DOI: https://doi.org/10.30546/19023.978-9952-610-40-6.2025.5109.
E-ISBN: 978-9952-610-40-6

EFFECTS OF COVID-19 VACCINES ON MALE FERTILITY AND SEMEN PARAMETERS: A NARRATIVE REVIEW OF CURRENT EVIDENCE

Görkem AKÇA[1*]

[1]Department of Urology, Recep Tayyip Erdoğan University Training and Research Hospital, Rize, ORCİD: 0000-0002-7019-4264

Abstract

Background: Concerns regarding the potential impact of COVID-19 vaccines on male fertility have contributed to vaccine hesitancy in certain populations. Although SARS-CoV-2 infection has been associated with impaired semen parameters and hormonal alterations, the effects of COVID-19 vaccination on male reproductive health remain a topic of ongoing investigation.

Objective: This review aimed to summarize the current evidence regarding the effects of different COVID-19 vaccine platforms on sperm parameters, reproductive hormones, and male fertility.

Methods: A narrative review of the literature was conducted using the PubMed, Scopus, and Web of Science databases. Studies published between December 2020 and January 2026 were searched using the keywords “COVID-19 vaccine”, “male fertility”, “sperm parameters”, “semen analysis”, and “reproductive hormones”. Clinical studies evaluating semen parameters or reproductive hormones in vaccinated men were included. Due to methodological heterogeneity among studies, findings were analyzed qualitatively.

Results: Current evidence suggests that COVID-19 vaccines, including mRNA, viral vector, and inactivated vaccines, do not cause clinically significant deterioration in semen parameters. Most prospective studies reported no significant changes in semen volume, sperm concentration, motility, morphology, or total motile sperm count following vaccination. Some studies have described temporary fluctuations in sperm concentration or total motile sperm count after vaccination; however, these changes appear to be transient and return to baseline levels during follow-up. Additionally, several studies indicate that vaccination may indirectly protect male reproductive health by preventing SARS-CoV-2 infection, which itself has been associated with impaired spermatogenesis and inflammatory damage to testicular tissue.

Conclusion: Current evidence strongly supports that COVID-19 vaccines do not adversely affect male fertility or semen quality. Considering the potential negative reproductive effects of SARS-CoV-2 infection, the benefits of vaccination outweigh the theoretical risks related to male reproductive health.

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Keywords: COVID-19 vaccine, male fertility, sperm parameters, semen analysis,

Introduction

Following the global pandemic caused by SARS-CoV-2, several COVID-19 vaccines were rapidly developed and widely implemented. Clinical trials and real-world data have demonstrated that these vaccines significantly reduce mortality, disease severity, and hospitalization rates. However, concerns regarding potential adverse effects have emerged, particularly regarding reproductive health. Vaccine hesitancy has increased in some populations due to misinformation, conspiracy theories, sociopolitical factors, and religious beliefs. One of the most frequently discussed issues has been the potential impact of COVID-19 vaccines on male fertility.

Previous studies have reported that SARS-CoV-2 infection itself may negatively affect male reproductive function, leading to impaired semen parameters, reduced testosterone levels, and an increased risk of erectile dysfunction. Therefore, evaluating the potential effects of COVID-19 vaccination on male reproductive health is of considerable importance. The aim of this review is to summarize the current literature regarding the effects of COVID-19 vaccines on sperm parameters, reproductive hormones, and male fertility.

Methods

This study was designed as a narrative review evaluating the potential effects of COVID-19 vaccines on male reproductive health and sperm parameters. A comprehensive literature search was performed in the PubMed, Scopus, and Web of Science databases. The search included the following keywords: “COVID-19 vaccine”, “male fertility”, “sperm parameters”, “semen analysis”, and “reproductive hormones”. Articles published in English between December 2020 and January 2026 were considered.

Clinical studies evaluating semen parameters—such as semen volume, sperm concentration, motility, morphology, and total motile sperm count—and/or reproductive hormones in vaccinated men were included in the review. Studies investigating different vaccine platforms, including mRNA vaccines (e.g., BNT162b2 and mRNA-1273), viral vector vaccines (e.g., Sputnik V) and inactivated vaccines (e.g., CoronaVac and BBIBP-CorV), were considered. Due to methodological heterogeneity among the included studies, a meta-analysis was not performed, and findings were analyzed qualitatively.

Results

mRNA Vaccines

mRNA-based COVID-19 vaccines function by delivering messenger RNA encoding the SARS-CoV-2 spike protein into host cells via lipid nanoparticles. The most widely used vaccines in this category include BNT162b2 (Pfizer-BioNTech) and mRNA-1273 (Moderna). During the pandemic, numerous studies investigated the potential effects of these vaccines on male fertility, particularly semen parameters.

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One of the earliest studies evaluating sperm parameters after BNT162b2 vaccination was conducted by Safrai et al., who included 43 men (14 infertile and 29 normozoospermic). Semen parameters were compared before and after vaccination, and no significant changes were observed in any parameter (Safrai et al., 2021).

Similarly, Gonzalez et al. evaluated 45 healthy men who received either the BNT162b2 or mRNA-1273 vaccine. Semen analyses performed approximately 75 days after the second dose showed no statistically significant changes in sperm concentration, motility, or total motile sperm count (Gonzalez et al., 2021). Lifshitz et al. also reported that semen parameters remained within the World Health Organization reference ranges after two doses of the Pfizer vaccine, suggesting no detrimental effect on male fertility (Lifshitz et al., 2021). However, Gat et al. reported a temporary decline in sperm concentration and total motile sperm count approximately three months after BNT162b2 vaccination. Importantly, these parameters returned to baseline levels during long-term follow-up, indicating that the effect was transient and unlikely to represent permanent gonadal toxicity (Gat et al., 2022).

Viral Vector Vaccines

Viral vector vaccines, such as ChAdOx1 nCoV-19 and Ad26.COV2.S, use adenovirus vectors to deliver genetic material encoding the SARS-CoV-2 spike protein into host cells.

Most studies evaluating these vaccines have reported no clinically significant adverse effects on semen parameters. In a prospective study including 101 vaccinated men, semen parameters were compared before and after vaccination, and approximately 20% of participants had received a viral vector vaccine. Interestingly, the study observed increases in sperm concentration, progressive motility, and total motile sperm count following vaccination. These findings were attributed to biological variation or differences in abstinence duration rather than a direct effect of vaccination. Overall, the authors concluded that both mRNA and viral vector vaccines do not negatively affect semen parameters (Massarotti et al., 2022).

Similarly, studies comparing different vaccine platforms have shown that COVID-19 infection may negatively impact sperm concentration and progressive motility, whereas vaccination does not cause significant alterations in semen parameters. Nevertheless, limited data suggest that viral vector vaccines may be associated with minor changes in sperm morphology or increased DNA fragmentation index. However, these findings are inconsistent and are generally based on small sample sizes, highlighting the need for larger studies (Lestari et al., 2023).

Systematic reviews and meta-analyses further support the conclusion that vaccinated and unvaccinated men do not differ significantly in semen volume, sperm concentration, total sperm count, motility, or morphology (Huang et al., 2023).

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Inactivated Vaccines

Inactivated COVID-19 vaccines are based on traditional vaccine platforms that contain chemically or physically inactivated SARS-CoV-2 viral particles. Common examples include CoronaVac and BBIBP-CorV.

Several studies have evaluated the potential impact of these vaccines on semen quality. A prospective study comparing semen parameters before and after two doses of CoronaVac found no significant changes in semen volume, sperm concentration, progressive motility, total motility, or normal morphology. However, a statistically significant but clinically limited decrease in total sperm count was reported in this study (Afşin ve ark., 2024).

Larger population-based studies have also demonstrated that inactivated vaccines do not adversely affect semen quality. For example, a large retrospective cohort study conducted in China reported increasing trends in sperm concentration, progressive motility, and total motile sperm count over time among vaccinated men. Interestingly, semen quality appeared to be better in individuals vaccinated during the recovery phase following COVID-19 infection, suggesting a potential protective role of vaccination in maintaining reproductive health (Zhao ve ark., 2024).

Overall, current evidence indicates that inactivated COVID-19 vaccines do not have a clinically significant negative effect on sperm parameters.

Discussion

Since the initiation of global vaccination campaigns, the potential effects of COVID-19 vaccines on male reproductive health have been widely debated. Concerns regarding possible fertility impairment have contributed to vaccine hesitancy in some populations. However, the current body of evidence suggests that COVID-19 vaccination does not cause clinically meaningful deterioration in semen parameters.

Multiple studies evaluating mRNA vaccines—including BNT162b2 and mRNA-1273—have consistently reported stable semen parameters following vaccination. Prospective studies comparing pre- and post-vaccination semen samples generally demonstrate no significant changes in semen volume, sperm concentration, motility, or morphology. Although a small number of studies have reported temporary decreases in sperm concentration or total motile sperm count, these alterations typically return to baseline levels during follow-up. This finding suggests that such fluctuations are more likely related to physiological variability rather than a direct gonadotoxic effect of vaccination.

Similar findings have been reported for viral vector vaccines, such as ChAdOx1 nCoV-19 and Ad26.COV2.S. Most available studies have not detected clinically significant effects on spermatogenesis. While minor alterations in sperm morphology or increases in DNA fragmentation

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index have been described in isolated reports, these findings remain inconsistent and are generally based on small cohorts.

Evidence regarding inactivated vaccines—including CoronaVac and BBIBP-CorV—also supports the absence of clinically relevant negative effects on semen quality. Most studies comparing semen parameters before and after vaccination have found no significant differences in semen volume, sperm concentration, motility, or morphology.

An additional important aspect highlighted in the literature is the potential indirect protective effect of vaccination. A growing body of evidence indicates that SARS-CoV-2 infection itself may impair male reproductive function through mechanisms such as systemic inflammation, oxidative stress, fever-induced suppression of spermatogenesis, and inflammatory damage to testicular tissue. The high expression of angiotensin-converting enzyme-2 (ACE2) receptors in testicular tissue further suggests that the testes may be susceptible to virus-related inflammatory processes. Therefore, preventing infection through vaccination may help protect male reproductive health by avoiding these pathological mechanisms (Carto et al., 2021).

Transient changes in semen parameters observed after vaccination may also be explained by systemic immune responses rather than direct testicular toxicity. Fever and cytokine-mediated inflammatory responses following vaccination can temporarily affect spermatogenesis. Similar short-term alterations have been observed after other routine vaccinations or febrile illnesses and typically normalize within a single spermatogenic cycle.

Despite these reassuring findings, several limitations should be considered. Many studies have relatively small sample sizes and are often conducted at single centers. In addition, follow-up durations are generally limited to several weeks or months, which may not fully capture long-term reproductive outcomes. Variability in abstinence duration, baseline fertility status, and study design may also contribute to heterogeneity across studies. Furthermore, relatively few studies have evaluated advanced reproductive parameters such as sperm DNA fragmentation, oxidative stress markers, or real-world fertility outcomes including pregnancy rates.

Future research should therefore focus on large-scale prospective studies with longer follow-up periods and standardized semen analysis protocols. Evaluating hormonal profiles, sperm functional tests, and real-world fertility outcomes would further clarify the long-term reproductive safety of COVID-19 vaccines.

Overall, the available evidence strongly supports that COVID-19 vaccines do not adversely affect semen parameters or male fertility. Considering the potential negative reproductive consequences of SARS-CoV-2 infection, the benefits of vaccination clearly outweigh any theoretical risks related to male reproductive health.

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