter of the levator ani muscle. Consequently, CrossFit or high-intensity training is not recommended during pregnancy due to its potential impact on the pelvic floor muscles.²⁶

This study has limitations related to participants' openness in filling out the provided questionnaires, specifically among postpartum mothers in Ubud Village. Given that the questions and topics addressed pertain to reproductive health issues, which are often considered taboo in society, participants may be hesitant to disclose their experiences with Stress Urinary Incontinence (SUI). This reluctance may impact the results obtained from the questionnaires. Therefore, practical approaches and communication are necessary during the study.

Additionally, since the methodology used in this research is cross-sectional, it cannot determine causal relationships between risk factors and SUI, as the data were collected at a single point in time. Alternative methods would be required to establish cause-and-effect relationships involving the risk factors. Furthermore, the findings of this study are limited to representing data from only one area, specifically Ubud Village.

Conclusion

This study investigated the risk factors influencing Stress Urinary Incontinence (SUI) among postpartum mothers within one year in Ubud Village, focusing on four key factors: delivery method, gestational age, body mass index (BMI) before childbirth, and prenatal exercise. The findings indicate a significant relationship between these factors and the occurrence of SUI. Notably, the multivariate analysis identified that not engaging in pelvic floor muscle training or doing so for less than 12 weeks significantly increases the risk of SUI by 8.5 times compared to participating in exercises for 12 weeks or more before childbirth. Therefore, incorporating a minimum of 12 weeks of pelvic floor and aerobic exercises into antenatal care programs is crucial for reducing the risk of SUI postpartum. Furthermore, attention should also be given to other factors, including the delivery method, appropriate gestational age, and maintaining a normal BMI before childbirth, to enhance overall maternal health and well-being.

Author Contribution

Pande Kadek Agus Artiana: Conceptualization, methodology, data collection, data analysis, and manuscript drafting.
Ni Luh Nopi Andayani: Supervision, guidance on research design, and critical review of the manuscript.
Ni Luh Putu Gita Karunia Saraswati: Supervision, validation, and manuscript editing.
Made Hendra Satria Nugraha: Supervision, methodological consultation, and final manuscript

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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Ethics Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana (Approval No. 0540/UN14.2.2.VII.14/LT/2024). All participants provided informed consent prior to data collection.

References

1. Chauhan G, Tadi P. Physiology, Postpartum Changes [Internet]. StatPearls; 2022 [cited 2023 Dec 28]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK555904/>
2. Tran LN, Puckett Y. Urinary Incontinence [Internet]. StatPearls; 2022 [cited 2023 Dec 28]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK559095/>
3. Murbidah. Pengaruh latihan otot dasar panggul terhadap pencegahan incontinensia urine pada ibu post partum di Rumah Sakit Muhammadiyah Palembang. 2017;5(2).
4. Gao J, Liu X, Zuo Y, Li X. Risk factors of postpartum stress urinary incontinence in primiparas: what should we care. *Medicine (United States)*. 2021 May 21;100(20):E25796.
5. Liu W, Qian L. Risk factors for postpartum stress urinary incontinence: a prospective study. *BMC Urol*. 2024 Dec 1;24(1).
6. Fakhri E, Priyatini T, Santoso BI, Junizaf, Moegni F, Djudad S, et al. Prevalence and risk factors of persistent stress urinary incontinence at three months postpartum in Indonesian women. *Med J Indones*. 2016;25(3):163–70.
7. Yang X, Sayer L, Bassett S, Woodward S. The prevalence, associated factors, and impact of urinary incontinence in pregnant and postpartum women in Nanjing, China: a cross-sectional study. *Asian J Urol*. 2023 Jul 1;10(3):337–43.
8. Suparwati KTA, Suadnyana IAA, Jaya IPP, Ananda MAMD. Hubungan indeks massa tubuh terhadap inkontinensia urin tipe stres pada wanita usia 45-60 tahun di RSUD Bangli. *PREPOTIF (Jurnal Kesehatan Masyarakat)*. 2021 Oct;5(2):975–9.
9. Fakhri E, Rustam RP, Maryuni SW. The prevalence of stress urinary incontinence in coastal community from Riau Province. In: *Galaxy Science*; 2022.
10. Jansson MH, Franzén K, Tegerstedt G, Hiyoshi A, Nilsson K. Stress and urgency urinary incontinence one year after a first birth—prevalence and risk factors. A prospective cohort study. *Acta Obstet Gynecol Scand*. 2021 Dec 1;100(12):2193–201.
11. Wardani RS, Judistiani RTD, Siddiq A. Prevalence of urinary incontinence in women aged 20–59 years in community dwellings. *Althea Med J*. 2017 Jun;4(2):178–83.
12. Wang X, Sun Z, Xu T, Fan G. Efficacy of supervised pelvic floor muscle training with a home-based biofeedback device for urinary incontinence in postpartum women: protocol for a multicentre randomised controlled trial. *BMJ Open*. 2023 Apr 25;13(4).
13. Badan Pusat Statistik. Penduduk Kabupaten Gianyar berdasarkan jenis kelamin [Internet]. 2020. Available from: <https://gianyarkab.bps.go.id/indicator/12/45/1/penduduk-menurut-jenis-kelamin.html>
14. Ikatan Ahli Urologi Indonesia. Panduan tata laksana inkontinensia urine pada dewasa edisi kedua. 2018.
15. Fauziyah N. Analisis data menggunakan multiple logistic regression test di bidang kesehatan masyarakat dan klinis. In: Pramartanto Eko Mulyo G, editor. Bandung: Politeknik Kesehatan Kemenkes Bandung; 2019.
16. Liu W, Qian L. Risk factors for postpartum stress urinary incontinence: a prospective study. *BMC Urol*. 2024 Dec 1;24(1).
17. Chang SD, Hsieh WC, Chiu SYH, Ng KL, Liang CC. Factors determining the persistence of prenatal stress urinary incontinence 12 months postpartum. *Taiwan J Obstet Gynecol*. 2023 Jan 1;62(1):40–4.
18. Leroy L da S, Lúcio A, Lopes MHB de M. Risk factors for postpartum urinary incontinence. *Rev Esc Enferm*. 2016 Mar 1;50(2):200–7.
19. Suparwati KTA, Suadnyana IAA, Jaya IPP, Ananda MAMD. Hubungan indeks massa tubuh terhadap inkontinensia urin tipe stres pada wanita usia 45-60 tahun di RSUD Bangli. 2021;5(2).

20. Kementerian Kesehatan Republik Indonesia. Klasifikasi obesitas setelah pengukuran IMT [Internet]. 2018 [cited 2023 Dec 28]. Available from: <https://p2ptm.kemkes.go.id/infographic-p2ptm/obesitas/klasifikasi-obesitas-setelah-pengukuran-imt>
21. Mantilla Toloza SC, Villareal Cogollo AF, Peña García KM. Pelvic floor training to prevent stress urinary incontinence: a systematic review. *Actas Urol Esp*. 2024 May 1;48(4):319–27.
22. Johannessen HH, Frøshaug BE, Lysåker PJG, Salvesen K, Lukasse M, Mørkved S, et al. Regular antenatal exercise including pelvic floor muscle training reduces urinary incontinence 3 months postpartum—Follow up of a randomized controlled trial. *Acta Obstet Gynecol Scand*. 2021 Feb 1;100(2):294–301.
23. Pinem HL, Setyowati, Gayatri D. Pencegahan inkontinensia urin pada ibu nifas dengan paket latihan mandiri. *J Keperawatan Indonesia*. 2013;15:47–52.
24. Asklund I, Nyström E, Sjöström M, Umeåfjord G, Stenlund H, Samuelsson E. Mobile app for treatment of stress urinary incontinence: a randomized controlled trial. *Neurourol Urodyn*. 2017 Jun 1;36(5):1369–76.
25. Brennen R, Frawley HC, Martin J, Haines TP. Group-based pelvic floor muscle training for all women during pregnancy is more cost-effective than postnatal training for women with urinary incontinence: cost-effectiveness analysis of a systematic review. *J Physiother*. 2021 Apr 1;67(2):105–14.
26. Yang J, Cheng JW, Wagner H, Lohman E, Yang SH, Krishinger GA, et al. The effect of high impact CrossFit exercises on stress urinary incontinence in physically active women. *Neurourol Urodyn*. 2019 Feb 1;38(2):749–56.