Characteristics of Patients with Diminished Ovarian Reserve Undergoing in Vitro Fertilization (IVF) at Hasan Sadikin Hospital from 2019 – 2023

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Abstract
Objective: This study aimed to describe the characteristics of patients with diminished ovarian reserve undergoing in vitro fertilization (IVF) to improve understanding of its implications for infertility.
Methods: Cross-sectional descriptive study using medical records of patients who underwent IVF at Dr. Hasan Sadikin General Hospital (RSHS) from 2019 to 2023. Analyzed variables included age, education level, occupation, duration of marriage, body mass index, Anti-Müllerian hormone (AMH) level, and ovarian stimulation protocol.
Results: A total of 57.14% of the 55 patients were aged 35 – 40 years, 87.5% nulliparous, and 55.36% had a body mass index greater than 24.9 kg/m^2. The percentage that held a bachelor's degree was 64.29%, and 55.36% had AMH levels below 1.1 ng/ml. A total of 78.57% received a short stimulation protocol, and 21.43% received a long stimulation protocol.
Conclusion: Most patients with diminished ovarian reserve undergoing IVF at RSHS (2019 – 2023) were aged 35 – 40, nulliparous, obese class I–II, AMH value <1.1 ng/ml, and were subjected to a short IVF protocol.

Keywords: Anti-Müllerian hormone, assisted reproductive technology, diminished ovarian reserve, FSH, Infertility, In vitro fertilization.

Karakteristik Pasien dengan Diminished Ovarian Reserve yang Melakukan In Vitro Fertilization (IVF) di Rumah Sakit Hasan Sadikin pada Tahun 2019 – 2023

Abstrak
Tujuan: Penelitian ini bertujuan menggambarkan karakteristik pasien dengan cadangan ovarium menurun yang menjalani fertilisasi in vitro untuk meningkatkan pemahaman tentang implikasi cadangan ovarium menurun pada infertilitas.
Metode: Metode yang digunakan dalam penelitian ini adalah deskriptif observasional potong lintang yang menggunakan data rekam medis pasien yang menjalani fertilisasi in vitro di Rumah Sakit Hasan Sadikin (RSHS) periode 2019 – 2023. Variabel yang dianalisis meliputi usia, tingkat pendidikan, pekerjaan, lama menikah, indeks massa tubuh, kadar hormon anti-Müllerian, dan protokol stimulasi ovarium.
Hasil: Hasil penelitian menunjukkan bahwa dari 55 pasien, 57,14% berusia 35 – 40 tahun, 87,5% belum pernah melahirkan, 55,36% memiliki indeks massa tubuh lebih dari 24,9 kg/m^2, 64,29% berpendidikan sarjana, dan 55,36% memiliki kadar hormon anti-Müllerian kurang dari 1,1 ng/ml. Sebanyak 78,57% menjalani protokol stimulasi pendek dan 21,43% menjalani protokol stimulasi panjang.
Kesimpulan: Sebagian besar pasien dengan cadangan ovarium menurun yang menjalani fertilitasi in vitro di RS Dr. Hasan Sadikin (201 – 2023) berusia 35 – 40 tahun, nullipara, obesitas kelas I–II, nilai AMH <1.1 ng/ml dan menjalani protokol IVF pendek.

Kata kunci: *Anti-mullerian hormone*; *diminished ovarian reserve*; FSH; infertilitas; *in vitro fertilization* (IVF), teknologi reproduksi berbantu

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Introduction

Ovarian reserve is the reproductive potential of the ovaries, which is determined by the number and quality of oocytes available for fertilization. A condition of decreased ovarian reserve, known as diminished ovarian reserve (DOR), is a state in which the number or quality of oocytes is lower than expected for patient chronological age.[1] There is a lack of epidemiological data on DOR in Indonesia. However, population studies in Korea report that the prevalence of diminished ovarian reserve increases with age, affecting fewer than 5% of women under 30 and approximately 95% of those aged 45–49 years.[2]

The pathogenesis of DOR includes multiple interacting mechanisms. Intrinsic factors include altered follicular fluid composition, imbalances in vaginal microbiota, and autoimmune disorders affecting hormonal regulation and ovarian tissue integrity. Some external contributors, such as environmental pollutants, thermal, and oxidative stress, can disrupt mitochondrial function and folliculogenesis.[3]including hormones, metabolites, initial ovarian reserve, environmental problems, diseases, and medications, among others. With the trend of postponing of pregnancy in modern society, diminished ovarian reserve (DOR Additionally, psychological stress, contraceptive use, advanced maternal age, surgical or gonadotoxic exposure, and genetic variations in gonadotropin receptors may further increase follicular depletion and decline in ovarian reserve markers, including Anti-Müllerian hormone (AMH), antral follicle count, and gonadotropins.[4]

In this study, ovarian reserve is assessed through serum tests and ultrasound.[5] AMH, produced by granulosa cells, shows the size of the follicular pool and remaining oocyte quality. In this context, decreased AMH represents low primordial follicles and antral follicle count (AFC).[6] Several international guidelines recommend specific criteria and methods for assessing ovarian reserve.[5,7,8] The European Society of Human Reproduction and Embryology recommends the use of AFC or AMH with Bologna criteria to identify poor ovarian responders.[6] Cohort data show an increasing proportion of assisted reproductive technology (ART), such as in vitro fertilization (IVF), cycles associated with diminished ovarian reserve over recent decades.[9] This trend shows the growing need for understanding the clinical characteristics of patients with DOR for clinical planning, counselling, and evaluation of fertility service quality. Therefore, this study aimed to describe the characteristics of patients with DOR undergoing IVF at Dr. Hasan Sadikin Hospital (RSHS), Bandung, between 2019 and 2023, to provide baseline information for further analytical study and improvement of clinical management

Method

A descriptive observational study was conducted at RSHS, specifically at the Assisted Reproductive Technology Unit of Aster Clinic. A cross-sectional design was adopted using secondary data from patient medical records. Data were collected from 1 March 2024 to 30 April 2024, covering patients from January 2019 to December 2023. The inclusion criteria were medical records of patients with DOR who underwent assisted reproductive technology during the study period. Exclusion criteria were medical conditions that were incomplete, missing, or inaccessible to the authors. All samples that met the inclusion and exclusion criteria were included as study subjects.

A total sampling method applied in this study and the sample size was equal to the population. Data collected on the subject characteristics include age, highest level of education, patient occupation, parity,

body mass index (BMI), AMH value, and IVF protocol. Among several other markers, this study used AMH values based on the reliability and accuracy of ovarian reserve.[10,1], AMH values were classified into three, namely 0.1–0.4, 0.5–1.1, and >1.1 ng/ml. IVF received by patients were either short or long GnRH agonist protocols.

Categorical data were presented as frequency distributions and proportions. All data were recorded in a special form and processed using SPSS software version 24.0 for Windows.[12] Ethical approval for this study was granted by the Ethics Committee of Padjadjaran University. Furthermore, the ethical aspects were taken into account through data anonymization to prevent patient identification. Access to data was restricted to only the analyst. Both physical and electronic data were discarded from the repository five years after the study was completed.

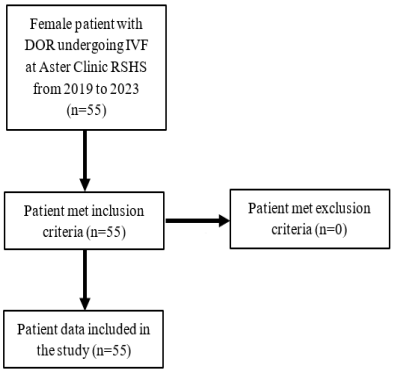


Figure 1 Data Collection Process

Results

Based on the inclusion and exclusion criteria, a total of 55 subjects were included in this study, and the characteristics were described in Table 1. Most subjects were aged between 35 and 40, with an equal number of 16 patients (28.57%). In addition, 87.5% of subjects did not have children (nulliparous). Obese I was the most frequent BMI (55.36%), followed by obese II, with a percentage of 25%. BMI classification used in this study referred to World Health Organization (WHO) for the Asia Pacific classification.[13]

Table 1 Characteristics of Patients with DOR Undergoing IVF at RSHS

Variable	Number n, %)
Age	
<35 years old	19 (33.93%)
35–37 years old	16 (28.57%)
37–40 years old	16 (28.57%)
> 40 years old	5 (8.93%)
Highest level of education	
Primary school or equivalent	0 (0.00%)
Junior high school or equivalent	1 (1.79%)
High school or equivalent	19 (33.93%)
Bachelor's degree or equivalent	36 (64.29%)
Patient occupation	
Housewife	17 (30.36%)
Working	39 (69.64%)
Parity	
0	49 (87.50%)
1	7 (12.50%)
Body mass index (BMI)	
Underweight	2 (3.57%)
Normal	18 (32.14%)
Overweight	5 (8.93%)
Obesity class I	17 (30.36%)
Obesity class II	14 (25.00%)
AMH value	
>1.1 ng/ml	25 (44.64%)
0.5–1.1 ng/ml	22 (39.29%)
0.1–0.4 ng/ml	9 (16.07%)
IVF Protocol	
Short protocol	44 (78.57%)
Long protocol	12 (21.43%)

A large portion of the subjects in this study had completed a bachelor's degree (64.29%) and were employed (69.64%). A total of 44.67% had AMH levels above 1.1 ng/ml, with high AMH levels showing better ovarian reserve. Most of respondents (55.36%) had AMH levels below 1.1 ng/ml. Most DOR patients undergoing IVF at RSHS followed a short protocol (78.57%), while the remaining 21.43% followed a long protocol. Ovarian stimulation protocols

were individualized according to patient characteristics and clinical indications. Long and short regimens were based on physician assessment rather than a uniform institutional policy.

Discussion

In this study, patients aged 35–40 years were the most frequent age group among those diagnosed with DOR and undergoing IVF. This result is consistent with previous reports that the prevalence of DOR and IVF-seeking behavior increases after the mid-30s, driven by age-related follicular depletion (AMH/AFC decline) and clinical tendency to pursue ART in the reproductive window.[14] This study also found a considerable number of patients aged <35 years. The results supported the conclusion of Hazarika et al., who found 62% of younger women with DOR aged 31–35 years.[15] Younger women with DOR may have a greater chance of pregnancy than older women. However, a decline in ovarian reserve can also occur in younger women since the biological aging of the ovaries does not correspond to chronological age.[16] Other factors were found to be related, including endometrioma, hypothyroidism, and prior history of ≥3 cycles of ovulation induction.[15]

The study subjects who underwent IVF procedures at RSHS were mostly nulliparous, suggesting primary infertility is the predominant cause. This result is consistent with previous studies showing that nulliparous women constitute a large proportion of IVF patients, as fertility treatment was often initiated earlier when conception had not occurred despite regular attempts. Nulliparity in DOR patients may be associated with both quantitative and qualitative decline in oocytes, leading to reduced response to stimulation and lower pregnancy rates.[15] These results show the need for early ovarian reserve assessment and individualized IVF protocols to optimize outcomes in nulliparous women experiencing infertility.

In this study, the majority of subjects correspond to obesity class I and later class II. Increased BMI has been associated with poorer reproductive outcomes, including impaired ovarian response, altered hormonal balance, and reduced implantation rates during IVF cycles.[17,18] Excess weight affects low AMH levels, which are often found in women with DOR. Furthermore, AMH is secreted locally by the ovaries and is not regulated externally, for example, by pituitary gonadotropins. The secreted AMH is diluted in the woman's circulation based on the higher blood volume in those with a high BMI, leading to apoptosis of granulosa cells.[19]

The majority of subjects in this study had completed a bachelor's degree and were employed. Therefore, economic factors, social and cultural environments, and biological limitations were found to influence a woman's decision to start a family. The main problem faced by women who delay childbirth due to educational or work demands is biological limitations, namely declining fertility with age. Most women with higher education give birth for the first time in mid-thirties, when the period of fertility has already decined.[20]

A total of 55.36% of subjects with DOR studied had AMH levels < 1.1 ng/ml, while the remaining had AMH levels greater than 1.1 ng/ml. This result is consistent with previous studies showing that AMH is a highly sensitive marker for ovarian reserve. A study by Alipour et al. reported that AMH had a sensitivity and specificity of 80% and 78.89% for predicting ovarian failure, compared to FSH with 28.57% and 78.65%, respectively.21 A prospective study found that AMH had a sensitivity of 100% and specificity of 73% for predicting poor ovarian response, while antral follicle count (AFC) had 93% and 88%, respectively.[22]

Most patients received the short GnRH

agonist protocol, while a smaller proportion used the long protocol. The short protocol is often preferred for DOR patients to avoid excessive pituitary suppression, reduce gonadotropin consumption, and shorten stimulation duration, showing its efficiency and cost-effectiveness. Although the long protocol has been traditionally considered effective and is associated with higher clinical pregnancy and implantation rates in some age groups, evidence remains mixed.[23] Some studies and meta-analyses report superior outcomes with the long protocol,[23,24] while others found no significant difference between protocols.[25] The short GnRH agonist protocol represents a practical alternative for DOR patients, particularly in minimizing ovarian suppression and optimizing resource utilization, though individualized protocol selection remains essential to maximize IVF success.

This study is limited by its descriptive design, which only allows characterization of the patient population with DOR undergoing IVF and does not permit inference of causal relationships or statistical associations between characteristics, stimulation protocols, and IVF outcomes. The lack of an analytical component precludes identification of independent risk factors or predictors of treatment success. Additionally, this study was conducted at a single tertiary referral center, which may limit the generalizability of the results to other populations or clinical settings. Future studies using analytical or prospective designs are needed to explore causal relationships and to optimize individualized fertility management in DOR patients.

Conclusion

In conclusion, the predominant characteristics in a cohort of patients with diminished ovarian reserve undergoing IVF at RSHS between 2019 and 2023 are age 35–40 years (57.14%), nulliparous (87.5%), held a bachelor's degree (64.29%), and were employed (69.64%). Obesity class I (30.36%) and II (25%) are identified as risk factors associated with DOR patients. The majority of patients underwent short GnRH agonist stimulation (78.57%), while 21.43% received the long protocol. These results provide a basis for further studies to examine the interplay between patient characteristics, protocol selection, and IVF outcomes, aiming to optimize fertility management.

Conflict of Interest

The authors declare no conflict of interest in this study.

References

1. Tan Z, Gong X, Wang CC, Zhang T, Huang J. Diminished Ovarian Reserve in Endometriosis: Insights from In Vitro, In Vivo, and Human Studies—A Systematic Review. Int J Mol Sci. 2023;24(21).
2. Choi R, Park W, Chun G, Lee SG, Lee EH. Investigation of the Prevalence of Diminished Ovarian Reserve in Korean Women of Reproductive Age. J Clin Med. 2023;12(15).
3. Zhu Q, Li Y, Ma J, Ma H, Liang X. Potential factors result in diminished ovarian reserve: a comprehensive review. J Ovarian Res. 2023;16(1):1–14.
4. Annalisa R, Dominic S, Nikolaos P P. Editorial: Diminished Ovarian Reserve and Poor Ovarian Response: Diagnostic and Therapeutic Management. Front Physiol. 2022;13(July):1– 3.
5. Workup I, Specialist H. Infertility Workup for the Women's Health Specialist: ACOG Committee Opinion, Number 781. Obstet Gynecol. 2019;133(6):e377–84.
6. Moolhuijsen LME, Visser JA. Anti-Müllerian Hormone and Ovarian Reserve: Update on Assessing Ovarian

Function. J Clin Endocrinol Metab. 2020;105(11):3361–73.
7. Bosch E, Broer S, Griesinger G, Grynberg M, Humaidan P, Kolibianakis E, et al. ESHRE guideline: Ovarian stimulation for IVF/ICSI. Hum Reprod Open. 2021;2020(2):1–13.
8. Penzias A, Azziz R, Bendikson K, Falcone T, Hansen K, Hill M, et al. Testing and interpreting measures of ovarian reserve: a committee opinion. Fertil Steril. 2020;114(6):1151–7.
9. Devine K, Mumford S, Schertz J. Diminished ovarian reserve (DOR) in the US ART population: diagnostic trends among 181,536 cycles. 2015;21(9):1161–1170.
10. Broer SL, van Disseldorp J, Broeze KA, Dolleman M, Opmeer BC, Bossuyt P, et al. Added value of ovarian reserve testing on patient characteristics in the prediction of ovarian response and ongoing pregnancy: An individual patient data approach. Hum Reprod Update. 2013;19(1):26–36.
11. Ferraretti AP, La Marca A, Fauser BCJM, Tarlatzis B, Nargund G, Gianaroli L. ESHRE consensus on the definition of 'poor response to ovarian stimulation for in vitro fertilization: The Bologna criteria. Hum Reprod. 2011;26(7):1616–24.
12. Windows. SPSS software version 24.0 [Internet]. Available from: https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-24
13. Inoue S, Zimmet P, Caterson I, Chunming C, Ikeda Y, Khalid A, et al. Obesity Task Force. The Asia – Pacific Perspective: Redefining Obesity and its Treatment. World Heal Organ [Internet]. 2000;56. Available from: https://apps.who.int/iris/bitstream/handle/10665/206936/0957708211_eng.pdf
14. Li S, Hu L, Zhang C. Effect of chronological age of patients with diminished ovarian reserve on in vitro fertilization outcome. J Obstet Gynaecol (Lahore) [Internet]. 2022;42(4):654 – 7. Available from: https://doi.org/10.1080/01443615.2021.1922996
15. Hazarika S, Dasari P, Mangolnganbi S, Chanu, Basu S. Factors Associated with Poor Ovarian Reserve in Young Infertile Women: A Hospital-based Cohort Study. J Hum Reprod Sci. 2023;16(2):140 – 7.
16. Özelçi R, Aldemir O, Dilbaz S, Özkaya E, Kahyaoğlu İ, Dilbaz B, et al. The impact of different etiologies of diminished ovarian reserve on pregnancy outcome in IVF-ET cycles. Turkish J Med Sci. 2019;49(4):1138 – 44.
17. Rittenberg V, Seshadri S, Sunkara SK, Sobaleva S, Oteng-Ntim E, El-Toukhy T. Effect of body mass index on IVF treatment outcome: An updated systematic review and meta-analysis. Reprod Biomed Online [Internet]. 2011;23(4):421 – 39. Available from: http://dx.doi.org/10.1016/j.rbmo.2011.06.018
18. Jungheim ES, Travieso JL, Carson KR, Moley KH. Obesity and Reproductive Function. Obstet Gynecol Clin North Am. 2012;39(4):479 – 93.
19. Podfigurna A, Lukaszuk K, Czyzyk A, Kunicki M, Maciejewska-Jeske M, Jakiel G, et al. Testing ovarian reserve in pre-menopausal women: why, whom and how? Maturitas. 2018;109(November):112 – 7.
20. Gurtcheff SE, Klein NA. Diminished ovarian reserve and infertility. Clin Obstet Gynecol. 2011;54(4):666 – 74.
21. Alipour F, Jahromi AR, Maalhagh M, Sobhanian S, Hosseinpoor M. Comparison of specificity and sensitivity of AMH and FSH in diagnosis of premature ovarian failure. Dis Markers. 2015;2015:10 – 3.
22. Jayaprakasan K, Campbell B, Hopkisson J, Johnson I, Raine-Fenning N. A prospective, comparative analysis of anti-Müllerian hormone, inhibin-B, and three-dimensional ultrasound determinants of ovarian reserve in the prediction of poor

response to controlled ovarian stimulation. Fertil Steril [Internet]. 2010;93(3):855 – 64. Available from: http://dx.doi.org/10.1016/j.fertnstert.2008.10.042

23. Ou J, Xing W, Li Y, Xu Y, Zhou C. Short versus Long Gonadotropin-Releasing hormone analogue suppression protocols in IVF/ICSI cycles in patients of various age ranges. PLoS One. 2015;10(7):1 – 11.
24. Lambalk CB, Banga FR, Huirne JA, Toftager M, Pinborg A, Homburg R, et al. GnRH antagonist versus long agonist protocols in IVF: A systematic review and meta-analysis accounting for patient type. Hum Reprod Update. 2017;23(5):560 – 79.
25. Tian Y, Hao J, Tu X, Feng S, Li M, Chen Y, et al. Comparison of clinical outcomes between flexible antagonist protocol and long luteal phase protocol in patients with normal ovarian reserve function: a prospective cohort study. Front Endocrinol (Lausanne). 2025;16(August):1 – 11.