

Effect of COVID-19 on Mother and Fetus in Pregnancy and Partum Periods; A Systematic Review

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Abstract

Aims: Women during pregnancy and postpartum periods are among the most important groups susceptible to emerging diseases affecting the mother and fetus. Hence, the current systematic review investigated the effect of COVID-19 on maternal and fetal outcomes in pregnancy and partum outcomes periods.

Information & Methods: This systematic review was carried out using international databases of Web of Science, Scopus, Proquest Pubmed, and Iranian databases such as Irondoc, Magiran, and SID to find studies published between 2020 and 2021 with specified relative keywords. Based on the Ottawa checklist, the full-text selected articles were reviewed, and those with specific scores were analyzed.

Findings: 8 case-control, cohort, and cross-sectional studies out of 380 collected were selected after applying the inclusion and exclusion criteria. They were conducted in Iran, the United States, Canada, China, Parkland, and the UK.

Conclusion: COVID-19 disease harms maternal and fetal messages during pregnancy and has adverse consequences during and after childbirth.

Keywords

COVID-19 [<https://www.ncbi.nlm.nih.gov/mesh/2052179>];
Pregnancy [<https://www.ncbi.nlm.nih.gov/mesh/68011247>];
Partum [Not in MeSH];
Maternal [<https://www.ncbi.nlm.nih.gov/mesh/68009035>];
Fetus [<https://www.ncbi.nlm.nih.gov/mesh/68005333>]

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Introduction

Coronavirus disease 2019 (COVID-19) is an emerging infection rapidly evolving. It is reported that pregnant women are also susceptible to severe acute respiratory syndrome coronavirus (SARS-CoV-2), which may increase the risk of adverse pregnancy outcomes. Currently, studies investigating the status of COVID-19 in obstetrics and gynecology and its perinatal outcomes are scarce. In addition, most published studies are case reports/series in Chinese, leading to evidence gaps [1].

The main clinical symptoms of COVID-19 are fever, cough, and shortness of breath. Less common symptoms include headache and some gastrointestinal symptoms. COVID-19 has a more significant impact on people with underlying diseases and weak immune systems. Meanwhile, pregnant women are also more susceptible to infection due to physiological changes during pregnancy [2]. Physiological changes occur during pregnancy to reduce acute immune responses to prevent fetal death. Because of these physiological changes in the body's cardiopulmonary immune system during pregnancy, pregnant women are more prone to severe diseases after exposure to viruses, especially respiratory viruses [3].

Pregnant women are less tolerant to hypoxia due to the weakness of their immune system and physiological changes in their respiratory system (decrease in the height of the diaphragm, increase in oxygen consumption, respiratory tract mucosal edema). Respiratory problems are expected to increase in pregnant women with COVID-19. Studies by researchers in China showed that the clinical symptoms of pregnant women do not differ from non-pregnant ones [4-5]. The outcomes associated with the coronavirus in pregnant women and their infants are not precisely known, and the results of the studies are contradictory. As most studies focus on non-pregnant women, there are limited studies regarding the impact of the coronavirus on pregnancy and childbirth [6].

Zhang conducted a two-group retrospective study on females affected by COVID-19 and healthy women. Both groups had been the same in terms of gestational age. However, the rate of weak conceptions, use of carboprost, and carbetocin were higher in the group of women with COVID-19 than in healthy women, and both were the same regarding the amount of bleeding. Both groups were the same regarding fetal distress, meconium excretion, neonatal asphyxia, and birth weight [7].

The results of a study conducted by Adhikari *et al.* on pregnant women with and without COVID-19 showed that both groups were the same in terms of gestational diabetes, preeclampsia, gestational age, abortion, and induction of labor; placental abruption, stillbirth, epidural anesthesia, and spontaneous vaginal delivery. However, the cesarean section rate

was higher in the group with COVID-19. Both groups were the same regarding SGA rate, meconium excretion, 5th-minute Apgar score, sepsis, and positive pressure ventilation [8].

Pirjani *et al.* research on two groups of women with COVID-19 and healthy women showed that both groups were the same regarding gestational diabetes, preeclampsia, PROM, LBW, IUGR, and preterm. They were also similar in terms of stillbirth and postpartum hemorrhage. However, the ICU hospitalization rate was significantly higher in the group with COVID-19. The rate of sepsis and hospitalization in the NICU was the same between both groups [9].

Li *et al.* conducted a case-control study on 16 cases contaminated with COVID-19 and 18 cases suspected of the disease. The results showed that both groups were the same regarding childbirth, postpartum, and neonatal outcomes [10].

Metz conducted a prospective study on three groups of infected people without symptoms, mild and moderate symptoms, and severe symptoms. The results showed a significant difference between the three groups regarding the incidence of gestational hypertension, postpartum bleeding, cesarean section, and thromboembolism. There was no significant difference between them regarding fetal death and SGA; however, they significantly differed in preterm, birth weight, and the rate of hospitalization in the NICU department [11].

Antoun *et al.* conducted a two-group prospective study on 23 pregnant women with COVID-19. The results showed that the rate of preeclampsia in the case group was higher than in the control group. The rate of premature birth and cesarean delivery was higher in the case group [12].

Because of the severity of the COVID-19 pandemic around the world, the increasing number of pregnant women infected with this virus, the unknown consequences of Coronavirus in pregnant women and their infants, the contradictory results of the studies, and the limitation of studies on COVID-19 in pregnant women, childbirth, and babies, this study aimed to review the studies about the effect of COVID-19 on pregnancy, childbirth, postpartum and neonatal periods.

Information and Methods

This systematic review was conducted in 2022 at Isfahan University of Medical Sciences by determining a clear set of objectives.

The study questions were designed based on the PICO process [5].

International research databases (Web of Science, Scopus, Proquest, Google Scholar, Pubmed, and Iranian databases such as Normex, Irondoc, Magiran, and SID) were searched to find the studies published in 2020-2021 using relevant keywords. Then, based on the Newcastle-Ottawa checklist, the full text of the

selected articles was checked by two people, and in the case of a specific score, the desired article was analyzed. keywords of COVID-19, Coronavirus, pregnancy, childbirth, postpartum, outcome, maternal, and neonate were searched to find the research background in English and Persian through MESH in PubMed. In addition, the systematic search process was completed using the combination of the

mentioned keywords. The search keywords were limited in the subjects and abstracts of the articles, and the studies with experimental and semi-experimental intervention designs were selected. Finally, all the studies containing the mentioned keywords were reviewed in this study. To maximize the comprehensiveness of the search, the reference list of the related articles was reviewed.

Table 1. Summary of the studies in the field of the impact of the COVID-19 disease on the outcomes of pregnancy, childbirth, and newborns in Iran and the world

Author/Date	Location	Research method	Pregnancy outcome	Childbirth outcome	Neonatal outcome
Metz/2021 ^[11]	-	A 3-group prospective study (579 people without symptoms, 499 people with mild and moderate symptoms, and 141 people with severe symptoms)	There was a significant difference between the three groups regarding gestational hypertension.	There was a significant difference between the three groups regarding postpartum lochia, cesarean, and thromboembolism.	There was no significant difference between the three groups regarding fetal death and SGA. However, there was a significant difference in preterm birth weight and the NICU hospitalization rate.
Zhang et al./2020 ^[7]	Hubei Province (China)	2-group perspective of study (16 women with COVID-19 and 45 healthy women)	Both groups were the same in terms of gestational age. In the group of women with COVID-19, the rate of weak conceptions and the use of carboprost and carbetocin were more than in healthy women (p=0.001).	In terms of bleeding, both groups were the same.	Both groups were the same regarding fetal distress, meconium excretion, neonatal asphyxia, and birth weight.
Adhikari et al./2020 ^[8]	Parkland Hospital, Texas	Cohort on 3374 pregnant women with and without COVID-19 infection	Both groups were the same regarding gestational diabetes, preeclampsia, gestational age, abortion, and labor induction.	Both groups were the same regarding placental abruption, stillbirth, epidural anesthesia, and vaginal delivery. The cesarean section rate was higher in the group with COVID-19 (p=0.03).	Both groups were the same regarding SGA rate, meconium excretion, 5th-minute Apgar score, sepsis, and positive pressure ventilation.
Pirjani et al./2020 ^[9]	Arash Hospital, Tehran, Iran	A 2-group prospective study (66 women with COVID-19 and 133 healthy women)	Both groups were the same regarding gestational diabetes, preeclampsia, PROM, LBW, IUGR, and preterm.	Both groups were the same regarding stillbirth and postpartum hemorrhage, but the hospitalization rate in the ICU was significantly higher in the group with COVID-19.	Both groups were the same regarding the rates of sepsis and NICU admission.
Li et al./2020 ^[10]	China	Case-control (16 subjects infected with COVID-19, 18 subjects suspected of the disease)	Pregnancy outcomes were the same for both groups.	Both groups were the same in terms of delivery and postpartum outcomes.	Both groups were similar in terms of neonatal outcomes.
Mullins et al./2020 ^[14]	London	Report of 19 pregnant women with definite COVID-19 disease	-	17 maternal with cesarean delivery, two maternal with natural childbirth, 8 cases with premature birth	One case of infant death: 15 infants were tested, and the results were negative for COVID-19 disease.
Gabriel et al./2020 ^[15]	Canada	Prospective study on 242 pregnant women with COVID-19	There was more pregnancy period of less than 37 weeks.	The cesarean delivery rate was higher.	The hospitalization rate of infants in the NICU department was higher.
Antoun et al./2020 ^[12]	England (Birmingham hospital)	A 2-group prospective study (23 pregnant women with a definite diagnosis of COVID-19 disease)	The preeclampsia rate in the case group was higher than the control group.	The premature birth rate and cesarean delivery were higher in the case group.	-

The observational studies (case-control, cohort study, cross-section studies) in English and Persian were investigated. The articles with inappropriate content, articles presented at the conferences, letters to the editor, articles with insufficient data, and

articles without access to their full-text version were excluded.

The quality of articles was evaluated based on the Newcastle-Ottawa scale for non-randomized studies (Newcastle-Ottawa cohort scale version and its

modified version for cross-sectional studies) [2]. This scale examined the articles in terms of the selection process (in 4 sections, including the eloquence of the samples, sample size, non-response, and measurement tools), comparability (one section includes investigation of confounders and other influencing factors), and results (two aspects: evaluation of the result and statistical tests). Based on the Newcastle-Ottawa scale, the minimum and maximum scores were 0 and 9, respectively, and articles with a score of 6 or more were considered high-quality and sound articles. On the other hand, articles with a score of less than six were considered low-quality articles. This scale examines all stages of the study, including sample selection, comparison of two groups, and outcomes [13].

First, a list of subjects and an article abstract were prepared to extract the information. and the full text of related articles was checked using the Ottawa checklist.

Findings

In the initial search, 380 articles were found, and after reviewing the titles and abstracts of the articles and excluding duplicate and unrelated articles, 150 related studies were examined. 60 out of 150 articles were excluded due to non-compliance with the inclusion criteria, lack of access to the original article, shortage of information in the articles' abstracts, and inaccurate reporting of maternal and fetal outcomes. Finally, eight case-control and prospective studies were examined.

The review of eight studies showed no significant difference between most of the women infected by COVID-19 and the healthy women. They suspected cases of this disease in terms of gestational age, preterm, post-term, the rate of gestational diabetes, gestational hypertension, preeclampsia, fetal heartbeat, and miscarriage.

The characteristics of the studies, including research method, pregnancy outcome, childbirth outcome, and neonatal outcome, are presented in Table 1.

Discussion

This is a systematic review of the impact of COVID-19 on the outcomes of pregnancy, childbirth, and newborns in 8 full articles in English. It seems that midwives, as pregnancy caregivers, are responsible for the comprehensive care of this society group and should increase their knowledge in this field. According to the selected articles, midwives can reduce the concern regarding the impact of COVID-19 on the results and outcome of pregnancy and provide their usual care for pregnant mothers in person or present to increase their self-efficacy and reduce the fear and anxiety of maternal, due to the lack of awareness of the disease effects on the process and outcome of pregnancy and childbirth. Other results from the review of studies are on the effects of COVID-19 on childbirth and postpartum outcomes.

Conclusion

COVID-19 leads to adverse outcomes during childbirth and postpartum and negative effects on maternal and fetal outcomes during pregnancy.

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