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DETERMINANT OF INFERTILITY: INTERNAL AND EXTERNAL FACTORS IN A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Infertility remains a major reproductive health problem globally, affecting 12–15% of Indonesian couples of reproductive ages. Both biological and lifestyle-related factors contribute to infertility, yet evidence on their relative influence in the Indonesian context is limited. **Objectives:** This study aimed to identify internal factors (tubal, uterine, ovulation, and sperm issues) and external factors (age, employment status, BMI, and smoking habits) influencing infertility. **Methods:** This analytical cross-sectional study was conducted at a government fertility clinic. A total of 343 infertile couples were included using a total sampling approach. Secondary data were extracted from medical records using a structured checklist encompassing socio-demographic, lifestyle, and clinical reproductive variables. The dependent variable was infertility type. Independent variables included age, occupation, BMI, smoking, and reproductive organ factors. Bivariate analysis was performed using Chi-square tests, and variables with $p < 0.25$ were entered into multiple logistic regression to determine the most influential predictors of infertility. **Results:** Wife's age ($p = 0.001$), husband's age ($p = 0.014$), ovulation disorders ($p < 0.001$), and sperm abnormalities ($p < 0.001$) were significantly associated with infertility. Multivariate analysis identified ovulation disorders (OR = 2.34; 95% CI: 1.35–4.03) and sperm abnormalities (OR = 2.52; 95% CI: 1.45–4.37) as the dominant predictors. **Conclusion:** Infertility among Indonesian couples is primarily influenced by ovulation and sperm abnormalities, underscoring the need for early reproductive health screening and lifestyle-based prevention strategies.

INTRODUCTION

Infertility, defined as the inability to conceive after 12 months of regular unprotected intercourse, affects a substantial portion of the global population. According to the World Health Organization (2022), approximately 17.5% of adults worldwide experience infertility, with prevalence rates particularly high in developing countries, especially in Southeast Asian nations, including Indonesia [1, 2, 3]. Recent data indicate that 12-15% of Indonesian couples of reproductive age face infertility issues, influenced by factors such as delayed childbearing, obesity, and increased smoking rates [4, 5].

Globally, infertility is influenced by a combination of internal factors, such as ovulatory dysfunction, tubal blockages, and sperm abnormalities, and external factors, including lifestyle choices, age, employment status, and BMI [4, 5]. A comprehensive meta-analysis indicates that male-related factors account for approximately 20-30% of infertility cases worldwide, with environmental exposures and lifestyle behaviors identified as significant contributing factors [5]. In addition, increasing infertility rates have been observed in regions such as Europe and North America, largely attributed to delayed parenthood and the prevalence of metabolic disorders, including obesity and diabetes [7, 8]. These conditions are strongly associated with ovulatory dysfunction, further complicating reproductive health outcomes [7, 8]. Socio-economic barriers and cultural stigma surrounding male infertility remain significant challenges, restricting access to reproductive healthcare [8].

Additionally, exposure to environmental pollutants, particularly endocrine-disrupting chemicals, has an increasing impact on sperm quality and hormonal balance [10]. In Indonesia, previous studies have explored both male and female infertility factors; however, existing research primarily describes the findings without identifying which factors have the strongest association with infertility. While female infertility has been more extensively studied, data on male infertility and the combined socio-demographic influences on reproductive outcomes remain limited [11] [12]. Given the socio-cultural implications of infertility in Indonesia, where couples often face stigma and psychological distress, this study offers crucial insights for reproductive health practices and public health policies [11]. By analyzing both male and female infertility factors alongside socio-demographic variables, this study provides a comprehensive understanding of infertility in Indonesia. It addresses existing gaps by examining internal and external determinants, offering deeper insights into key contributing factors. The findings support targeted interventions that address both biological and lifestyle influences, ultimately improving reproductive health outcomes.

METHOD

This study employed a quantitative, analytic research design with a cross-sectional approach to identify factors influencing infertility. The study was conducted at a fertility clinic in a government hospital in West Java Province, Indonesia, between January and June 2024. The study population consisted of all infertile patients who visited the clinic during this period. A total of 343 pairs respondents were included in the study using a non-probability total sampling technique. In addition, couples with documented congenital reproductive anomalies or conditions unrelated to infertility diagnosis that could bias clinical assessment were excluded from the analysis.

The unit of analysis was the couple, specifically husband and wife pairs who had sought fertility consultation at the clinic. Inclusion criteria required that both the husband's and wife's medical records were available and complete, allowing for comprehensive assessment of internal and external infertility factors for each partner. Couples with incomplete or missing data were excluded from the study to maintain data quality and consistency. Secondary data were extracted from the couple participants medical records using a structured checklist. The checklist captured demographic characteristics (age, employment status), lifestyle factors (BMI, smoking habits), and clinical factors (tubal blockages, uterine abnormalities, ovulation disorders, and sperm quality). The dependent variable in this study was the incidence of infertility, categorized into primary infertility (the inability to conceive at all) and secondary infertility (difficulty conceiving after a previous pregnancy). Independent variables were classified into external and internal factors. External factors included age, employment status, BMI, and smoking habits. Age was categorized as at-risk (≥ 35 years for women, ≥ 40 years for men) or not at-risk (≤ 34 years for women, ≤ 39 years for men).

men). Employment status was recorded as working or not working. BMI was grouped as normal (18.5–29) or at-risk (<18.5 or >29). Smoking status was defined as smoker (currently smoking) or non-smoker. Internal factors comprised tubal, uterine, ovulation, and sperm-related issues. Tubal factors assessed the presence or absence of blockages or damage in the fallopian tubes. Uterine factors evaluated abnormalities such as fibroids or polyps. Ovulation factors examined whether the ovulation cycle was normal or disrupted, including conditions such as polycystic ovary syndrome (PCOS). Sperm quality was evaluated based on motility, count, and morphology, and was categorized as normal or abnormal.

Ethical consideration

Ethical clearance for this research was obtained from the Jakarta Ministry of Health Polytechnic Ethics Commission III (Approval No. B.02.02/F.XIX.21/2342/2024), ensuring adherence to ethical research standards.

Statistical analysis

Data were analyzed in three phases. Univariate analysis was conducted to describe the characteristics of the respondents. Bivariate analysis using the Chi-Square test was employed to examine associations between independent variables and infertility outcomes. Multivariate analysis was performed using multiple logistic regression to identify the strongest predictors of infertility, adjusting for potential confounders. Model fitness was evaluated using the Hosmer–Lemeshow goodness-of-fit test to assess the adequacy of the logistic regression model.

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA), and statistical significance was set at $p < 0.05$

RESULT

A total of 343 infertile couples participated in this study. The analysis aimed to examine the relationship between various internal and external factors and the type of infertility experienced by the couples. Descriptive statistics were used to summarize the characteristics of the participants, while inferential statistics were applied to explore the associations between the variables studied.

Table 1 illustrates that most wives (71.7%) and husbands (56.9%) are under the age of 35, categorized as not at risk. More than half of the wives are employed (54.5%), and most have a BMI within the normal range (83.7%). A significant portion of husbands do not smoke (71.1%). Primary infertility is predominant (75.8%). Most respondents do not have disturbances in their reproductive organs, with 68.5% having no tubal issues, 59.2% without uterine disturbances, 51% without ovulation problems, and 52.2% without sperm abnormalities.

Table 1. Overview of the Characteristics of the Research Subject and Infertility Factors

No	Characteristic	n (%) *
1	Wife's Age	
	At risk (>35 years)	97 (28.3)
	Not at Risk (\leq 35 years)	246 (71.7)
2	Husband's Age	
	At risk (>35 years)	148 (43.1)
	Not at Risk (\leq 35 years)	195 (56.9)
3	Wife's Occupation	
	Working	187 (54.5)
	Not Working	156 (45.5)
4	Wife's BMI	
	At risk (<18.5 or >29)	56 (16.3)

	No Risk (18.5 - 29)	287 (83.7)
5	Husband's Smoking Habit	
	Smoker	99 (28.9)
	Non-smoker	244 (71.1)
6	Infertility Type	
	Primary	260 (75.8)
	Secondary	83 (24.2)
7	Tubal factor	
	Disturbance present	108 (31.5)
	No disturbance	235 (68.5)
8	Uterine factor	
	Disturbance present	140 (40.8)
	No disturbance	203 (59.2)
9	Ovulation factor	
	Disturbance present	168 (49.0)
	No disturbance	175 (51.0)
10	Sperm factor	
	Disturbance present	164 (47.8)
	No disturbance	179 (52.2)
	Total	343 (100.0)

* Univariate analysis

Table 2 demonstrates that wife's age ($p=0.001$), husband's age ($p=0.014$), ovulation disturbances ($p<0.001$), and sperm factor disturbances ($p<0.001$) show significant association with infertility. Wife's BMI also approaches significance ($p=0.085$). Conversely, employment status, smoking habits, tubal, and uterine factors do not have significant associations with infertility.

Table 2. Results of Bivariate Analysis of External Factors and Internal Factors on the Incidence of Infertility

No	Variable	Infertility Type		OR (95% CI)	<i>p-value*</i>
		Primary	Secondary		
1	Wife's Age (year)				
	At risk (>35)	61 (62.9)	36 (37.1)	1.00	0.001
	Not at risk (≤ 35)	199 (80.9)	47 (19.1)	0.400 (0.238-0.673)	
2	Husband's Age				
	At risk (>35)	102 (68.9)	46 (31.1)	5.190 (3.150-8.560)	0.014
	Not at risk (≤ 35)	158 (81.0)	37 (19.0)	1.00	
3	Wife's Occupation				
	Working	144 (77.0)	43 (23.0)	1.155 (0.704-1.895)	0.658
	Not Working	116 (74.4)	40 (25.6)	1.00	
4	Wife's BMI				
	At risk (<18.5 or >29)	48 (85.7)	8 (14.3)	2.123 (0.960-4.693)	0.085
	No Risk (18.5 - 29)	212 (73.9)	75 (26.1)	1.00	

5	Husband's Smoking Habit				
	Smoker	73 (73.7)	26 (26.3)	0.856 (0.500-1.464)	0.668
	Non-smoker	187 (76.6)	57 (23.4)	1.00	
6	Tubal factor				
	Disturbance present	80 (74.1)	28 (25.9)	0.873 (0.516-1.477)	0.711
	No disturbance	180 (76.6)	55 (23.4)	1.00	
7	Uterine factor				
	Disturbance present	111 (79.3)	29 (20.7)	1.387 (1.830-2.319)	0.261
	No disturbance	149 (73.4)	54 (26.6)	1.00	
8	Ovulation factor				
	Disturbance present	142 (84.5)	26 (15.5)	2.638 (1.562-4.456)	<0.001
	No disturbance	118 (67.4)	57 (32.6)	1.00	
9	Sperm factor				
	Disturbance present	140 (85.4)	24 (14.6)	2.868 (1.682-4.890)	<0.001
	No disturbance	120 (67.0)	59 (33.0)	1.00	

* Chi-square

Table 3, reveals that ovulation ($p=0.002$) and sperm factors ($p=0.001$) significantly influence infertility, with odds ratios of 2.34 and 2.52 respectively. These findings indicate that ovulation and sperm disturbances double the risk of primary infertility. Other variables like husband's age, wife's BMI, and wife's age were not statistically significant in the multivariate model but may still contribute as confounding factors.

Table 3. Multivariate end modelling with multiple logistic regression tests

No	Variable	Coefficient (B)	OR	95% CI		<i>p-value</i> *
				Lower	Upper	
1.	Ovulation	0.848	2.336	1.353	4.034	0.002
2.	Sperm	0.923	2.516	1.447	4.375	0.001
3.	Husband's Age	-0.319	0.727	0.381	1.385	0.332
4.	Wife's BMI	0.524	1.689	0.732	3.899	0.219
5.	Wife's Age	-0.477	0.621	0.316	1.221	0.167

* Multiple logistic regression

DISCUSSION

The findings of this study highlight significant factors influencing infertility, including both internal and external contributors. The analysis revealed that wife's age, husband's age, ovulation disturbances, and sperm quality significantly correlate with infertility incidence. In terms of external factors, women over 35 have a higher risk of infertility due to declining ovarian reserve and hormonal changes [13, 14]. However, our study identified a substantial proportion of infertility cases in women under 35. This discrepancy may be due to increased reproductive health awareness among younger couples in Indonesia, prompting earlier

medical consultations. This finding suggests that infertility is not exclusively an issue for older women but is increasingly recognized among younger demographics.

Building on the age factor, the significant association between the husband's age and infertility is also noteworthy. Men over 40 exhibit reduced sperm quality, affecting embryo viability [15, 16]. This finding complements the results related to the wife's age, indicating that age-related fertility decline is pertinent for both genders [17]. These insights emphasize the need for early fertility evaluations and interventions for couples, regardless of which partner is older.

In addition to age-related factors, internal reproductive health conditions play a crucial role in infertility. Ovulation disorders and sperm quality emerged as primary infertility determinants in this study. Ovulation disorders, such as polycystic ovary syndrome (PCOS), disrupt hormonal balance, leading to anovulation and irregular menstruation, while poor sperm quality diminishes fertilization potential [13, 14]. Male infertility is influenced by environmental and genetic factors, including oxidative stress, DNA mutations, immunogenetic disorders, azoospermia factor (AZF) microdeletions, and conductance regulator (CFTR) gene mutations. These factors disrupt spermatogenesis, reduce semen quality, and contribute to obstructive conditions, highlighting the need for genetic screening and targeted interventions [16, 19]. Likewise, female infertility is affected by lifestyle and environmental factors that disrupt neuroendocrine pathways, leading to metabolic imbalances and ovulatory failure. Delayed childbearing, prolonged exposure to stressors, and genetic predispositions can impair hormonal regulation and follicular development, increasing the risk of infertility [20].

Considering these findings, the increasing prevalence of infertility among younger couples underscores an urgent need to strengthen reproductive health education, promote early screening, and expand access to affordable infertility services. This trend reflects shifting reproductive behaviors, lifestyle changes, and delayed childbearing patterns that require a proactive response from healthcare systems [3] [21]. Comprehensive reproductive health education, starting from adolescence and continuing through adulthood, can improve awareness of fertility preservation and encourage timely medical consultation when conception difficulties arise [6, 22]. Healthcare professionals, particularly midwives and reproductive health practitioners, play an essential role in counseling couples, identifying risk factors, and facilitating early detection of infertility through evidence-based assessment tools.

From a broader public health perspective, integrating infertility prevention and management into existing reproductive health and family planning programs could yield substantial benefits [23]. Emphasizing preconception counseling, healthy lifestyle modification, and early fertility assessment as part of routine maternal and child health services would enhance reproductive outcomes and reduce the stigma and psychosocial burden commonly experienced by infertile couples [24]. This approach aligns with national health objectives to strengthen family planning, reduce infertility related morbidity, and promote reproductive wellbeing [25]. Ultimately, empowering health workers to address infertility comprehensively through education, preventive interventions, and accessible clinical services represents a critical step toward achieving equitable and sustainable reproductive health in Indonesia.

Although this study provides valuable insights, several limitations should be acknowledged. Due to the cross-sectional design, temporal relationships between exposure variables and infertility outcomes cannot be established. Therefore, the possibility of reverse causality, particularly regarding lifestyle-related variables such as BMI and smoking habits, cannot be ruled out. In addition, the use of secondary data from medical records may introduce information bias and reduce the precision of certain measurements. The study was also conducted in a single fertility clinic located in West Java, which may not fully represent the broader demographic and clinical diversity of the Indonesian population. Future research should employ longitudinal or multicenter approaches to confirm these findings and explore additional biological, environmental, and psychosocial factors associated with infertility, thereby improving the validity and generalizability of the results.

Conclusion

This study highlights that infertility among Indonesian couples is influenced by both internal and external factors, with ovulation disorders and sperm abnormalities emerging as the most significant

predictors. Age remains an important contributor, reflecting the combined effects of biological decline and lifestyle changes. These findings emphasize the urgent need for early reproductive health education, timely fertility screening, and accessible counseling services to prevent infertility and support family planning goals. Strengthening the role of healthcare professionals, particularly midwives, in providing fertility awareness and preconception counseling can enhance early detection and intervention. Future studies employing longitudinal and multicenter designs are recommended to further explore the complex interplay of biological, behavioral, and environmental factors affecting infertility in Indonesia, thereby contributing to more comprehensive reproductive health strategies.

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