



Ann Med Res

Current issue list available at [Ann Med Res](https://annalsmedres.org)

Annals of Medical Research

journal page: annalsmedres.org

Assessing the effect of semen parameters on pregnancy outcome in couples undergoing intrauterine insemination for unexplained infertility and male infertility

Cigdem Karaca ^{a, *}, Selin Kenan ^{b, }, Ayse Gulusur ^{b, }, Dilsad Arisoy Demir ^{b, }, Ozlem Akay ^{c, }^aGaziantep Islam, Science and Technology University, Faculty of Medicine, Department of Histology and Embryology, Gaziantep, Türkiye^bGaziantep City Hospital, Clinic of Histology and Embryology, Gaziantep, Türkiye^cGaziantep Islam, Science and Technology University, Faculty of Medicine, Department of Biostatistics, Gaziantep, Türkiye*Corresponding author: cigdem.karaca@gibtu.edu.tr (Cigdem Karaca)

■ MAIN POINTS

- This study compares semen parameters and pregnancy outcomes between unexplained infertility and male infertility cases IUI.
- In unexplained infertility, no significant association was found between semen parameters and pregnancy rates.
- We observed that in male infertility, pre-wash TPMS density is more predictive of pregnancy outcomes than total TPMS count. And the TPMSC value after washing was also observed to be important in pregnancy prediction, since the TPMSC after washing is also concentrated semen.

Cite this article as: Karaca C, Kenan S, Gulusur A, Arisoy Demir D, Akay O. Assessing the effect of semen parameters on pregnancy outcome in couples undergoing intrauterine insemination for unexplained infertility and male infertility. *Ann Med Res.* 2025;32(6):252–257. doi: [10.5455/annalsmedres.2024.10.216](https://doi.org/10.5455/annalsmedres.2024.10.216).

■ ABSTRACT

Aim: The aim is to investigate the effect of semen parameters in predicting pregnancy outcomes in the unexplained infertility and male infertility groups among couples who received insemination within the scope of infertility treatment.

Materials and Methods: In our study, spermiogram data were retrospectively obtained from 57 couples diagnosed with male infertility and 251 couples diagnosed with unexplained infertility who applied to Gaziantep Cengiz Gökçek Obstetrics and Gynecology Hospital ART Clinic and underwent IUI between July 2021 and July 2023, and the demographic data of the patients were analyzed. Before IUI, ovulation induction with an aromatase inhibitor and recombinant FSH was performed in female patients. Semen was collected from the male patient on the day of the procedure, and semen analysis was performed. Semen prepared by applying the semen preparation protocol was injected into the uterus with an insemination catheter. Pregnancy in the patients was assessed by serum beta-hCG on day 14 after the procedure.

Results: The positive pregnancy rate for male infertility was 10.5%, and the positive pregnancy rate for unexplained infertility was 13.5%. There was no association between unexplained infertility and spermiogram parameters. In male infertility, there was a relation between Total Progressive Motile Sperm (TPMS) density and post-wash TPMS Count (TPMSC) and positivity of pregnancy ($p=0.035$, $p=0.017$, respectively).

Conclusion: Semen parameters generally don't predict pregnancy outcomes in couples with unexplained infertility. However, for couples seeking help for male infertility, calculating Total Progressive Motile Sperm (TPMS) density and post-wash TPMS Count (TPMSC) during the initial semen evaluation is a crucial step in predicting pregnancy outcomes.

Keywords: Male infertility, Unexplained infertility, Spermiogram, Intrauterine insemination

Received: Oct 10, 2024 **Accepted:** May 08, 2025 **Available Online:** Jun 25, 2025



Copyright © 2025 The author(s) - Available online at annalsmedres.org. This is an Open Access article distributed under the terms of Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

■ INTRODUCTION

Infertility is defined as the inability to achieve pregnancy within 12 months despite regular unprotected intercourse in couples of reproductive age. The male plays a role in 20-30% of cases, the female factor in 20-35%, and both factors in 25-40%, while the cause of infertility is unknown in 15-30% of cases [1]. Unexplained infertility is defined as a situation in which the basic tests used to diagnose infertility are normal, but the factors affecting fertility cannot be identified [2]. Although no male or female factor can be identified, it accounts

for 30% of infertile couples [3]. Male infertility is the inability of a man to have children due to various unknown or known reasons, such as hormonal disorders, infections, varicocele, and cryptorchidism in the couple. In these couples, the woman has no barriers to pregnancy [4-6]. With the development of assisted reproductive techniques (ART), success rates in infertility treatment have begun to increase. Among these, intrauterine insemination (IUI), also known as insemination, is used as a first-line treatment because it is cheaper, easier to use and less invasive than other ART. By crossing

the cervical mucus barrier, IUI aims to increase the number of motile sperm in the fertilized region. Pregnancy rates following intrauterine insemination (IUI) typically range from 10-20% [7], though they vary based on factors like the couple's age, the causes of infertility, and the clinic. Sperm analysis is a primary diagnostic tool for infertility, offering crucial insights for selecting appropriate assisted reproductive techniques [8]. Current semen analysis parameters, as recommended by the World Health Organization in 2010, include volume, viscosity, liquefaction time, total sperm count, total motility, progressive motile sperm count, pH, sperm concentration, morphology (defined by Kruger [9]), and leukocyte count. Despite their apparent importance, the clinical value of these sperm parameters in predicting fertility, especially for IUI success, is not yet clearly established. While some studies find no significant relationship between overall sperm parameters and pregnancy rates after IUI, others suggest that a normal sperm count is important for maintaining pregnancy, or that only progressive motile sperm count is effective for IUI success [10,11]. Research on the effect of semen parameters on pregnancy outcomes in IUI treatment for male infertility has yielded highly variable results. This inconsistency underscores the need for more comprehensive studies on this topic [12]. Based on this information, the aim of our study was to investigate the effects of semen parameters on pregnancy outcome in couples presenting to Gaziantep Cengiz Gökçek Maternity and Children's Hospital Assisted Reproductive Treatment Centre for unexplained infertility and male infertility and undergoing IUI.

■ MATERIALS AND METHODS

In our study, we used the data of all patients who applied to the ARTC (Assisted Reproductive Treatment Centre) Polyclinic of Gaziantep Cengiz Gökçek Gynaecology and Obstetrics and Paediatrics Hospital and underwent IUI between July 2021 and July 2023. In our study, spermiogram data and patient demographic characteristics of 251 couples diagnosed with unexplained infertility and 57 couples diagnosed with male infertility were used; data of couples with chronic diseases and those who did not want to participate in the study were not included in our study. In women, couples with ovulatory cycles and normal hysterosalpingography (HSG) were included in our study. Cases with a sperm count less than 20×10^6 (oligozoospermia), a motility assessment of sperm percentage with fast progressive motile sperm less than 25% or the sum of fast and slow progressive motile sperm less than 50% (asthenozoospermia) or a morphology assessment of less than 4% normal sperm (teratozoospermia) according to Kruger criteria were classified as having a male infertility, and cases in which a male infertility was not identified were classified as having 'unexplained infertility'.

Ovulation Induction (OI)

Aromatase inhibitor (letrozole) and recombinant FSH (rFSH) preparations were used together for ovulation induc-

tion (OI). For ovulation induction with rFSH, the treatment dose was determined according to age, weight, and antral follicle count on day 2 of menstruation. Letrozole 2.5 mg 2x1 tb for 3 days and rFSH were started at doses of 50-150 IU. On day 7 of treatment, follicular development was assessed and recorded by serum estradiol measurement and transvaginal ultrasound. If no follicles larger than 10 mm were seen in the ovaries on the 7-day scan, the daily dose was increased to 37.5-75-112.5-150 IU. The maximum dose was set at 225 IU. The days on which patients were to be called for control were determined according to follicle size. If follicles >10 mm were observed at the check-ups, the same dose was continued until the follicle diameter reached 18 mm. When the follicle diameter reached 18 mm, 10,000 IU of human chorionic gonadotropin (hCG) was administered to induce follicular maturation and ovulation. IUI cycles with >3 follicles on hCG day >16 mm were cancelled due to the risk of multiple pregnancy and hyperstimulation. Cycles cancelled in this way were not included in the study. Ovulation was assessed in all patients by progesterone measurement on day 21 of the cycle.

Sample collection, Semen analysis, and Preparation protocol

On the day of the procedure, the couple to be inseminated was called approximately 3 hours before the procedure. After 2-5 days of abstinence by the male patient, semen samples were collected by masturbation. The semen sample was kept in the incubator until the semen liquefied (minimum 20 min, maximum 60 min), and the liquefaction time was calculated. After the liquefaction phase, the semen was homogenised by pipetting, its volume was recorded and evaluated with the Makler camera. Semen analysis was performed according to WHO criteria, and pre-preparation values were recorded. Motility assessment included the number of progressive motile spermatozoa, the number of in situ motile spermatozoa, and the number of immotile spermatozoa. The density-gradient washing method was used to prepare semen for intrauterine insemination in almost all cases; in a few cases of low sperm concentration, only the washing method was used. The amounts of density-gradient solution were determined according to the amount of semen, and the solutions were heated in an oven to 37 °C for half an hour. 2 ml of the heated lower phase was added to a sterile disposable centrifuge tube using a sterile glass Pasteur pipette. Using the same pipette, 2 ml of the upper phase was added drop by drop to the centrifuge tube at an angle of 45 degrees to avoid mixing with the lower phase. 2 ml of liquefied spermatozoa was added to the upper phase. The tube was centrifuged at 400g (45-90% density) for 15 minutes, and the supernatant was removed from the pellet. Then 5 ml of sperm wash solution (SpermRinse™), previously heated in an oven at 37°C, was added to the pellet and pipetted without foaming. This solution was centrifuged at 400g for 5 minutes, and 0.5- 1 mL of the pellet was prepared for insemination, and the sperm count

was recorded after preparation by counting in a machine camera. The pellet filled into the insulin syringe was kept in the oven until the time of insemination.

Insemination technique

The mean follicular diameter was calculated for each follicle greater than 16 mm during transvaginal ultrasound monitoring between days 11 and 13 of the menstrual cycle. IUI was planned in the presence of at least 1 follicle with a mean diameter greater than 18 mm. Intrauterine insemination was performed 36-40 hours after hCG administration. Female patients were asked to urinate during insemination so that the uterus could be easily seen on transabdominal imaging. The cervix was washed with 2-3 ml saline and the insemination catheter (TechnoCath) was gently inserted into the uterus, advanced through the cervix and stopped ~1 cm from the fundus. The prepared specimen from the male patient, stored at 37 C, was slowly inserted through the cervix with the catheter. Patients were rested in a lying position for 15-30 minutes after the procedure. All patients received progesterone to support the luteal phase.

Patients were evaluated for pregnancy by serum beta-hCG measurement on day 14 after the procedure.

Statistical analysis

Descriptive statistics of the variables used in the study are presented as median and interquartile range. The Kolmogorov-Smirnov test was used to test whether the quantitative variables conformed to a normal distribution, and it was found that the variables did not conform to a normal distribution. Therefore, the Mann-Whitney U test was used to compare variables according to pregnancy outcome for male infertility and unexplained infertility. The relationship between the cause of infertility and pregnancy outcome was examined using chi-squared analysis. Analyses were performed using IBM SPSS Statistics 25.0, and the significance level was set at $p < 0.05$.

■ RESULTS

In our study, we evaluated 252 couples with unexplained infertility and 57 couples with male infertility who underwent intrauterine insemination (IUI). We assessed the male patients' spermogram parameters and compared these with the couples' pregnancy rates.

Within the male infertility cohort, 51 patients had negative pregnancy results, while 6 achieved positive pregnancy results after IUI. We observed no significant differences in mean age, semen volume, total sperm count, or total progressive motile sperm count (TPMSC) based on pregnancy outcome. However, a statistically significant difference was found in TPMSC/semen volume (representing total progressive motile sperm (TPMS) density) and post-wash TPMSC values ($p=0.035$, $p=0.017$, respectively). For couples with male infertility, pregnancy success was higher in those with

greater progressive motile sperm density and progressive motile sperm count after sperm preparation (Table 1).

Among couples undergoing IUI for unexplained infertility, 217 achieved negative pregnancy outcomes and 34 positive outcomes. In this group, age, semen volume, total sperm count, sperm density, motile sperm count per millimeter, and post-wash TPMSC showed no difference according to pregnancy outcome. Nevertheless, couples with a positive pregnancy outcome in the unexplained infertility group had a significantly higher progressive motile sperm count ($p=0.048$). Table 2 indicates that pregnancy outcomes in unexplained infertility cases are independent of male factors.

Overall, 89.5% of patients with male infertility and 86.5% of those with unexplained infertility experienced negative pregnancy outcomes. No statistically significant relationship was found between pregnancy success in patients with unexplained and male infertility who underwent IUI ($p=0.665$) (Table 3).

When comparing groups by the cause of infertility, no significant differences were observed in male age, female age, or semen volume ($p=0.456$, $p=0.454$, $p=0.472$, respectively). However, significant differences based on infertility status were found for total sperm count, sperm count per milliliter, progressive motile sperm count, patient's TPMSC/semen volume, and post-wash TPMSC values (all $p=0.000$). Despite higher values for total sperm count, sperm count per milliliter, progressive motile sperm count, motile sperm density, and post-wash progressive motile sperm count in the unexplained infertility group, pregnancy success following IUI did not differ significantly from that in male infertility ($p=0.665$) (Table 3, Table 4).

■ DISCUSSION

Intrauterine insemination (IUI) is a common first-line assisted reproductive technique (ART) for various indications, including cervical infertility, minimal or mild endometriosis, ovulatory dysfunction, moderate male infertility, and unexplained infertility [13, 14]. However, reported IUI pregnancy success rates vary widely across studies. For instance, Mohammadi et al. reported a 15.7% pregnancy rate after IUI for different infertility causes, while another study found 18.2% [11, 15]. Specifically for male infertility, rates have ranged from 12.95% (Zhang et al.) to 5.3% (Luco et al.) [16, 17], with Sinha P et al. reporting 14.28% for male infertility and 33.33% for unexplained infertility [18]. Another study documented a 29.9% pregnancy rate for unexplained infertility [19].

In our study, the pregnancy success rate was 10.5% for male infertility and 13.5% for unexplained infertility, which aligns with findings in the literature. Historically, IUI pregnancy success rates have ranged from 5% to 70%. This considerable variability is influenced by numerous factors, including the cause of infertility, population heterogeneity, evolving ovarian stimulation protocols, differences in sperm preparation and

Table 1. Comparison of variables according to pregnancy outcome in male factor infertility.

	Pregnancy Outcome		p-value
	β -hCG Negative (n=51)	β -hCG Positive (n=6)	
	Median (Interquartile Range)	Median (Interquartile Range)	
Male Patient Age	34 (7)	35.5 (9.75)	0.114 Ψ
Female Patient Age	27 (7)	30.5 (8.5)	0.064 Ψ
Semen Volume (ml)	2.5 (1.75)	2.25 (1.67)	0.365 Ψ
Total Sperm Count (million)	10.5 (24.2)	11.76 (21.75)	0.391 Ψ
Sperm count per millilitre (million/ml)	5 (6.70)	7 (4.60)	0.149 Ψ
TPMSC (million)	3.90 (7)	5.25 (8.34)	0.203 Ψ
TPMSC /Semen Volume(million/ml)= TPMS density	1.14 (2.63)	2.59 (3.18)	0.035 Ψ *
Post-wash TPMSC	0.6 (1.84)	4.25 (3.95)	0.017 Ψ *

*p<0.05; Ψ : Mann-Whitney U test.

Table 2. Comparison of variables according to pregnancy outcome for unexplained infertility.

	Pregnancy Outcome		p-value
	β -hCG Negative (n=217)	β -hCG Positive (n=34)	
	Median (Interquartile Range)	Median (Interquartile Range)	
Male Patient Age	32 (6)	32 (7.5)	0.556 Ψ
Female Patient Age	28 (8)	29.5 (7)	0.826 Ψ
Semen Volume (ml)	2.5 (2)	3 (1.78)	0.099 Ψ
Total Sperm Count (million)	126 (174)	156.5 (129.25)	0.134 Ψ
Sperm count per millilitre (million/ml)	55 (58)	51 (55.5)	0.856 Ψ
TPMSC (million)	69.03 (118.25)	97.69 (108.59)	0.048 Ψ *
TPMSC /Semen Volume(million/ml)= TPMS density	29 (37.3)	30.08 (33.77)	0.344 Ψ
Post-wash TPMSC	17 (38.5)	20.4 (29.01)	0.158 Ψ

*p<0.05; Ψ : Mann-Whitney U test.

Table 3. Relationship between the cause of infertility and pregnancy outcome.

		Pregnancy Outcome		p-value
		Negative	Positive	
Cause of infertility	Male factor	51 (89.5%)	6 (10.5%)	0.665 χ
	Unexplained	217 (86.5%)	34 (13.5%)	

*p<0.05; χ : Chi square test.

IUI techniques, and a lack of well-controlled prospective randomized trials [20, 21].The use of IUI in couples with male infertility remains a contentious topic. While some studies suggest that in vitro fertilization (IVF) should be the first-line treatment for patients with very low semen volume, total sperm count, and progressive motile sperm count, IUI is generally accepted as a first-line option for moderate male infertility [20]. Nevertheless, persistently low pregnancy rates have prompted researchers to evaluate specific semen parameters as predictors of pregnancy. Among these, the total motile sperm count has been identified as an important prognostic factor for IUI success, with other parameters often showing no significant relationship with pregnancy [22]. Specifically in male infertility, IUI success has been linked to a pre-wash Total Progressive Motile Sperm Count (TPMSC)

exceeding 5×10^6 , suggesting that patients below this threshold should be referred for IVF [16, 23, 24]. Some studies advocate for a total motile sperm count above 10×10^6 before proceeding to IVF [25, 26]. Yavuzcan et al. emphasized that a pre-wash TPMSC $\geq 10 \times 10^6$ was the sole factor contributing to IUI success across all infertile couples in their clinic [27].

In our study, the pre-wash TPMSC for male infertile couples with positive pregnancies was $(8.57 \pm 9.14) \times 10^6$, but this did not show a statistically significant difference in terms of pregnancy success. Conversely, the post-wash TPMSC of $(3.41 \pm 1.90) \times 10^6$ showed a significant relationship with pregnancy success. Furthermore, TPMS density was $(3.68 \pm 2.59) \times 10^6$ and positively influenced pregnancy, although no relationship was found between other semen parameters and pregnancy success. These results suggest that post-wash sperm count and pre-wash sperm density can predict IUI success in couples with male infertility.

For patients with unexplained infertility, where the underlying cause remains unknown, a course of ovarian stimulation-IUI is commonly recommended, followed by IVF if IUI is unsuccessful. While semen parameters have been evaluated for their predictive value in IUI pregnancy success in this group, many studies indicate that parameters other than TPMSC are not reliable markers. Hajder et al. found higher IUI preg-

Table 4. Comparison of variables according to infertility status.

	Pregnancy Outcome		p-value
	β -hCG Negative (n=252)	β -hCG Positive (n=57)	
	Median (Interquartile Range)	Median (Interquartile Range)	
Male Patient Age	32 (6)	34 (6)	0.456 ^Ψ
Female Patient Age	28 (7.75)	27 (7)	0.454 ^Ψ
Semen Volume (ml)	2.8 (2)	2.5 (1.75)	0.472 ^Ψ
Total Sperm Count (million)	137.5 (169)	10.5 (24.26)	0.000 ^{Ψ*}
Sperm count per millilitre (million/ml)	54.5 (57.75)	6 (6.70)	0.000 ^{Ψ*}
TPMSC (million)	74 (115.13)	4 (6.64)	0.000 ^{Ψ*}
TPMSC /Semen Volume(million/ml)= TPMS density	29.03 (37.06)	1.88 (2.55)	0.000 ^{Ψ*}
Post-wash TPMSC	17.75 (36.02)	0.7 (2.22)	0.000 ^{Ψ*}

*p<0.05; Ψ: Mann-Whitney U test.

nancy rates than spontaneous rates in patients with a TPMSC above 5×10^6 [19]. Another study on unexplained infertility cases undergoing IUI reported significantly higher live birth rates in those with a post-wash TPMSC of $15-20 \times 10^6$ compared to those with 5×10^6 [28]. Conversely, Lin et al. found that TPMSC did not affect IUI success rates in patients with unexplained infertility [29]. Another study concluded that couple's age, infertility duration, follicle number and size, number of treatment cycles, and all semen parameters were not significant predictors of pregnancy success in this patient group [30].

Our study found no association between semen parameters and pregnancy success in patients with unexplained infertility. Although semen volume was higher in those with positive pregnancies, this difference was not statistically significant. Interestingly, total and per milliliter sperm count, sperm concentration, sperm density, and post-wash sperm concentration were higher in couples with negative pregnancies. Our results confirm that semen parameters are not related to pregnancy success in cases of unexplained infertility, implying they cannot be used for pregnancy prediction in these situations.

CONCLUSION

Our study, which evaluated the effects of semen parameters on pregnancy outcomes in couples undergoing IUI for unexplained and male infertility, revealed no significant difference in positive pregnancy rates between these two groups. Furthermore, we found no relationship between semen parameters and pregnancy success in cases of unexplained infertility.

However, in male infertility, pregnancy rates were observed to increase in patients with higher post-wash TPMSC and, notably, higher pre-wash progressive motile sperm density. We believe that evaluating post-wash TPMSC and pre-wash total progressive motile sperm density will be effective in predicting pregnancy before IUI in male infertility, potentially avoiding unnecessary IUI cycles. Comprehensive studies are still needed in this area to refine pregnancy prediction.

Additional Information: Preliminary data of this study were presented orally at NICHE2024; 16th National and 2nd International Histology and Embryology Congress on 26-28 September 2024.

Ethics Committee Approval: Our study received approval from the Ethics Committee for Non-Interventional Clinical Studies of Gaziantep Islam, Science and Technology University (numbers 2023/342 and 342.33.08). Additionally, institutional approvals were obtained from Gaziantep Cengiz Gökçek Maternity and Child Diseases Hospital and Gaziantep Provincial Health Directorate.

Informed Consent: Written informed consent was obtained from the legal guardians of all participating patients.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no competing interests.

Author Contributions: Concept: Ç.K.; Design: Ç.K., S.K.; Supervision: Ç.K.; Materials: S.K., A.G., D.A.D.; Data Collection and/or Processing: A.G., D.A.D.; Analysis: Ö.A.; Literature Review: Ç.K., S.K., Ö.A.; Writing: Ç.K.; Critical Review: S.K., D.A.D.

Financial Disclosure: No financial support was obtained for this study.

REFERENCES

- Brugo-Olmedo S, Chillik C, Kopelman S. Definition and causes of infertility. *Reprod Biomed Online*. 2001;2(1):173-85. doi:10.1016/S1472-6483(10)62193-1.
- Collins J, Crosignani P. Unexplained infertility: a review of diagnosis, prognosis, treatment efficacy and management. *Int J Gynaecol Obstet*. 1992;39(4):267-75. doi:10.1016/0020-7292(92)90257-J.
- Infertility GGoU, Romualdi D, Ata B, et al. Evidence-based guideline: unexplained infertility. *Hum Reprod*. 2023;38(10):1881-90. doi:10.1093/humrep/dead150.
- Punab M, Poolamets O, Paju P, et al. Causes of male infertility: a 9-year prospective monocentre study on 1737 patients with reduced total sperm counts. *Hum Reprod*. 2017;32(1):18-31. doi:10.1093/humrep/dew284.
- Tournaye H, Krausz C, Oates RD. Novel concepts in the etiology of male reproductive impairment. *Lancet Diabetes Endocrinol*. 2017;5(7):544-53. doi:10.1016/S2213-8587(16)30040-7.

6. Agarwal A, Baskaran S, Parekh N, et al. Male infertility. *The Lancet*. 2021;397(10271):319-33. doi:10.1016/S0140-6736(20)32667-2.
7. Ateş E, Akdağ A, Kol A, Turan ÖD, Erol H. Bir üniversite hastanesi'nin intrauterin inseminasyon deneyimi: Gebelik oranı ve ilişkili faktörler. *Androl Bul*. 2021;23(2):82-6. doi:10.24898/tandro.2021.85619.
8. Montoya JM, Bernal A, Borrero C. Diagnostics in assisted human reproduction. *Reprod Biomed Online*. 2002;5(2):198-210. doi:10.1016/S1472-6483(10)61624-0.
9. Kruger TF, Menkveld R, Stander FSH, et al. Sperm morphologic features as a prognostic factor in in vitro fertilization. *Fertil Steril*. 1986;46(6):1118-23. doi:10.1016/S0015-0282(16)49891-2.
10. Solakhan M, Demir M. Effects of Sperm Parameters on Pregnancy Rate in Patients Undergoing Intrauterine Insemination. *Gynecol Obstet Reprod Med*. 2020;26(3), 199-202. doi:10.21613/GORM.2020.1040.
11. Mohammadi F, Mehdinia Z, Ghasemi S, et al. Relationship between sperm parameters and clinical outcomes of Intra Uterine Insemination (IUI). *Caspian J Intern Med*. 2021;12(1):70. doi:10.22088/cjim.12.1.70.
12. Ombelet W, Dhont N, Thijssen A, Bosmans E, Kruger T. Semen quality and prediction of IUI success in male subfertility: a systematic review. *Reprod Biomed Online*. 2014;28(3):300-9. doi:10.1016/j.rbmo.2013.10.023.
13. Group ECW. Intrauterine insemination. *Hum Reprod Update*. 2009;15(3):265-77. doi:10.1093/humupd/dmp003.
14. Wainer R, Albert M, Dorion A, et al. Influence of the number of motile spermatozoa inseminated and of their morphology on the success of intrauterine insemination. *Hum Reprod*. 2004;19(9):2060-5. doi:10.1093/humrep/deh390.
15. Mehrafza M, Nobakhti N, Roushan ZA, Oudi M, Dashtdar H, Oudi M, Hosseini A. The correlation between semen parameters and pregnancy outcome after intrauterine insemination. 2003.
16. Zhang E, Tao X, Xing W, Cai L, Zhang B. Effect of sperm count on success of intrauterine insemination in couples diagnosed with male factor infertility. *Mater Sociomed*. 2014;26(5):321. doi:10.5455/msm.2014.26.321-323.
17. Luco SM, Agbo C, Behr B, Dahan MH. The evaluation of pre and post processing semen analysis parameters at the time of intrauterine insemination in couples diagnosed with male factor infertility and pregnancy rates based on stimulation agent. A retrospective cohort study. *Eur J Obstet Gynecol Reprod Biol*. 2014;179:159-62. doi:10.1016/j.ejogrb.2014.05.003.
18. Sinha P, Pandey K, Srivastava A. Factors determining successful intrauterine insemination. *Int J Reprod Contracept Obstet Gynecol*. 2017;6(9):3887-91. doi:10.18203/2320-1770.ijrcog20174028.
19. Hajder M, Hajder E, Husic A. The effects of total motile sperm count on spontaneous pregnancy rate and pregnancy after IUI treatment in couples with male factor and unexplained infertility. *Med Arch*. 2016;70(1):39. doi:10.5455/medarh.2016.70.39-43.
20. Ahinko-Hakamaa K, Huhtala H, Tinkanen H. Success in intrauterine insemination: the role of etiology. *Acta Obstet Gynecol Scand*. 2007;86(7):855-60. doi:10.1080/00016340701416895.
21. Chatterjee S, Bagchi B, Chatterjee A. Intrauterine Insemination- Can we make it more successful. *Int J Surg Med*. 2020;6(5):43. doi:10.5455/ijsm.Intrauterine-Insemination-108.
22. Huniadi A, Bimbo-Szuhai E, Botea M, et al. Fertility predictors in intrauterine insemination (IUI). *J Pers Med*. 2023;13(3):395. doi:10.3390/jpm13030395.
23. Merviel P, Heraud MH, Grenier N, et al. Predictive factors for pregnancy after intrauterine insemination (IUI): an analysis of 1038 cycles and a review of the literature. *Fertil Steril*. 2010;93(1):79-88. doi:10.1016/j.fertnstert.2008.09.058.
24. Huang HY, Lee CL, Lai YM, et al. The impact of the total motile sperm count on the success of intrauterine insemination with husband's spermatozoa. *J Assist Reprod Genet*. 1996;13:56-63. doi:10.1007/BF02068871.
25. Van Voorhis BJ, Barnett M, Sparks AET, et al. Effect of the total motile sperm count on the efficacy and cost-effectiveness of intrauterine insemination and in vitro fertilization. *Fertil Steril*. 2001;75(4):661-8. doi:10.1016/S0015-0282(00)01783-0.
26. Cohlen BJ, te Velde ER, van Kooij RJ, Looman CW, Habbema JD. Controlled ovarian hyperstimulation and intrauterine insemination for treating male subfertility: a controlled study. *Hum Reprod*. (Oxford, England). 1998;13(6):1553-8. doi:10.1093/humrep/13.6.1553.
27. Yavuzcan A, Yurtçu E, Keyif B, Osmanlioğlu Ş. Is There Any Effect of Change in Pre-Wash and Post-Wash Semen Parameters on the Success of Intrauterine Insemination? *J Pers Med*. 2023;14(1):43. doi:10.3390/jpm14010043.
28. Hansen KR, Peck JD, Coward RM, et al. Intrauterine insemination performance characteristics and post-processing total motile sperm count in relation to live birth for couples with unexplained infertility in a randomised, multicentre clinical trial. *Hum Reprod*. 2020;35(6):1296-305. doi:10.1093/humrep/deaa027.
29. Lin H, Li Y, Ou S, et al. Role of the total progressive motile sperm count (TPMSC) in different infertility factors in IUI: a retrospective cohort study. *BMJ Open*. 2021;11(2):e040563. doi:10.1136/bmjopen-2020-040563.
30. Abd-Alkreem AH, Muhammed YH. Pregnancy Predictors after Intrauterine Insemination in Case of Unexplained Infertility. *Med J Tikrit Uni (MJOTU)*. 2022;28(2). doi:10.25130/mjotu.28.2.2.