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Impact of Covid 19 Vaccine on Male and Female Fertility

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Abstract:

Background:
The COVID-19 outbreak has emerged as one of the most difficult global medical crises in a decade. SARS-CoV-2, the pathogen responsible for the disease, has contaminated more than 110 million individuals and resulted in over 2.30 million deaths worldwide within the first year of its emergence. The global scientific community has been working tirelessly to understand the virus, develop vaccines, and comprehend natural immunity.

Objective:
This review aims to explore the impact of COVID-19 on male and female fertility, with a primary focus on the mechanisms and effects of different COVID-19 vaccines on fertility.

Methodology:
We reviewed existing literature on the effects of SARS-CoV-2 on fertility and the various COVID-19 vaccines authorized for emergency use. Special emphasis was placed on the Pfizer-BioNTech, Moderna, and Johnson & Johnson–Janssen vaccines, which received emergency use approval from the U.S. Food and Drug Administration at the end of 2020 and the beginning of 2022.

Results:
The study will provide insights into the direct effects of the virus on male and female fertility and how different vaccines might influence these effects. Each vaccine has a unique mechanism of action, which may have varying implications for fertility.

Conclusion:
This review highlights the importance of understanding the interaction between COVID-19 vaccines and fertility, as this knowledge is crucial for informed decision-making regarding vaccination, particularly among individuals concerned about reproductive health. Further research is necessary to fully elucidate the long-term impacts of these vaccines on male and female fertility.

Keywords: SARS-CoV-2, COVID-19 pandemic, fertility, spike protein, ACE2 receptor, syncytin-1, COVID-19 vaccines, Pfizer-BioNTech, mRNA vaccines, reproductive health

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INTRODUCTION

In the end of 2019, a huge number of patients got effected by an unknown infection Wuhan China for the identification of this disease lots of tests were conducted result shows that symptoms are similar to the symptoms of severe disease of corona virus. Due to these similarities of the symptom's researcher termed these diseases as a name of severe acute disease of coronavirus. [SARS-COV-2] was spreading worldwide in a very short time. Cases of this diseases is more than 1.86 million this leads to the death of approximately 4 million deaths. March 11 [World Health organization] announce this diseases as a disaster due to large number of cases and deaths [1].Corona virus refers to the family of viruses named as corona viridiae, positive stranded RNA viruses. It contains a nucleoprotein which is surrounded by the genome of RNA, viral envelop, and a spikes protein. Spikes protein plays a critical function in receptor identification, cell adhesion, and merging throughout viral infection. They enter into the host cell with the aid of viral spike protein and with beneficiary cell ACE2.When ACE2 is connected with spikes protein the transmembrane protease serine 2 TMPRSS 2 divided the spike proteins into two subunits, on the host surface. Then the transcription and genome replication begin when viral entry releases the viral RNA[2].There are 1273 amino acids in corona spike protein that contains the sequence of VVNQN. With syncytin-1 [539 amino acids], a comparable but not comparable 5-amino-acid sequence [VVLQN] is generated at positions 378–382. [Homology is about 0.75 percent]. VVLQN is situated in a transmembrane component of syncytin-1 and is component of a heptad variable region at the point 363–391 [HRA2]. It has little fusion inhibitory activities and is not immediately accessible to antibodies. The fusion-causing sequences of syncytin-1 are predominantly found in its surface domain. According to UniProt alignments, that all the other related sequences are shortened [a maximum of three concordant consecutive amino acids], consequences in an overall identity of 7%.ACE 2 [angiotensin-converting enzyme] is a key receptor that role in the pathogenesis of covid. The cells in human that shows the maximum level of ACE 2 can be easily targeted by the virus [3].According to researches, it can be easily said that in male testes, seminiferous duct cells or spermatogonia have a high level of ACE 2 while in female ACE 2 intimate in ovary, uterus, vagina and placenta. The level of ACE 2 is varied according to the age, while TMPRSS an important priming enzyme plays a key role in the process. Whereas, in women Syncitin-1 direct effect on the fetus because it plays a vital role in placental trophoblastic formation. Syncitin-1 a protein that involve in implantation use to check the effects of covid-19 vaccine on fertility. High level of Syncitin-1 protein have a high chance of targeted by the virus[4].To control the virus scientist made different type of vaccine like Pfizer BioNTech, Moderna and Johnson and Johnson these are authorized by the U.S. [FDA] at the end of 2020 or early 2021, whereas Pfizer got fully accepted by the FDA on 23, August 2021.The main object is to inject the antibody or SARS-CoV-2- protein targeted T-cell production. The US United states [FDA] has passed 2 mRNA vaccines to prevent from COVID-19: the [Pfizer-BioNTech], which will be available on December 11, 2020, and the mRNA-1273 COVID-19 vaccine [Moderna], which will be available on 18 December, 2020.[ACIP] made an interim proposal on 12 December 2020 for use of a two-dose regimen of the Pfizer mRNA vaccine in persons aged 16 years [which was demonstrated to have 95 percent efficacy in prevention against COVID-19].On 19 December,2020,[ACIP] published a prescription for a double-dose schedule of mRNA-1273 vaccine [which has been founded 94 percent effectiveness in protection from COVID-19, including fatal disease. The immunization campaign's initial phase primarily targeted healthcare workers [HCWs] and inhabitants of long-time care facilities. The Pfizer vaccination is given in

two doses of 30 mg and 0.3 mL each, three weeks apart, intramuscularly. A comprehensive community study indicated that allergic responses to vaccines as 1.31 cases per million vaccination doses occur as a result of immunizations. [95 percent confidence zone 0.90–1.84], with no losses observed. Manifestations to the BNT162b2 mRNA vaccination may be common than with other types of vaccines, according to recent reports from the (CDC) [5].

Pfizer's freshly released mRNA CoV-2 vaccine was tested in a very large multicenter randomized controlled placebo-controlled trial. BNT162b2, a lipid nanomaterials nucleotide altered RNA that expresses the comprehensive SARS-CoV2 spike protein having two proline modifications, is used in the vaccine. The two 30 g dosages elicited SARS-COV2 neutralizing monoclonal antibodies were high, as were monoclonal antibody T lymphocytes+ and the T-helper subtype 1 cell type Myeloid+ T cell response. The week after the two doses, it was appeared to be 95 percent helpful in stopping SARS-CoV-2 infection. With an excellent safety profile throughout an average follow-up period of two months[6].

Pfizer, AstraZeneca, Moderna, and Janssen are the four covid vaccines. The pace with which the vaccinations were developed and approved initially raised some concerns. As the immunization programmed gathers traction, apprehensions regarding the vaccine's impact on future fertility have begun to surface. The effects of the recently approved vaccination on reproduction have been questioned in reports across several social networks, with little or no scientific proof to back up the assertions. Brief data is in short supply and will continue to be so for considerable time. Despite the fact that the effects on sexuality and reproductive health weren't really addressed in the early studies, presently, there really is no proof that the COVID-19 immunization affects future fertility... Contrary to popular opinion, expecting females are at so high chance of COVID-19-related outcomes including ICU admission and fatality, and even minor but terrible rise in placentas and stillbirth, underscoring the nessacity of vaccination for individuals expecting a pregnancy in the near future [7].Various fertility and obstetric societies have issued COVID-19 vaccine guidelines, and support and advice are constantly updated to reflect new scientific findings. " Currently there is really no indication that some COVID-19 vaccine impacts the fetus or fertility," the National Vaccination Advisory Panel and the Royal College of Physicians of Ireland declared in April 2021.Before February 2021, the Organization of Reproduction and Medical Researchers and the British Reproductive Institute put out a statement urging persons of breeding years to take a vaccine once it becomes accessible, while rejecting any relationship in between both the vaccine and fertility. That there is no any kind of proof, and no conceptual rationale, that none of the immunizations can affect women's or men's fertility [8].

The study hypothesizes that COVID-19 vaccines do not negatively impact male or female fertility, and any effects of SARS-CoV-2 on reproductive health are likely transient. The study aims to assess the impact of COVID-19 and its vaccines on fertility, with objectives to evaluate the virus's effects on reproductive systems, analyze vaccine effects on fertility, and address public concerns. The rationale is to provide evidence-based conclusions to guide healthcare decisions and counter misinformation about vaccine safety related to fertility.

MATERIALS AND METHODS

Literature Search: A systematic review was conducted across multiple databases, including PubMed, Springer, BMC, and Nature, to gather relevant peer-reviewed articles, clinical trials, and reviews published between 2020 and 2023. Keywords used in the search included "COVID-19," "SARS-CoV-2," "fertility," "reproductive health," "male fertility," "female fertility," "COVID-19 vaccines," "mRNA vaccines," "Pfizer-BioNTech," "Moderna," and "viral vector vaccines."

Inclusion and Exclusion Criteria: Studies were included if they specifically addressed the effects of SARS-CoV-2 or COVID-19 vaccines on fertility or reproductive health in humans. Exclusion criteria included studies focused on non-human subjects, those that did not directly address reproductive health, and articles lacking rigorous peer review.

Data Extraction: Relevant data were extracted from the selected studies, including study design, population characteristics, type of vaccine studied, outcomes related to fertility (such as sperm quality, hormonal levels, pregnancy outcomes), and any reported adverse effects on reproductive health.

Data Synthesis: The extracted data were synthesized to identify common findings, trends, and gaps in the literature. Special emphasis was placed on comparing the effects of different COVID-19 vaccines (mRNA and viral vector vaccines) on male and female fertility and identifying any potential mechanisms of action.

Ethical Considerations: The study was ethically cleared and all ethical considerations were taken into account. The ethical approval letter (IRB) Ref-IMBB/BBBC/22/879 was taken by the ethical approval board of The University of Lahore, Lahore, Pakistan.

Analysis: A qualitative analysis was conducted to evaluate the consistency and reliability of the findings across studies. Any discrepancies or conflicting results were critically analysed to provide a balanced interpretation of the evidence.

Limitations: The study acknowledges potential limitations, including the reliance on secondary data, potential biases in the included studies, and the evolving nature of the research on COVID-19 and its vaccines.

RESULTS

Taxonomy of SARS COV-2:

Covid-19 is a coronavirus subclass of the single-stranded RNA virus. People get infected by seven main viruses. 229E, NL63, OC43, and HKU1 are the first four that induce mild viral symptoms. SARS-CoV-1, MERS-CoV, and SARS-CoV-2, the other three, can induce more acute respiratory symptoms**.** Table-1 shows the classifications which is given below. Among recognized RNA viruses, SARS-CoV-2 seems to have the widest genome[9].

Using microscopic examination, the SARS CoV -2 membrane exhibits 20-nm spikes which resembled with a crown, hence the term coronavirus. The RNA sequence is wrapped in a coiled form by a nucleocapsid, which is adjoining by the viral capsid, similar to other viruses. The spike [S] proteins are linked to the capsid, and also has the structural protein contained in it. Throughout viral infection, these S proteins are essential for receptor identification, cell adhesion, and fusing. All humans' virus infections Aids, pneumonia, and Congo are among the viruses that contain S proteins, which are trimeric glycoproteins [10].

Table 1: Classifications of virus:

Sr no.	Virus with Mild viral symptoms	Virus with acute respiratory symptoms
1	229E	SARS-CoV-1
2	NL63	MERS-CoV
3	OC43	SARS-COV-2
4	HKU1	-

Mechanisms of Entrance of viral infection into host:

Severe acute respiratory is a coronavirus that is a single-stranded RNA virus. A nucleoprotein encasing an RNA genome, a viral coat, and a spike protein make up the virus. Throughout viral infection, the spike proteins are important for receptor recognition, adhesion, and fusion. The viral spike protein and the host cell receptor angiotensin-converting enzyme 2 help the virus get enter the cells [ACE2]. After the spike protein attaches to ACE2, the hosting cell's transmembrane protease serine 2 [TMPRSS2] primes the spike protein as well as other cellular proteolytic enzymes to divide it into two components. This enables for viral attachment and the introduction of viral RNA, allowing for the replication and transcription of the viral genome to commence [11].Several single-stranded RNA viruses, along with other coronavirus variations such as HIV, Mumps, and Zika, have been linked to cystitis and have been discovered in sperm. There is considerable confusion about SARS-capacity CoV-2's to attack the testis directly. The association of the SARS-CoV-2 Spike protein [S-protein] viral ligand to the host ACE2 receptor is thought to be the process of SARS-CoV-2 entrance. The S protein is then degraded by the serine protease co-receptor TMPRSS2, resulting in virus-cell transfection. On spermatogenesis, germinal epithelium tubules, Sertoli, and Leydig cells, the testes have a high level of ACE2 receptors. This receptor's intrinsic function isn't completely understood. In the male reproductive organs, ACE2 plays a regulatory role in steroidogenesis regulation. ACE2 receptors are also hypothesized to be involved in fertility. This link was discovered in a study that found decreased levels of ACE2 in infertile men with significant spermatogenesis defect relative to fertile men. The pathogenic S subunits and the [ACE2] agonist in the host genome [ACE 2] act as a mediator viral entry into host organism. When ACE2 receptor is banded by the S proteins, the infected cells surface [TMPRSS2] primes the S protein and other proteases to break it into S1 and S2 subunits as shown in Fig-1 given below [12]. Because ACE2 and [TMPRSS2] combinedly required for the entrance of virus, this essential issue promotes viral entry into in the host. When a virus enters the body, its RNA is set to release, and replication and gene regulation of the viral DNA begin. TMPRSS2 production is higher in men than in women. This is most likely owing to the fact that an androgen response element acts as a transcriptional promoter for TMPRSS2. Co-expression of ACE2 and TMPRSS2 is assumed to be essential for viral entrance inside cells [13]. For viral entrance into host tissue, both ACE2 and TMPRSS2 are necessary[14].

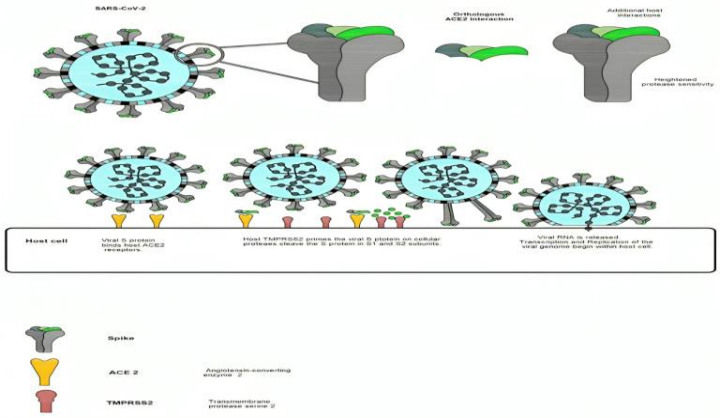

Fig-1: Mechanisms of virus

Covid 19 Sex Susceptibility:

Despite the deficiency of reliable data on the difference in COVID-19 occurrence between male and female, more males have been dying due to COVID-19 than women in 40 of 46 nations, or the net death case ratio is 2.4 time greater in male than female. Male sex vulnerability to more severe COVID-19 symptoms has been shown in epidemiological investigations. There have been a few explanations presented as to why there are sex disparities in Covid 2 results. Primarily, the ACE2 gene is found on the X chromosome's short arm. One of the X chromosomes is repressed in females, lead to the X chromosome to condense into a sex chromatin; nevertheless, some of genes , notably that present on the short arm, are unaffected [15].Because viral concentration is less common in females and ACE2 balance the hypertension system, which protects from vascular compromise and serious organ destruction, this upregulation of ACE2 may be beneficial against even the most serious COVID-19 symptoms [16].Next, lower testosterone levels in females are thought to play a role in TMPRSS2 expression on beneficiary plasma membranes and downregulation of this receptor. The androgen-responsive transcriptional promoter for TMPRSS2 was first discussed in the circumstances of the TMPRSS2-EGR fusion gene and prostatitis [17].

Covid-19 impact on reproduction:

Several studies have looked into the involvement of the SARS virus in sperm as shown in Table-2 which is given below. Including all research, there is no retroviruses particles were found in the sperm of male who were either infected or trying to recover**.** Only six out of 38 effectively infected cases were found to have the virus in one study, while viral proteins were noticed in one man's sperm sample in another. Sum up, based on existing research, it appears unlikely that Severe acute respiratory can be spread through sperm. This is less essential during critical infection because a person's respiratory drops are transmittable, but it is significant for sperm cryopreservation, intrauterine implantation or in fertility treatment using exclaim sperm in retrieve men.

Table 2. In sperm the appearance of virus after of before the covid 19 patients:

Study	Acutely Infected	Recovered
Kayaaslan [23] (n=16)	ND	ND
Best [24] (n=30)	ND	ND
Ruan [25] (n=74)	ND	ND
Holtmann [28] (n=34)	ND	ND
Song [29] (n=13)	Mark in 4 of 15 patients	ND
Li D [35] (n=38)	ND	Mark in 2 of 23 patients
Gacci [36] (n=43)	ND	Mark in 1 patient semen sample; Rest ND
Temiz [33] (n=20)	ND	ND
Li H [34] (n=23)	ND	ND

ND = Not Determined

There have also been mixed opinions involving sex hormones as shown in Table 3 describes. Two studies found no statistical difference in LH levels between COVID-19 cases and controls,3 findings strongly suggest that LH vastly expand in COVID-19 patients compared to controls, and one survey manifest that LH was reduced remarkably in COVID-19 patients versus controls. In one study, patients who had been retrieve back from COVID-19 weren't really compared to the control group, however the average LH amount was 3.95 μmol, is within the average limits.

Table 3 describe sex hormones levels of male with covid-19:

Study	LH	Testosterone
Ruan [25] (n=66)	Not compared to controls. The mean LH level in patients recovered from COVID-19 was 3.95 mIU/ml, SD 1.63.	Not compared to controls. The mean testosterone level in patients recovered from COVID-19 was 3.65 ng/ml, SD 1.19.
Temiz [33] (n=20)	Significant distinction between control and COVID-19 patients before treatment (p≤0.0001) and after treatment using Kruskal-Wallis's test (2.98 IU/L vs 3.22 IU/L vs 4.46 IU/L, p=0.04).	Statistical difference between control and COVID-19 patients before treatment and COVID-19 patients after treatment using Kruskal-Wallis Test (2.90 ng/ml vs 1.13 ng/ml vs 2.26 ng/ml, P=0.02).
Kadihasanoglu [38] (n=89)	Significant difference between COVID-19 patients and non-COVID-19 patients with respiratory tract infection and age-matched controls (5.67 U/L vs 5.39 U/L vs 4.1 U/L, p=0.0002).	Significant difference between COVID-19 patients and non-COVID-19 patients, age-matched controls (185.52 ng/dL vs 288.67 ng/dL vs 332 ng/dL, p=0.0001).
Guo TH [40] (n=41)	No statistically significant difference (3.6 U/L vs 3.6 U/L, p=0.1903).	No significant difference (3.6 ng/ml vs 3.5 ng/ml, p=0.93336).

In terms of testosterone, findings observed no significant distinction between COVID-19 patients and physical good condition controls, though average duration from noted diseases was announcing imperfectly. Two experiments searched that male with COVID-19 had noticeably low-level testosterone volume than controls. Afterwards, one study did not compare COVID-19 patients to controls, instead, discovered that the normalized level of testosterone was 3.65 ng/ml, which is within the standard range. It is unclear whether the increment in LH or declines in testosterone level are due to fiery disease or the direct impacts of SARS-CoV2 on testis cells, on the other hand Temiz discovered that the decline in testosterone throughout functioning infection appears to be short term and there is at lacking sufficient healing process after diagnosis, and Kadihasanoglu discovered a variation in LH and testosterone levels in those that suffer from COVID-19 versus non COVID acute respiratory infection. The majority of studies found an analysis significant reduction in semen parameters, overall semen count, and overall motile count**.** One research reveals that sperms factors going back to normal after the 30 days following COVID-19 detection, and the other discovered that there is no any measurable difference in semen quality among both controls, those who were effectively infected, for those who had been treated for COVID. According to one study, the severances of the disease—even the patient needed no hospitalization, or ICU admission—was varies contrarily to sperm parameters. Again, it is unsure whether the variations are due to febrile illness or the consequences of Severe acute respiratory on the cells in gamete formation, as febrile illness that is caused by viruses , such as varicella, influenza, and SARS, have been linked to lower testosterone count and motility, as well as abnormal morphology [11, 18].

Mechanism of action of vaccines:

Both of the Moderna and Pfizer/BioNTech vaccines use lipid nanoparticles with lipid membranes around the mRNA that expresses for the corona virus's S protein. The lipid membrane of the lipid nanoparticle will fuse with the membrane of host after injection, discharging the protein into the targeted nucleoid the mRNA for the S protein is then generated in the rear, culminating in the production of the S protein in plasma. MHC I and II breakdown the S protein and express it [MHC II]. Immunizing agent cells such as dendritic cells, and B lymphocytes, phagocyte include MHC II. T-helper cells use their protein called [TCR] to attach to the S protein fragment provided by the MHC II molecule, furthermore their CD4 ligand to bind to the MHC II molecule alone. IL10 are then generated by the T-Helper cell, be the cause of

B cells to grow and evolve into plasma cells. Primary antibody to the S protein segment is then set free by these plasmolysis cells. The initial T-Helper proliferates and forms T-Helper memory cells as a result of these interleukins as shown in Fig-2 which is shown below. By combining with S protein fragments generated by cells which is non immune through the MHC I component, cytotoxic T cells play a major role. The toxic T lymphocytes CD8 molecule will adhere to MHC I, although the cytotoxic T cell which contain TCR will attach to the S protein fragments. The cytotoxic T cell will subsequently generate cytokines, enhancing the T Helper cell's own advancement of B cell differentiation into plasma cell procreation. The cytotoxic T cell will also be prepared to attack any invading pathogens that later present with the corona virus's S protein. The AstraZeneca vaccine is made up of DNA that encodes for the S protein coiled in a chimpanzee adenovirus capsid. Autophagy is used to transfer the adenovirus and its DNA into the cell. The DNA is introduced into the cytosol once it is inside the cytoplasm. DNA is delivered to the nucleus of the cell, where it is synthesized into the mRNA, which coding for the S protein. The S protein is produced in the cytoplasm when this mRNA is transcribed in the [RER]. S protein is synthesized and presented via the MHC I and MHC II complexes by the immune and non-immune antigen presentation cells, just like the S protein synthesized by the mRNA vaccines above [19].

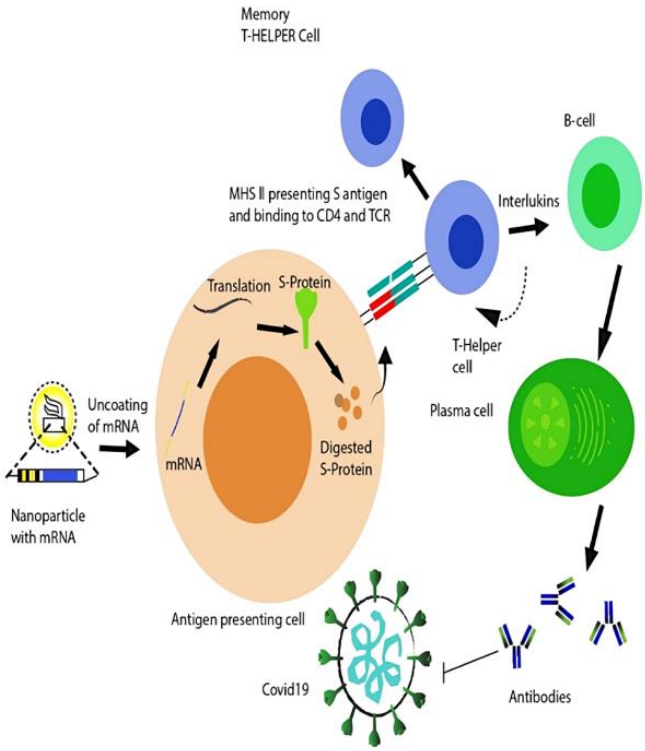

Fig-2: Mechanism of vaccine

Safety and effectiveness:

The research of COVID-19 immunizations had already explored two phases: the typical utilization of DNA incorporated into a viral capsid and the more recent use of mRNA embedded inside a phospholipid membrane to generate a nanoparticle. The inclusion of animal cells or the demand for mRNA to pierce the nucleus of the cell and eventually unite into the host DNA are regarded to be features of mRNA vaccines. The poorer strength of mRNA, as proof by the need to keep these vaccine at extremely low temperatures, and a potentially reduced capability to assist the cellular synthesis of S

protein antigen are also disadvantages [4].The Pfizer-BioNTech COVID-19 vaccine has a 91.3 percent vaccination protection over COVID-19, as tested seven days just after second dosage and up to six months afterwards. According to medical study results, the Moderna vaccine was 94.1 percent effective in preventing laboratory-confirmed COVID-19 infection in patients who took two doses and showed no indications of infection earlier.The BNT162b2 mRNA COVID-19 vaccine is expected to be as useful for pregnant women as it was reported earlier for the general population over the same time period in this study: efficiency against declared infection is 96 percent, and effectiveness against systemic infections is 97 percent, according to the findings. After obtaining the second dose of immunization, it takes 7-56 days to see results [20].A maximum of 31,000 people has been given the Moderna vaccine, with a placebo and non-placebo group [vaccinated]. From day 0 and day 28, both participants received injections. Both the placebo and immunized groups were examined for clinical manifestations 2 weeks after the second dose.185 people in non-placebo group developed pathological changes, whereas 11 people in the immunized group developed clinical symptoms. There have been 30 extreme incidents as among 185 participants in the placebo group, whereas there was nothing among those who obtained the vaccine [21].

This consequences in a high productivity of 95 percent against the onset of clinical symptoms and a maximum efficiency of 100 percent against the development of chronic disease. The Pfizer/BioNTech vaccine was administered to 43,000 people, who were divided into placebo and immunized groups and delivered injections on days 0 and 21. The trial was exposed seven days after the second dosage was given, and individuals having clinical symptoms were classified. 162 people in placebo category and 8 people in the immunized category had clinical symptoms. This results in a 95 percent success against clinical symptoms. Nine of the 162 symptomatic patients in the Placebo group had serious illness, but only one in the vaccination group did. For all those who acquired clinical manifestations, this relates to an efficacy of roughly 87 percent against serious disease. At day O and again at day 28, the AstraZeneca/Oxford DNA vaccine or the meningococcal vaccine had been administered as a baseline, with a PCR test searching for disease rather than clinical signs as formerly stated at 2 weeks after the double dose. The study enrolled 12,000 people and got that it was 70% helpful in stopping contamination and 100% effective in preventing serious disease [22].

The Russian Federation's Sputnik V vaccine is a kind of DNA vaccine that used two unique types of adenovirus vectors, rAd26 and rAd5. The vaccination was given in the succeeding manner: either as the rAd26 or rAd5 adenovector was given first. This was proceeded by the administration of rAd26 5 days later and rAd5 21 days later. The efficacy of PCR was then purposive by comparing positive PCR instances between both the treatment and placebo category. Vaccine had a 91 percent efficacy in stay away from the infection, but there was no evidence on its power to inhibit fatal infection [23].

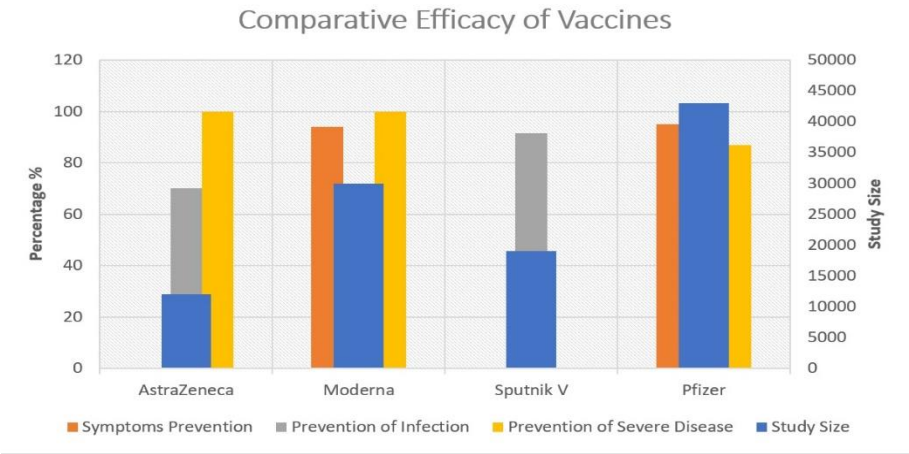

Fig-1: Efficiency of vaccines

MRNA Vaccination and their impact on human fertility:

According to current proofs Covid vaccine does not have any impact on human fertility. But two studies reveal that Moderna and Pfizer BioNTech have no any effect on sperm factors, comprising sperm volume, sperm concentration, semen quantity, sperm movement or net number of moving sperm. According to estimation oocyte and follicular steroidogenesis of vaccinated women does not show any kind of quality difference when resembling with female with no vaccine [10].Also, few IVF treatment parameters are reported, such as mature oocytes retrieved, number of oocytes, ratio of excellent quality embryo, or the fertilization rate, does not change after vaccination, they are same before and after vaccination. Researcher concluded that Covid-19 disease may lead to reduced proportion of TQEs. All These starting proofs, evidence, finding trying to say that vaccination does not have any kind of effect on the man or women reproductive system [24].

Vaccines impact on the health and reproduction of men's:

Pfizer, Moderna, and Janssen are the current three Covid 19 vaccine that is authorized by the US. AstraZeneca vaccine had not been accepted in US but accepted in UK. mRNA vaccines include Pfizer and Moderna vaccines are composed by the parts of mRNA that is extract by healthy cells, that codes spike protein from the mRNA, similar to one that are presented on surfaces of CoV 2, leading to immune identification of proteins then antibody is created for these proteins. These mRNA vaccines use a viral vector thus does not contain live viruses. The Oxford-AstraZeneca and Janssen /Johnson & Johnson vaccines use the technology of viral vector based, that attach the SARS-CoV-2 pieces, spikes proteins that is encoded by DNA combined to adenovirus that deliver to healthy cells. Still there is not any study that matched these two mechanics on the impact of semen parameters, fertility or sex hormones. Publicly it is concerned that the effect of vaccines on sperm and infertility, majority said conspiracy theories. Some fears that new mRNA vaccines or the misconception that DNA is altered by the virus that is enter in gametes with the help of spike proteins. Fact that pregnant women also been focused and extract from man or women both studies of progenitive potential in studies and utilize extremely effective method of remain moderate. All this related to the requirements for the clinical trials, and not concerned that vaccine is unsafe for offspring fertility or pregnancy [25]. Pain /reddishness /inflammation, tiredness, migraine, fevers and chills are the common issues reported in both studies .Injury ,right axillary splenomegaly ,spasmodic ventricular arrhythmia, Bell's palsy or right leg paresthesia are the rare but serious side effects [26].Vaccine have effect on the infertility of women or man, that vaccine can damage the placenta, leads to miscarriage, there is no evidence on this

statement. Covid vaccine does not have the composition of live attenuated virus thus they are not going to causing the increasing chance of subfertility, loss of trimester, miscarried or congenital anomalies. A study revealed that 45 men that is injected by 2 doses of vaccine does not show any deficiency in sperm rate while 45 out 8 men were oligospermic before vaccine, after vaccine they have decline in sperm concentration. It concluded that instead of live virus vaccine contain mRNA, unlikely vaccine affects S parameters. In another study it is clearly that vaccine does not affect the sperm parameters 43 male effected patients experience IVF after and before injecting the Pfizer mRNA vaccine. No differences in the parameters concluded total motile count, volume concentration, before and after vaccination. This study is not published or reviewed yet. Two other studies concluded that corona virus mRNA vaccine doesn't impact the male or female fertility. According to current all theories or data vaccines are safe and effective has no negative effect on fertility and sexual health [27].

SARS CoV 2 Vaccine Effect on Breastfeeding infants and Fetuses:

Although the mRNA micro particle and adenovirus vector SARSCoV-2 vaccines do not appear to cause a big threat to the beneficiary fetus, key questions about prenatal threat are still being answered. For example, it is unclear whether complete vaccination particles penetrate the placenta and reach fetal cells, however investigations of other phospholipid nanoparticle systems show that they do not. Clinical trials DART research data and tiny human trials are assisting in the clarification of such difficulties [28].People who are pregnant or breastfeeding should have the COVID-19 vaccine. Expectant mothers who have gotten mRNA are especially important for the baby. Antibodies to COVID-19 vaccinations were found in their mother's milk. SARS-CoV-2–specific immunoglobulin [6] A and IgG antibodies were identified in breast milk for 6 weeks following immunization in one of these trials. IgA production was also identified two weeks after immunization, accompanied by an increase in IgG four weeks later [a week after the second vaccine]. Antibodies found in the mother's milk of mRNA COVID-19–vaccinated people had substantial neutralizing effects, implying that the vaccine may protect the newborn from illness. Anti–SARS-CoV-2 IgG and IgM quantities in human milk were considerably higher among individuals who'd been breastfeeding for 2 years compared to those who were breastfeeding for much less than 2 years, according to a new analysis in respondents who reported that they were breastfeeding at the moment of COVID-19 vaccination[29].During one study, six women were assessed after receiving mRNA vaccines [5 is injected with Pfizer and 1 get Moderna], and there is no indications of vaccine mRNA was discovered in mother milk specimen collected within 3 days of immunization [30].One research of 20 mother–infant pairs found productive trans placental convey the anti-SARS-CoV-2 spike serum after prenatal vaccination only with BioNTech vaccine, as well as another discovered vaccine-derived IgA antibodies in breastmilk 1 month after vaccination with the Pfizer [n = 14] and Moderna [n = 9] vaccines. IgA antibody levels in breastmilk remained equivalent in the latter trial to the those of patients who had a spontaneous SARS-CoV-2 disease. Such observations should motivate breastfeeding women to get vaccinated, as any hypothetical dangers associated with vaccination are expected to be the same as in the common population. Furthermore, both of them Pfizer and Moderna are undertaking vaccination clinical testing in child, and Janssen expects to begin pre-clinical trials in teenagers in between March 2021, providing much-essential information on the vaccine's safety, cytotoxicity, and productiveness in these citizens [31].In contrast, 180 lactating women who received whether the Pfizer or the Moderna vaccination reported no significant side effects. As per study, after getting mRNA COVID-19 immunizations, individuals and their babies reported no to very minimal adverse effects Therefore, the efficacy of vaccination with either of the mRNA COVID-

19 vaccines in breastfeeding women and their breastfed children seems encouraging [32].

Covid-19 vaccine effect on pregnant women and fetuses:

Animal DART tests conducted by Pfizer/BioNTech, Moderna, and Janssen vaccines reported no detrimental effects on female reproduction, fertilization, fetal or embryonal or neonatal development, or abortion. Basic human investigations on mRNA-based vaccinations, such as those for the Zika virus, influenza virus, and rabies virus, have found that they are safe and immunomodulatory during gestation [33].Evidence on the utilization of the Pfizer/BioNTech and Moderna COVID-19 mRNA vaccines during gestation is scarce. According to the Centers for Disease Control and Prevention [CDC], roughly 25percent of women of reproductive age [15–49 years old] hospitalized with COVID19 during March 1 and August 22, 2020 were expectant, and pregnant women were more likely than no pregnant women to require ventilators. According to the CDC, women who are contaminated with COVID-19 during maternity are more likely to give birth prematurely. The COVID-19 mRNA vaccines from Pfizer/BioNTech and Moderna, which have been approved through an urgent use authorization [EUA], do not contain an adjuvant and are therefore not live vaccines [1]. In male and non-pregnant women, results from the Pfizer BioNTech mRNA BNT162b2 vaccine show a wide immunological response to the vaccination, comprising activation of neutralizing immune reaction, production of CD4 + cells, and development of functional memory CD8 + T cells [34]. Gray et al. found that mRNA-based COVID-19 vaccines produced rigorous humoral immune response in pregnant and lactating women, with antibody production and reactogenicity comparable to that seen in non-pregnant women, in a community sample involving 131 reproductive-age vaccine beneficiaries [84 pregnant, 31 breastfeeding, and 16 non-pregnant women]. They also discovered that protective immunoglobulins were transferred to newborns via the womb and breastmilk [35].

Pregnant woman is directly threatened by Covid-19, there is discussion about that mRNA vaccines are safe or not and still prolonged vaccination in this group. As we discuss, human syncitin-1 protein Cov-2 S protein is similar to this, but are in limited way. Two similar amino acids strains were found, when the small stretches of similarity were identified.in human body there is a low degree of similarity between any other proteins or S protein that is present in human body. The poor predict of allergenic cross-reactivity are the short contiguous amino acids matches. No cross reactivity occurs even with 8 amino acids, however over 80 amino acids 35 % identity are shared by proteins pair. Patients has no any kind of reactivity effect of syncitin-1 protein as when a women suffered with coved 19, Lu-culligan and Lwasaki analyzed her serum. However, the women that was vaccinated with Pfizer or Moderna vaccines have similar implantation or sustained implantation rates as compared to the women without vaccination. Th1 immunity induced from the mRNA vaccine like [Pfizer or modern] that trigger interferon-c CD8 T-cells response to pregnant women or man. Th1/Th2 immunity have a balance that is favorable obstetric outcomes which is good deal. From these results, it has been concerned that vaccine does effect to the immune system which leads to the pregnancy at risk. Although some studies reveals that there is reduced incidence of pregnancy obstacle and adverse results, like pretimed birth, miscarriages in normal women’s as well as vaccinated ones.

Table 4: Maternal outcomes of women before and after covid 19 vaccine:

Subject Character	Geographic area of focus	Pregnancy completed	Infection or vaccination in 3rd trimester	PROM	Pregnancy loss	Obstetric outcomes	Stillbirth	Preterm delivery	Vaginal	CS
USA	43	MEDIAN 37 WEEK	NP	18	NP	NP	5.6% (1/18)	55.6% (10/18)	44.4% (8/18)	0/8
UK	427	80.1% (342/427)	NP	266	1.5% (4/266)	1.1% (3/266)	24.8% (66/266)	40.5% (106/266)	59.5% (8/18)	26.9% (42/156)
Spain	60	56.7% (34/60)	NP	23	NP	8.7% (2/23)	78.3% (18/23)	21.7% (5/23)	20.0% (1/5)	
France	126	62.7% (79/126)	NP	126	NP	0/126	42.1% (53/126)	48.4% (61/126)	51.6% (65/126)	35.4% (23/65)
Turkey	533	44.7% (238/533)	NP	144	8.3% (12/144)	0.7% (1/144)	15.3% (22/144)	44% (131/144)	33.6% (87/144)	66.4% (87/133)
Saudi Arabia	288	38 WEEKS	NP	204	0/204	2.0% (4/204)	15.2% (31/204)	64.2% (131/204)	35.8% (73/204)	NP
India	162	NP	15.4% (25/162)	NP	16.7% (27/162)	1.2% (2/162)	36.4% (59/162)	63.6% (103/162)	NP	-
Turkey	75	57.3% (43/75)	NP	41	14.6% (6/41)	2.4% (1/41)	26.8% (11/41)	42.9% (18/41)	57.1% (23/41)	NP
China	116	91.4% (106/116)	NP	100	1.0% (1/100)	21.0% (21/100)	14.1% (14/99)	85.9% (85/99)	38.8% (33/85)	-
China	23	87.0% (20/23)	NP	23	13.0% (3/23)	NP	10.0% (2/20)	90.0% (18/20)	NP	-
China	118	63.6% (75/118)	NP	77	11.7% (9/77)	NP	18.2% (14/77)	7.4% (5/68)	92.6% (63/68)	60.3% (38/63)
Total	1971	63.4% (937/1478)	NP	1184	4.1% (35/855)	1.0% (11/1120)	21.4% (248/1161)	40.5% (465/1161)	59.5% (683/1148)	35.9% (137/382)
Israel	390	31.0% (121/390)	NP	57	0/57	NP	0/57	82.5% (47/57)	17.5% (10/57)	NP
CDC V-safe pregnancy	3958	25.7% (1019/3958)	NP	827	13.8% (114/827)	0.1% (1/827)	7.3% (60/827)	NP	NP	NP

Note: *CDC (Centre for Disease Control and Prevention), CS (caesarean section), NP (not provided), PROM (premature rupture of membranes*

As the above table shows, the lactating mothers who is infected by Covid -19 have a slightly chance of premature fracture of layer [8.3% versus 0.8%], preterm delivery [21.4% versus 7.3%], and stillbirth [1% versus o.1%] as compared to the vaccinated mothers. The newborn baby complications [like respiratory complications] from the vaccinated mother are similar to new born baby from the non-vaccinated ones. There is a miscarriage rate of 4.1% in Covid 19 patients. Diagnose the Covid 19 positive patient with attention and special care. However, it must be noted that impermanent women have a chance of Covid -19, but underestimate for the following 2 reasons.

1- In most of the cases infection was mild even if they have no symptoms.
2- Third trimester of pregnancy contain nearly 63% patients.

Often, in first trimester nearly 80% of pregnancy losses occurred.MRNA vaccines have undisputed impact on pregnant women. After 2 weeks, the SARS-COV-2 diseases in pregnant women that is vaccinated from the Pfizer starting reduce in contrast to unvaccinated lactating women. However, the maternal antibodies that are produced after vaccination or infection, can protect the newborn baby from the infection, so they have a great chance for pregnant female to be vaccinated. Recent working said that the fetus in which we transfer the Cov-19 specials antibodies have diminish among in patients who is infected in the 3rd trimester. In second trimester disease this deficiency has not been observed. Those who had been healthy from the SARS-COV-2 recently have an extreme ratio of maternal and string blood S-specific antibodies or the transfer ratio on delivery time. The pregnant women who take the Pfizer vaccine have a different transfer ratio measured from the S-specific antibody that we transfer into the placenta, reveals in the various studies. On the time of delivery or maternal vaccination there is increasing in duration associated with a higher transfer ratio.[36] After the first injection of Pfizer mRNA vaccine the maternal IgG cross the barrier of placenta within 15 days and then approaching the maternal titers that present in the fetus, at the 18th week of pregnancy or when the gestation period is at its peak then the maternal antibody passes through the placenta, and then the maternal vaccination is started during the early second stage of trimester of gestation have an optimum innate immunity against COV-19.If mother would be vaccinated within time then she would be protected from the infection as well protects her infant. When comparing the recent studies of vaccine extract antibody to flu, whooping cough, hepatitis B and measles, the neonatal antibody were satisfactory, women who has injecting the vaccine during the third trimester have a low placental transfer ratio. Transplacental antibodies in infant is highly effective then from the breast milk antibody for the protection. Those who are frontline health workers or lives in the high transmission area of infection should get the Covid-19 mRNA vaccine in third trimester [37].

MRNA vaccines and menstrual changes:

The UK's Central drugs Standard Control Agency lists harmful impact that are common in covid-19 immunization as a sore arm, cough, and tiredness and cramping. Changes in periods and unusual urethral perfusion are not mentioned, People who have been through these events, however, should get vaccinated. Are progressively approaching primary healthcare physicians and those working in reproductive health. After 2 September 2021, moreover 30 000 reports of those occasion made to yellow card surveillance system for all mRNA vaccines and the drug effect on them. The most of people who described a modification during their post-vaccination time, they discover that the relevant cycle goes back to normal, and, interestingly, there is no proof that this is the case. The mRNA vaccination has a negative impact on fertility. Unplanned pregnancies occurred in clinical testing.at comparable rates in vaccinated and no vaccinated individual's category [38].

The European medicines Agency [MHRA] states that an analysis of yellow card findings

not promote a connection between developments in menstrual cycles and covid-19 mRNA vaccines because the aggregate of results is small in comparison to the proportion of persons who have been vaccinated, as well as the prevalence of menstruation illnesses in general. Perhaps, the method used to collect yellow card data makes drawing firm result is difficult. Methodologies that are best prepared to make comparisons rates of menstruation fluctuation in vaccinated or unimmunized populations are required, and the Institute Of health and welfare in the United States has managed to make approximately two million [£1.2 million; €1.4 million] currently offered to stimulate this important research.

Menstrual developments have taken place following both mRNA vaccine and adenovirus vectored covid-19 vaccines**.** Implying that, if a link exists, it is most likely due to the innate immunity to immunizations or perhaps a particular vaccine portion. Immunizations against [HPV] papillomavirus has even been linked to menstrual irregularities. Evidently, innate immunity stimulation in response to exposure, which include viral infection, can distort the menstruation periods: in one study of lactating women, roughly a tiny fraction of those exposed to the virus with covid 19 experienced related to menstruation disruption [39].

Immune regulatory impacts on the hormone levels pushing the menstruation cycle or influence facilitated by white blood cells in the uterine wall, which are engaged in the economic cycle develop and breakdown of this tissue, are specific biological mechanisms connecting immune activation with menstruation changes. Investigation into the link between corona vaccines and menstruation altering could also help in understanding the methodology. Even though confirmed changes in the menstruation immunization are transient, thorough research into this potentially detrimental reaction is crucial to the effectiveness of the vaccine schedule. Vaccine concern among young ladies is largely motivated by baseless allegations that vaccines of corona will damage their possibility of successful pregnancy. Failure to reinvestigate findings of related to menstruation changes immunization is similarly to worsen these concerns. If a relation among both vaccination and menstruation changes would be founded, people would be able to plan for approach is helpful cycles. Concise and reputable data is especially necessity for those who depend on their ability to anticipate their menstrual periods to accomplish or prevent pregnancy [40].

One key insight is that the impact of surgical treatments on pregnancy should not be overlooked in future studies. Clinical studies include an ideal place for making a distinction between menses changing causing by therapies and those that happen naturally, but people involved are reluctant to tell changes to periods only if directly requested. Manses' and other genital blood loss data should be actually pursued in preclinical studies, such as testing of covid-19 vaccines [41].

Covid Vaccine; Pregnancy rates AND Menstrual cycles:

Several media sources have questioned whether COVID 19 immunizations are linked to menstrual cycle issues. However, among more over 71 million women's who have been vaccinated against coronavirus 2, the Vaccine Side Incident Notification System has still identified a tiny amount of moderate and temporary menstrual-related adverse effects [SARS-CoV-2].Similar worries were voiced about the human papillomavirus vaccine, which were eventually found to be false [42]. 36 couples getting IVF therapy 7–85 days after getting the mRNA COVID-19 vaccination were the subjects of Orvieto et al study's before and after acquiring the mRNA COVID19 vaccination, they observed no in-between cycle variations in ovulation induction and embryological characteristics. The effectiveness of the patients' ovarian function or subsequent IVF cycle were unaffected by the mRNA COVID-19 vaccination, they added [43].

On social sites, a method based just on resemblance between both the SARS spike protein and as well as syncytin-1, a protein intricate in pregnancy and uterus, was hypothesized to raise concerns about COVID-19 vaccines' potential negative effects on fertility. However, the supposed immunological responsiveness that could lead to unsuccessful implantation has been shown false; two proteins only utilize a four-amino-acid sequence. Moreover, antibodies generated following a spontaneous CoV-2 disease or COVID-19 immunization had been shown not to attach to syncytia. Furthermore, if cross reactivity did occur, natural antibodies generated by the sickness itself would promote sterility and have a long-term effect; however, has not been reported yet. A further incorrect notion regarding probable vaccine-related side effects is that COVID-19 vaccine mRNA develops in between ovaries. This false assertion stemmed from research in which rats were given a far larger dose of COVID-19 vaccination than people, and triglycerides from the vaccine amour assemble in the ovaries. The vaccine's additional elements and mRNA did not accumulate in the rat ovaries. Interestingly, a recent paper from the Healthcare Organizations in Europe reveals that following SARS based mRNA vaccination, there is a minimal bio distribution of mRNA in the testes and ovaries [42].

Furthermore, an another rat study found that the COVID-19 mRNA vaccination had no effect on efficiency of female pairings, ovulation, or any reproductive or uterus parameters.COVID-19 vaccination injection had no effect on throughout the end of lactation on blastocyst or neonatal survival, growth, or maturation in the posterity, according to this study [44].Corona disease and the Pfizer–BioNTech vaccination have no effect on ovarian follicular function in humans, according to a study conducted. Anti–SARS-CoV-2 antibodies were found in corpuscle plasma and sperms fluid in individuals going to the process of in vitro fertilization, so according findings from a preclinical studies [45]. Likewise, transplantation rates were comparing in between Pfizer live attenuated SARS-CoV-2–seropositive persons and Moderna vaccine–persuade SARS-CoV-2– seropositive [active vaccine], SARS-CoV-2– seropositive [active disease], and seronegative persons in a study of people trying conceiving using Deposit of frozen embryos [nonreactive]. The researchers noted that the 3 groups did not distinguish in terms of implantation rates, maintained pregnancy rates, or appearance of gestational sacs, as measured by serum human chorionic gonadotropin. This study was significant since it indicated that antibodies against the CoV-2 spike protein, although acquired from vaccination or infection with SARS-CoV-2, have no effect on embryo implantation or gestational development [46]. The animal and human research together show that there is no any kind of scientific proof that the COVID-19 vaccine has a negative impact on women fertility[47].

Covid 19 vaccine and negative thoughts about infertility:

Completely baseless assertions relating SARS-CoV-2 vaccines to subfertility have been experimentally proven false, according to ACOG and SMFM. The American Institution of Obstetricians and Gynecologists recommends vaccination for all female who may become pregnant in the future." "It is not known to create a higher risk of fertility, second or first trimester loss, stillbirth, or deformity," according to the American Society for Reproductive Medicine [ASRM]. Two of us [ALH and TN] highlighted some of the misguidance and misdirection that has led to a remarkable vaccine apprehension among in women with infertility or assumption issues in a recent publication. "False or negative information, especially that which is purposefully meant to defraud," says the dictionary. Misinformation, on the other hand, is characterized as "misleading info intended to deceive, particularly propaganda distributed by a national agency to the opposition potential or the media." According to a study of related social networks, a senior Pfizer researcher, raised concern that the COVID-19 vaccine could cause female

pregnancy by inducing an immune reaction to the syncytin-1 protein, which is essential for womb formation. Antibodies even against COVID19 spike glycoprotein could potentially cross-react with syncytin-1, a cell-cell integration protein pivotal for placental progress; they also claimed that antibodies against the COVID19 spike glycoprotein could probably cross-react with syncytin-1, possibly leading to anti-placental antibodies and female infertility [48].

The earliest "statement was based on a small sequence of five amino acids, four of which are purportedly linked among syncytin-1 and the SARSCoV-2 spike protein," a length too short to cause autoimmunity due to womb antibodies**.** Several authoritative bodies, such as the CDC, ASRM, and ACOG/SMFM, have denied unsupported claims more about SARS-COV-2 vaccines and the both man and women infertility. There is presently no convincing, scientifically possible technique by which COVID-19 sickness or COVID-19 vaccinations could harm female fertility.

From a male point of view, COVID-19 disease and male genital activity may be of issue; especially, COVID-19 infection may have had a detrimental effect on sperm motility, sperm count, male sex harmonic function, and male fertility. As expected, orchitis and testicular soreness are two of several adverse effects of COVID-19, so for every man who's really worried regarding his fertility in relation to COVID-19, the overwhelming research shows that obtaining the COVID-19 vaccine is preferable to getting COVID-19**.**

Considering that the Corona virus outbreak in the United States is already labelled "a plague of the unvaccinated," owing primarily to the Delta form, the American Society for Reproductive Medicine [ASRM] released an update21 on July 23, 2021 stating that

1. COVID19 immunization has no effect on both of male or female fertility or the success of reproductive treatments.
2. COVID19 vaccination throughout gestation period does not seem to increase the risk of abortion, according to existing research.
3. Antibodies even against placenta are not produced by the COVID19 vaccine.
4. Hardly any of the COVID-19 vaccinations currently accessible to reach or pass the placenta. The intramuscularly given vaccine mRNA only lasts just several days in the cytoplasm of deltoid muscle cells before being degraded. Protective antibodies against COVID19, on the other hand, have been demonstrated to pass the placenta as well as provide safety to the newborn after birth.
5. During the examination and treatment of fertility problems, reproductive endocrinologists must explain COVID-19 immunization with all sufferers and recommend vaccination. The greatest way to minimize maternal/fetal issues is to get vaccinated before conceiving or early in pregnancy. It has been proven that healthcare counselling has a considerable favorable impact on a patient's willingness to accept vaccination [49].

DISCUSSION

Both male and female reproductive systems are at risk from COVID-19. The decrease in female fertility is caused by SARS-CoV-2 being present in the vaginal and fetus. Even though the virus has also been found in testicles or semen tissues, it is still debatable whether it can affect the male reproductive system due to the extremely low incidence of positive identification and the potential for interference from non-semen causes during testing. Furthermore, even if an infection takes place, the virus cannot last for an extended period of time.

Vaccinating everybody is the most effective way to stop the current COVID-19 outbreak. Since the number of reported cases, critically ill victims, and fatality have decreased in many countries, we can assume vaccines to stop the pandemic even though we lack good clinical data on long-term harmful effects.

Doctors and other medical professionals should work together to try and convince everyone that getting vaccinated against COVID-19 is secure and has significant advantages in preventing infection for both the recipient and their unborn child, especially

those who are pregnant, lactating, or planning a pregnancy. From scientific proof, therefore, does not support any claims that the COVID-19 vaccines now being administered harm either male or female sexual health.

Female Reproductive System: A number of prior works have found SARS-CoV-2 in female reproductive tissues in one way or another. Studies have pointed out the fact that the virus has been identified in the placenta and vaginal fluid and this is in concord with the pathologic effects on female fertility. However, previous studies had not been as definitive about the degree and processes of the aforementioned effects. Subsequent researches that have been done have added more evidence to this discovery, revealing the ability of the virus to infect reproductive tissues. Male Reproductive System: Earlier research was ambivalent on the findings of SARS-CoV-2 in seminal and testicular tissues. Some of the very first studies indicated the presence of the virus of low prevalence about which its impact on male fertility was yet unknown. However, current research still poses this question, despite recognizing the problems related to contamination examination and the brief viral stay in semen. Vaccination: The previous publications made the foundation to know about the safety and the effectiveness of COVID-19 vaccines. Pre-studies in clinics revealed that vaccines significantly brought down the probability of its acquisition and severe manifestation. These favorable effects are now being supported by long-term evaluation studies that show continued decreases in COVID-19 morbidity and mortality. In the initial phase, there were restricted studies regarding the effects of vaccines on pregnant and lactating women; however, continuous studies have strengthened the role of vaccines in pregnant and lactating women.

The findings regarding COVID19's effects on reproductive health in part changed with time as more data was collected to either support previous studies or provide a better understanding of the benefits of vaccination. Other people are focusing on long-term effects more, and they will follow up their studies to enhance the development of public health.

CONCLUSION

This virus has proved to have an impact on the male and the female reproductive systems, but vaccination alone can help to reduce the spread of the virus. Despite the unknown effects of the virus on male fertility and possible implications of vaccines on their future fertility, getting vaccinated for COVID-19 reduces the risk and effects of this disease. There are arguments that need to be voiced by doctors and other healthcare workers about vaccination and its efficacy, including for pregnant, lactating, or those of childbearing age.

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Authors contribution:

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