Type of the Paper (Systematic Review)

The Effect of COVID-19 Vaccines on Male Sexual Health and Satisfaction

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Received: 2 December, 2024 Reviewed: 1 March, 2025
Accepted: 24 May, 2025 Published online: 26 June 2025

Abstract:

Introduction: While the primary focus of COVID-19 vaccines has been on preventing severe illness and death related to COVID-19, there are several indirect ways in which these vaccines may positively impact male sexual function.

Aim of the study: To provide a comprehensive overview of the evidence surrounding this issue, offering insights into how vaccination might intersect with male sexual health.

Methods: We searched the Cochrane Library, Web of Science, PubMed, and Scopus for relevant articles. We utilized a strategy for our search by combining these keywords: (‘’COVID-19’’ OR ‘’ COVID-19 vaccine’’) AND (‘’ Sexual health ‘’ OR ‘’ Sexual function ‘’ OR ‘’ Erectile dysfunction ‘’ OR ‘’ semen analysis‘’). Quality evaluation of the involved studies was assessed to Cochrane’s risk of bias tool (ROB).

Results: We found that the COVID-19 vaccination may positively affect the male sexual function and lead to improvement of the sperm parameters, sexual satisfaction, sexual desire, and erectile dysfunction.

Conclusions: By contributing to overall well-being and reducing the complications associated with COVID-19, vaccines can support a healthier and more fulfilling sexual life. Vaccination causes positive improvements in sexual functions and anxiety.

Keywords: COVID-19 infection; COVID-19 vaccine; Sexual health; Sexual function; semen analysis.

1. Introduction

Global health has been profoundly impacted by the COVID-19 pandemic, influencing various aspects of medical and personal well-being. Among the many questions that have emerged in the wake of this global health crisis is the potential role of COVID-19 vaccines on the sexual function of males [1]. As vaccination campaigns have rolled out worldwide, there has been increasing interest in understanding the broader implications of these vaccines beyond their primary role in preventing

COVID-19. COVID-19 vaccines, including those created by Johnson & Johnson, Moderna, and Pfizer-BioNTech, have gone through extensive testing to ensure their safety and efficacy. They act by stimulating the immune system to fight and identify the SARS-CoV-2 virus, which causes COVID-19 [2]. These vaccinations have been essential in lowering the number of COVID-19-related deaths, hospitalizations, and severe illnesses. The COVID-19 vaccine's most frequent adverse effects are moderate and transient, such as injection site soreness, exhaustion, headaches, and mild fever. However, as with any medical intervention, there have been reports of less common and more concerning side effects [3].

Sexual function is a complex interplay of physiological, psychological, and hormonal factors. Any potential impact of COVID-19 vaccines on male sexual function warrants careful examination, given the significance of sexual health to overall quality of life [4]. It is essential to consider that changes in sexual function may be influenced by various factors unrelated to the vaccine itself. The stress and anxiety associated with the pandemic, the vaccination process, or the ongoing global health crisis can affect sexual function [5]. Additionally, the stress of dealing with the pandemic and concerns about vaccine side effects could contribute to psychological factors that impact sexual health [6].

There have been anecdotal reports and some studies suggesting that individuals might experience changes in sexual function following vaccination. Concerns have included potential impacts on libido and erectile function [7]. However, most of these concerns are based on limited evidence or personal reports rather than large-scale clinical studies. Research into any direct biological impact of COVID-19 vaccines on sexual function is still ongoing. For instance, there have been theoretical discussions about whether the immune response triggered by the vaccine might affect hormonal or vascular systems, but no definitive evidence has been found linking the vaccines to changes in testosterone levels or other factors directly affecting sexual function [8]. As of now, the majority of research and clinical trials have not identified significant long-term effects of COVID-19 vaccines on male sexual function. The available evidence suggests that any reported changes in sexual function are not commonly associated with vaccination and may often be attributed to other factors [9].

Another dimension is the public's trust in medical recommendations. Vaccine hesitancy, fueled by misconceptions, underscores the importance of transparent and accessible communication. Addressing myths about the vaccines' impact on sexual and reproductive health requires collaboration between scientists, healthcare providers, and media outlets. Clarifying the distinction between transient side effects and long-term health risks is critical to dispelling fears and encouraging informed decision-making [9].

Overall, the goal is to provide a comprehensive overview of the evidence surrounding this issue, offering insights into how vaccination might intersect with male sexual health and guiding future research directions to ensure that vaccination programs continue to support holistic well-being.

2. Methods

2.1. Information Sources and Search Strategy

We performed this study based on the PRISMA guidelines and recommendations [10].

We utilized a strategy for our search by combining these keywords: (''COVID-19'' OR '' COVID-19 vaccine'') AND ('' Sexual health '' OR ''Sexual function '' OR '' Erectile dysfunction ''OR '' semen analysis ''). Regarding the sources of data, we utilized Cochrane Library, Google Scholar, Web of Science, PubMed, and SCOPUS databases in the search process. We searched these databases till August 2024.

2.2. Study selection

We started by screening the titles and abstracts. We then carried out a full-text screening. Finally, we chose the qualifying articles by the following eligibility requirements: Case cohort: Adults had COVID-19 vaccines, Control cohort: Adults did not get the COVID-19 vaccines, Intervention: Assessing sexual health of the involved individuals, and Outcomes: Sperm parameters, sexual satisfaction, erectile dysfunction, and orgasmic function.

2.3. Subjects

Inclusion criteria

We included papers that met our eligibility criteria, which were recent studies above 2010, studies that included only males, studies that evaluated male sexual health, double-arm studies that had case and control cohorts, and articles in English. We chose observational studies and blind or non-blind and non-randomized or randomized controlled clinical trials (RCTs).

Exclusion criteria

We excluded reviews, surveys, abstracts, and meta-analyses. Also, we excluded single-arm studies that assessed only one group and studies in languages other than English.

2.4. Quality evaluation

As we involved only observational studies, we used the Cochrane ROB assessment that evaluates 14 categories in each clinical study [11]. Each study got a score from 1 to 14, and the overall average score was calculated.

2.5. Data extraction

Two different categories of data were taken from the included papers. The first type includes the demographic information about the patients involved and the data of baseline data for our results. The second type was data on quality assessment. Microsoft Excel was used to carry out the data collection process [12].

3. Results

3.1. Summary of the involved articles

The results of our search are demonstrated in the PRISMA flow chart (**Figure 1**). In this systematic review, we involved four studies (13-16) that met the inclusion criteria of our systematic review. Our study involved 752 individuals. The average age of the included individuals was 36.3 years. **Table 1** reveals the baseline characteristics of the involved individuals and studies.

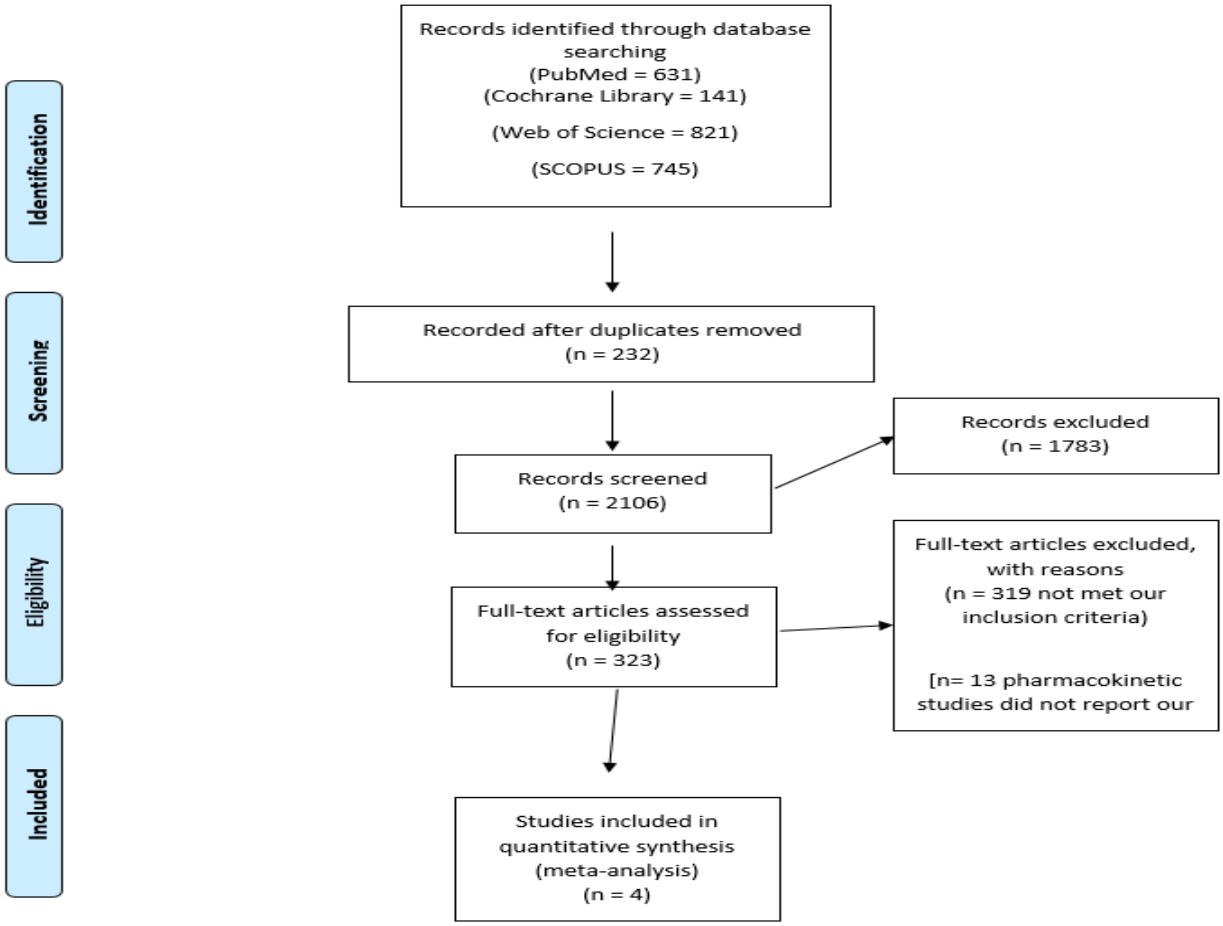

Figure 1: Literature search's PRISMA flow diagram.

Table 1: The baseline characteristics of the involved individuals and studies.

Study ID	Country	Study design	Sample size	Age (years)	Marital status	
					Married	Single
Mehta et al., 2023	India	Questionnaire	465	38	NR	NR
Başer et al., 2023	Turkey	prospective cross-sectional	170	36.91	140	30
Safrai et al., 2022	Palestine	Cohort	72	35.7	11	14
Gonzalez et al., 2021	USA	Single-center prospective	45	NR	NR	NR

3.2. *Results of quality assessment*

Since this review included four observational studies (13-16), their quality was assessed using Cochrane's tool. Cochrane's tool indicated that the observational studies' mean score was 10.7 out of 14. The quality evaluation of the observational studies is shown in detail in **Table 2.**

Table 2: The quality evaluation of the involved studies.

	Mehta 2023	**Başer 2023**	**Safrai 2022**	**Gonzalez 2021**
1. Was the paper's goal or research question made clear?	1	1	1	1
2. Was the target population for the study well-defined and specified?	1	1	1	1
3. Was at least 50% of the eligible individuals participating?	1	1	1	1
4. Did all the participants come from the same or comparable populations, and did they all participate over the same period?	0	1	1	1
5. Was there a power description, an explanation for sample size, or estimates of effect and variance?	0	0	0	0
6. Were the exposure(s) wanted to be measured before the outcome(s) were determined for the analysis in this paper?	1	1	1	1
7. Was the duration such that, if a relationship between outcome and exposure existed, one could fairly anticipate seeing it?	1	1	1	1
8. Was the relationship between different exposure levels and outcomes for exposures that can change in quantity or degree (such as exposure categories or exposure measured as a continuous variable) examined in the study?	1	1	1	1
9. Were the measures of exposure, or independent variables, well-defined, legitimate, dependable, and applied similarly to every study participant?	1	1	1	1
10. Was there a repeated evaluation of the exposure(s) throughout time?	1	0	0	0
11. Were the dependent variables, or outcome measurements, properly defined, dependable, valid, and applied similarly to every study participant?	1	1	1	1
12. Were the people evaluating the results blinded to the participants' exposure status?	*	*	*	*
13. Was the follow-up loss 20% or less of the baseline?	1	1	1	1
14. Has the impact of important potential confounding variables on the link between outcome(s) and exposure(s) been quantified and statistically adjusted?	1	0	1	1
Total score (out of 14)	11/14	10/14	11/14	11/14

*0 = No, Key: 1 = Yes, N/A = Not applicable, * = Not reported.*

Table 3: The changes in male sexual health after COVID-19 vaccination.

Author	Vaccines	Outcomes
Mehta et al., 2023 [13]	Variable	• How did the COVID-19 vaccinations affect male sexual activities? 71% of respondents had no effect, 3% had a negative effect, 2.7% had a positive effect, and 23.3% were unable to determine the effect. • The age category of the participants and the amount of time that had passed since vaccination: There was no effect regardless of the subjects' ages or the amount of time that had passed since vaccination. • Male sexual functions, such as orgasmic function, erectile function, satisfaction during intercourse, and overall sexual satisfaction, are unaffected by the COVID-19 vaccinations.
Başer et al., 2023 [14]	Variable	• The subjects' intercourse times were the only ones to significantly increase after taking the vaccine (p =0.034). • The median Beck anxiety inventory score before vaccination was 19; after vaccination, it was 17 (p <0.001). • Following vaccination, Arizona Sexual Experiences Scale (ASEX) ratings were lower (median: 10) than they were before vaccination (median: 12) (p <0.001). • The post-vaccination International Index of Erectile Function (IIEF) score increased (p <0.001) from 24.71 ±7.10 to 25.49 ±6.50. • Orgasmic function, intercourse satisfaction, and sexual desire all showed improvements (p =0.013, p =0.0001, p =0.001, p =0.027).
Safrai et al., 2022 [15]	BNT162b2	• The interval spanning from the initial vaccination to the sperm analysis following vaccination was 71 days. • Sperm volume before vaccination was 3.0 (2.0–4.0) and following vaccination was 3.0 (1.6–3.9) ml, p =0.02. • Sperm concentration before vaccination was 26.5 (14.0–64.7) and following vaccination was 31.0 (14.2–80.0) 106/ml, p =0.35. • Total motile sperm count before vaccination was 33.7 (9.0–66.0) and following vaccination was 29 (6.0–97.5). • For patients with normal semen analyses and those with male infertility, subgroup studies were performed. • After vaccinations, there were no discernible differences in any subgroup. • Among men with an abnormal and normal semen examination, sperm parameters did not significantly change following vaccination. Thus, it appears that sperm parameters are unaffected by the BNT162b2 vaccination.
Gonzalez et al., 2021 [16]	BNT162b2 and mRNA-1273	• The initial values of total motile sperm count (TMSC) and the baseline median sperm concentration were 36 and 26 million/ml, respectively. • Following the second dose of the vaccine, these values significantly increased to 44 million/mL (p =0.001) and 30 million (p =0.02), with corresponding increases in sperm motility and semen volume. • Before the vaccine, 8/45 men had a median concentration of 8.5 million/mL, and 7/45 had increased their sperm concentration to the range of normozoospermic at follow-up (median concentration of 22 million/ml). One-man experienced oligospermia after the vaccination.

4. Discussion

The COVID-19 vaccines have proven to be a crucial tool in combating the pandemic, with robust evidence supporting their safety and efficacy. However, emerging discussions and concerns about the potential impact of these vaccines on male sexual function have surfaced, driven by anecdotal reports and public interest [17]. Most studies conducted to date have not found direct, consistent evidence linking COVID-19 vaccines to significant changes in male sexual function. The clinical trials and post-marketing surveillance have primarily focused on the overall safety profile of the vaccines, with sexual function not being a primary endpoint. The vaccines work by stimulating an immune response against the SARS-CoV-2 virus [18]. Theoretically, this immune activation could impact various bodily systems, including the hormonal and vascular systems. However, no substantial evidence supports the idea that this immune response significantly affects sexual function [19]. There has been speculation about the impact of COVID-19 vaccines on vascular health, which could theoretically affect erectile function. Nonetheless, there is no concrete evidence indicating that the vaccines have adverse effects on blood flow or endothelial function that would impact sexual performance [20].

By preventing COVID-19, vaccines eliminate the risk of developing the disease, which can have a range of negative effects on sexual function. Severe COVID-19 infections have been associated with complications such as erectile dysfunction (ED) and decreased libido due to the systemic effects of the virus, including inflammation and vascular damage. COVID-19 can lead to long-term symptoms or "Long COVID," which may include fatigue, decreased libido, and psychological effects that impact sexual function [21]. Vaccination reduces the risk of developing severe COVID-19 and potentially mitigates the long-term symptoms associated with the disease [22].

It was said that the COVID vaccine had no adverse effects, even though there was insufficient information on how the vaccination affected sexual functions. Research on ED has shown that COVID-19 infection is more likely to cause ED than immunization [23]. Penile microvascular damage, penile endothelium damage, and the finding of COVID-19 particles in the tissue of the corpus cavernosa of infected

individuals after recovery all contribute to the pathogenesis (24). Rarely performed research compares the sexual state of men before and after vaccination. In a cross-sectional investigation of males who were vaccinated against COVID-19 and those who were not, Díaz et al. demonstrated that vaccination against the virus was not linked to an elevated incidence of ED [26]. Approximately 94.3% of respondents said that the COVID-19 vaccine had no appreciable impact on a man's ability to conceive. Of the remaining group (about 6%), two to 4% reported an improvement, and 2-4% reported a deterioration in most sexual functions. The length of sexual activity following vaccinations increased statistically significantly, despite an improvement in IIEF characteristics [26].

The study had no question about the number of partners—one or more. Multiple relationship choices may have been impacted by the COVID-19 pandemic's decline in social contact. There hasn't been a thorough investigation of how COVID-19 pneumonia affects the assessment of sexual health following vaccination. Men's sexual functioning may differ depending on their age before and after vaccination; however, this was not investigated in this study.

5. Conclusion

While the primary benefits of COVID-19 vaccines are related to preventing severe illness and death from COVID-19, there are several indirect positive impacts on male sexual function. These benefits are largely associated with improved overall health, reduced pandemic-related stress, and the restoration of normal activities. By contributing to overall well-being and reducing the complications associated with COVID-19, vaccines can support a healthier and more fulfilling sexual life. Vaccination causes positive improvements in sexual functions and anxiety.

Ethical committee approval: not applicable

Competing interests: All authors declare no conflict of interest.

Funding: This research is not funded.

AI declaration statement: None declared.

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