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Demographic, Nutritional, Obstetrics, Maternal, and Neonatal Outcomes of Pregnant Women with Covid-19; A Cross Sectional Descriptive Study

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Abstract

Background: During the COVID-19 pandemic, SARS-CoV-2 infection among pregnant women increased. Pregnancy-related physiological changes can reduce the acute immune response to inflammation. This study aimed to evaluate demographic, nutritional, obstetric, maternal, and neonatal outcomes in pregnant women with COVID-19.

Material and Methods: This cross-sectional descriptive study included all pregnant women aged 18–40 years with COVID-19 who were referred to Rafsanjan Ali-ibn Abi-talib Hospital in 2021. Data were retrospectively collected from hospital records in 2023. Demographic, midwifery, and nutritional data were collected using a questionnaire and the hospital standardization program (HSP). Obstetric variables, as well as maternal and neonatal outcomes, were extracted after delivery from medical records and file data sheets.

Results: A total of 50 women participated (mean age 31.66 ± 5.64 years). Blood group O+ was the most common (n=23), followed by A+ (n=16). Most women had no history of infertility (46%). Cesarean delivery occurred in 58% of cases. Ten mothers (20%) required mechanical ventilation, and one (2%) was admitted to the ICU. Most newborns weighed 2,500–4,000 g (87.5%); 12.5% had low birth weight (<2,500 g). No neonates showed signs or symptoms of COVID-19.

Conclusion: No severe maternal or neonatal complications were observed among pregnant women with COVID-19 in this sample, and no neonatal COVID-19 symptoms were detected. Given the novelty of COVID-19, long-term follow-up is necessary to identify potential late effects on infants. These findings may support healthcare systems in developing management approaches and protocols to promote safe and healthy delivery during maternal COVID-19 infection.

Keywords: COVID-19, Neonates, Pregnancy, Pregnancy Outcome

Introduction

Pregnancy is a unique physiological state accompanied by significant immunological, hormonal, and cardiopulmonary changes, which may increase susceptibility to infectious diseases and their complications [1]. During this period, the maternal body undergoes substantial adaptations in the cardiovascular, respiratory, and immune systems to support the growing demands of the fetus [2]. These changes, while necessary for a successful pregnancy, may also alter the mother's susceptibility to infectious diseases and affect the severity of their clinical manifestations [3]. Thus, pregnancy is often regarded as a vulnerable period in which maternal health can have direct and significant consequences for fetal and neonatal well-being. In addition to physiological adaptations, maternal demographic characteristics, nutritional status, and obstetric history play important roles in determining pregnancy outcomes. Factors such as age, body mass index, socioeconomic condition, dietary habits, parity, and preexisting maternal disorders may impact both maternal and neonatal health [4-6]. Adequate maternal nutrition along pregnancy is especially critical, as it contributes not only to the mother's health but also to fetal growth, birth outcomes, and neonatal adaptation after delivery [7]. Similarly, obstetric factors such as gestational age, mode of delivery, pregnancy complications, and access to prenatal care are important determinants of pregnancy outcomes [8].

The coronavirus disease (COVID-19) pneumonia has been an emerging disease that has been associated with a rapid increase in mortality since its first diagnosis in China in December 2019. Coronavirus disease 2019 (COVID-19), caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), rapidly spread across many countries and became a global pandemic.[9]. Meanwhile, the World Health Organization (WHO) considers Covid-19 as a pandemic [10]. In general, human infections with zoonotic coronaviruses (transmitted to humans and animals) including Severe Acute Respiratory Syndrome (SARS)-CoV, Middle East respiratory syndrome (MERS)-CoV, and Covid-19 have raised numerous public health concerns worldwide [11].

Coronavirus is usually caused by infections of the respiratory tract and gastrointestinal tract which can range from mild to more severe [12]. Previous studies noted that Covid 19 is released in the air by respiratory droplets, physical contact, and suspended particles [13], which can be detected via testing the Reverse transcription polymerase chain reaction (RT-PCR) and CT scans of the chest [14]. Meanwhile, the incidence of COVID-19 infection among pregnant women increased during the pandemic. Physiological changes occur during pregnancy to lower the acute immune response to inflammation. Also, changes in the body's cardiovascular system during pregnancy make pregnant mothers more susceptible to respiratory viruses than their non-pregnant counterparts [15].

In addition, along the epidemic of infectious diseases, special attention should be paid to the fetus and newborns. There is currently no evidence of vertical transmission from mother to fetus [16]. Chen et al. (2020) at Wuhan University in China investigated nine pregnant women with Covid-19. They found no signs of intrauterine infection caused by the corona virus and its vertical transmission to the fetus in the last month of pregnancy [10]. Nevertheless, many studies have noted that many infants become infected at birth through infected people [17-18]. Infants with the infection may be asymptomatic and have mild or severe symptoms.

Because Covid-19 may elevate the risk of pregnancy complications, there is still no evidence to suggest that pregnancy increases the risk of Covid-19. Indeed, in public health policies and strategies, pregnant women are considered a high-risk population. Nonetheless, there is little information about the effect of this disease on pregnancy.

Owing to the controversies surrounding isolation measures, it is necessary for reproductive health specialists to consider lifestyle quality parameters, dietary habits, and maternal and neonatal outcomes in pregnant women with COVID-19. Therefore, the present study was designed to examine the status of pregnant women with COVID -19 and their infants.

Based on aims (some maternal and neonatal information in pregnant women with COVID-19), our study focused on several main research questions: in pregnant woman infected by COVID-19 what is the prevalence of miscarriage, birth death, low birth weight, confirmed vertical transmission to neonate, pregnancy complications, delivery term and signs of Covid-19.

The results of present study can be useful for healthcare systems to develop management of training, educating, and counseling pregnant woman with COVID-19 to lower the risk of maternal and neonatal complications.

Materials and Methods

This descriptive cross-sectional study was performed in Rafsanjan Ali Ibn Abi Talib hospital and study population (50 pregnant women) were assessed by convenience sampling method, from the first of April 2021 to the end of September 2021. Data were retrospectively collected from hospital records in 2023.

Inclusion criteria: all pregnant women aged 18-40 years with Covid-19 who consented to participate in the study. The pregnancy was established by ultra sonography and Covid-19 confirmed by Polymerase chain reaction (PCR) or chest Computed tomography (CT) scan. Pregnant women younger than 18 years or older than 40 years, those who did not consent to participate in the study, and women with severe

COVID-19-related conditions who were admitted to the intensive care unit before delivery were excluded from the study. Informed consent was taken from all participants and they were able to withdraw from study without any negative effects on their next medical care.

Demographic, obstetric, and nutritional information was collected using a researcher-made questionnaire and data obtained from the Hospital Standardization Program (HSP). Obstetrics parameters, along with maternal and neonatal outcomes were collected after delivery from file data sheet and medical records.

The data were classified into the following seven sections:

1: Demographic information (age, ethnicity, education, occupational status, blood groups, history of disease)

2: Fertility and pregnancy history (history of infertility, previous mode of delivery, history of miscarriage, previous pregnancy complications)

3: COVID-19 midwifery information (Gestational age at infection (wks), source of infection, epidemiological history, Covid testing, treatment and Covid-19 severity)

4: COVID-19 clinical information including signs and complications (fever, cough, dyspnea, etc.)

5: Nutritional characteristics (supplementation of multivitamin, iron, folic acid and different groups of food consumed)

6: Maternity information (type of delivery, miscarriage, time of delivery, pregnancy and postpartum complications)

7: Neonatal information (sex, birthweight, Apgar score, presence of symptoms, newborn intensive care unit (NICU)) Data were categorized, with statistical analysis was performed using SPSS software (version 20.0, IBM). The characteristics of the data were described using relative frequencies for categorical variables. Qualitative variables were analyzed via the relative test, and numbers (percentages) were reported for qualitative variables. Continuous variables were compared between two groups using the independent t-test, and one-way analysis of variance (One-way ANOVA) was employed for comparisons among more than two groups. Descriptive indicators such as mean and standard deviation were reported for continuous quantitative data. The p-values below 0.05 were considered statistically significant.

Results

Out of 272 pregnant women referring to Ali Ibn Abi Talib Hospital, finally 50 women with an average age of 31.66 years participated in this study. Two pregnant women died. Four pregnant women had Afghan ethnicity (8%) with the majority of mothers holding a diploma (56%) and being a housekeeper (74%). Twenty-three showed blood group O+ and 16 had blood group A+, which were the two most common blood groups among patients. In the history of the disease, 8 patients with hypothyroidism (16%), 5 patients had thalassemia minor (10%), and 5 patients had anemia (10%) (Table 1).

Table 1. Demographic information of 50 pregnant women with coronavirus disease (COVID-19)

Demographic information	N (%)	
Age	≤ 30 years	21 (42%)
	31–35 years	15 (30 %)
	≥ 36 years	14 (28%)
Ethnicity	Iranian	46 (92%)
	Afghan	4 (8%)
Education	Unlettered	3 (6%)
	Diploma	28 (56%)
	Bachelor’s degree	13 (26%)
	Master’s degree and PhD	6 (12%)
Occupational status	Housekeeper	37 (74%)
	Employee	13 (26%)
Blood groups	B^+	4 (8%)
	B^-	1 (2%)
	A^+	16 (32%)
	A^-	-
	AB^+	4 (8%)
	AB^-	-
	O^+	23 (46%)
	O^-	2 (4%)
History of disease	Healthy	21 (42%)
	Type 1 diabetes	1 (2%)
	Type 2 diabetes	1 (2%)
	Hypertension	4 (8%)
	Anemia	5 (10%)
	Chronic heart disease	2 (4%)
	Chronic respiratory diseases	1 (2%)
	Chronic kidney disease	4 (8%)
	Migraine	3 (6%)

	Fatty Liver	1 (2%)
	Asthma	1 (2%)
	Allergy	2 (4%)
	Hypothyroidism	8 (16%)
	Polycystic ovary syndrome	1 (2%)
	Arthritis	1 (2%)
	Constipation	3 (6%)
	Thalassemia minor	5 (10%)

The majority of pregnant women had no history of infertility (46%) and their previous delivery mode was reported as cesarean section (60%). Thirteen mothers with Covid-19 had a history of miscarriage (26%), 11 of whom had experienced less than three miscarriages (22%). The most common complications in previous pregnancies were introduced as urinary tract infection (16%) and maternal obesity (10%) (Table 2).

Table 2. History of previous pregnancy of 50 pregnant women with Coronavirus disease (COVID-19)

History of previous pregnancy	N (%)	
History of infertility	Yes	4 (8%)
	No	46 (92%)
No. of infertility years	One ≤	1 (2%)
	One >	3 (6%)
Previous delivery mode	Cesarean section	30 (60%)
	Natural delivery	20 (40%)
History of miscarriage	Yes	13 (26%)
	No	37 (74%)
No. of miscarriage	Three ≤	11 (22%)
	Three >	1 (2%)
Pervious pregnancy complications	No complication	25 (50%)
	Molar pregnancy	2 (4%)
	Stillbirth	1 (2%)
	Gestational diabetes	1 (2%)
	gestational hypertension	2 (4%)
	Maternal obesity	5 (10%)
	Intra Uterine Growth Retardation	3 (6%)
	Urinary tract Infection	8 (16%)
	Late delivery	1 (2%)
	Placenta previa	1 (2%)
	Fetal macrosomia	1 (2%)

Nine of the samples were in the first trimester (19.5%), 19 in the second trimester (41.3%), and 18 in the last trimester of pregnancy (39.1%). Most mothers had become infected with Covid-19 through contact with infected people (65.3%), and in 50% of cases, they consulted with a midwife when the symptoms began (50%). In the present study, 54% of pregnant women were diagnosed with Covid-19 using PCR and 34% based on Chest X-ray. Among 50 pregnant women with the infection, 10 mothers needed mechanical ventilation (20%) and 1 mother post-delivery was admitted to the ICU (2%). Meanwhile, 4 patients received antibiotic drugs (8%) and 8 mothers were treated with antiviral drugs (16%) (Table 3).

Table 3. Clinical characteristics and treatments of 50 pregnant women with coronavirus disease (COVID-19)

Clinical characteristics and Treatments	N (%)	
Gestational age at infection (wk)	< 14 (The first trimester)	9 (19.5%)
	14–28 (The second trimester)	19 (41.3%)
	28 < (The third trimester)	18 (39.1%)
Epidemiological history	Contact with infected person	32 (65.3 %)
	Exposure to relevant environment	4 (8.1 %)
	Unclear	13 (26.5%)
The first consultation at the time of onset of symptoms	General practitioner	6 (12%)
	Midwife	25 (50%)
	Gynecologist	10 (20%)
	Infectious disease specialist	12 (24%)
	Pulmonologist	1 (2%)
	Internal Medicine Specialist	6 (12%)
Covid testing	Throat and nose swab	27 (54%)
	Chest X-ray	17 (34%)

Treatment	Antibiotic therapy	4 (8%)
	Antiviral therapy	8 (16%)
	ICU admission	1 (2%)
	Mechanical ventilation	10 (20%)
Covid-19 severity	Mild	8 (16%)
	Moderate	26 (52%)
	Severe	14 (28%)

Regarding the manifestations of Covid-19 disease in pregnancy, the most common symptoms were cough (80%), malaise (74%), myalgia (68%), sore throat (64%), and dyspnea (64%), respectively. Overall, the results of this study revealed that most mothers showed moderate disease severity (52%), though 14 of them reported severe degree of Covid-19 (28%)(Fig. 1).

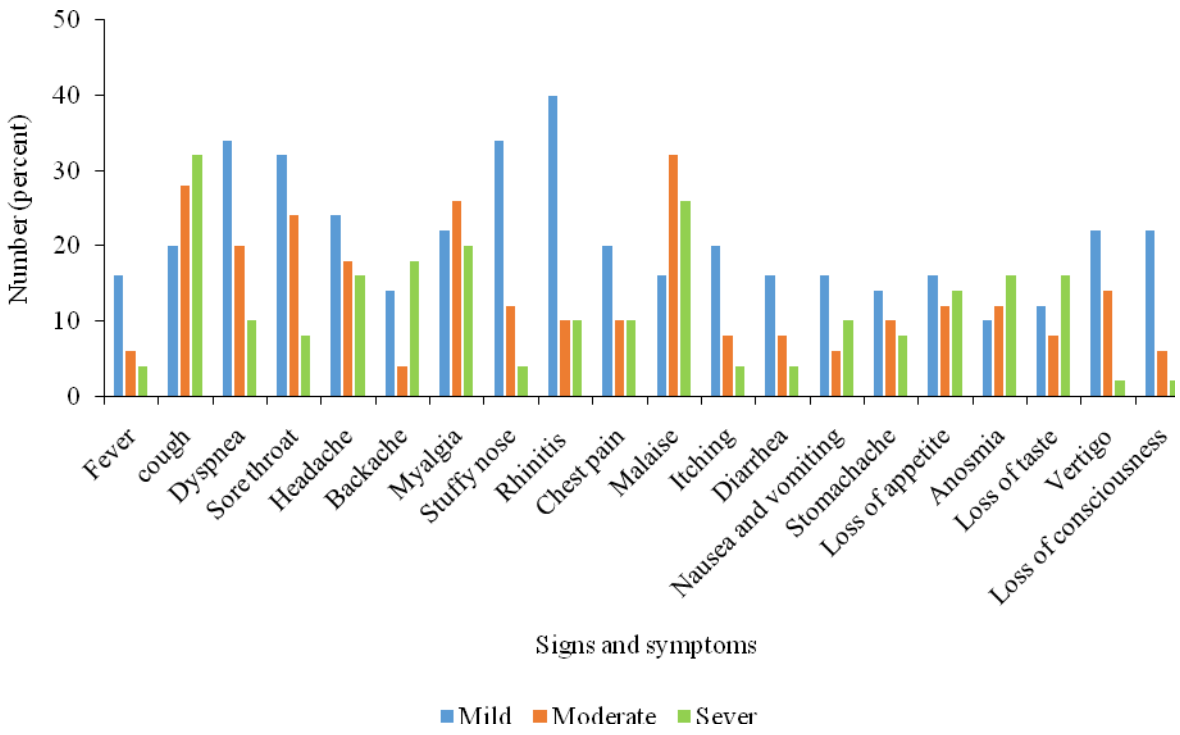

Fig. 1. Signs and symptoms of 50 pregnant women with coronavirus disease (COVID-19)

In this study, most pregnant women with Covid-19 supplemented multivitamins (94%), iron (94%), and folic acid (94%) (Table. 4). Nevertheless, 36% of mothers consumed less red meat, 16% dairy products, and 8% eggs during pregnancy, respectively (Fig.2).

Table 4. Nutritional characteristics of 50 pregnant women with coronavirus disease (COVID-19)

Nutritional characteristics		N (%)
Multivitamin tablets	Yes	47 (94%)
	No	3 (6%)
Supplementation of iron	Yes	47 (94%)
	No	3 (6%)
Supplementation of folic acid	Yes	47 (94%)
	No	3 (6%)

With regards to maternal outcomes, the frequency of cesarean section and vaginal delivery was obtained 58% and 42%, respectively. One miscarriage occurred at the first trimester, and most mothers had term deliveries (84%), though 8 preterm deliveries were also reported. Maternal obesity (18%), intrauterine growth retardation (18%), and urinary tract infection (18%) were among the main complications of mothers during pregnancy, respectively. Six mothers developed fever after delivery (12%) and five mothers needed mechanical ventilation (8%). One mother received antiviral drugs (2%) and 17 mothers were treated with antibiotic drugs (cephalexin) (34%) (Table 5).

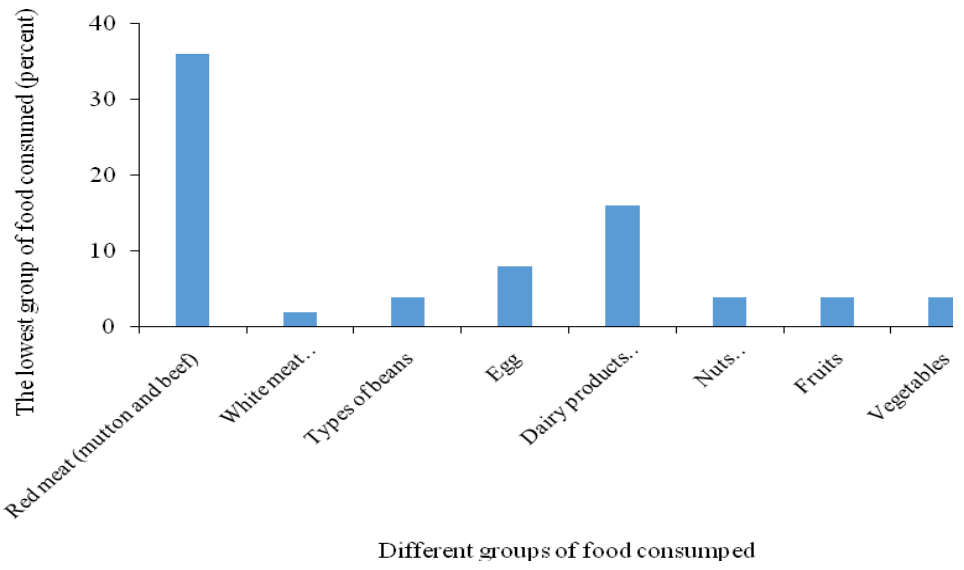

Fig. 2. The lowest group of food consumed by 50 pregnant women with coronavirus disease (COVID-19)

Table 5. Maternal outcomes of 50 pregnant women with coronavirus disease (COVID-19)

Maternal outcomes	N (%)	
Delivery mode	Cesarean section	29 (58%)
	Vaginal delivery	21 (42%)
Miscarriage	Yes	1 (2%)
	No	49 (98%)
Time of delivery	Preterm	8 (16%)
	Term	42 (84%)
	Postterm	-
Pregnancy complications	Gestational hypertensive	4 (8%)
	Tooth infection	5 (10%)
	Maternal obesity	9 (18%)
	Intra Uterine Growth Retardation	9 (18%)
	Urinary tract Infection	9 (18%)
	Remained in hospital	-
	Discharged	50 (100%)
	Death	-
Postpartum complications	Fever	6 (12%)
	Mechanical ventilation	4 (8%)
	Treatment with antiviral drugs	1 (2%)
	Treatment with antibiotics	17 (34%)

Out of 50 patients, 36 males and 12 females were born, respectively. Most babies weighed an average of 2,500 to 4,000 grams (87.5%), and only six babies were born weighing less than 2,500 grams (12.5%). None of the infants presented signs and symptoms of covid-19, and 48 infants exhibited an Apgar score ≥ 7 at one and 5 minutes (96%). A male neonate death was observed in the second trimester and three days after birth. Also, one infant death was reported in the third trimester and one week after birth. The other two infants were admitted to the NICU owing to preterm delivery and low birth weight (<2500g) (Table 6).

Table 6. Neonates born outcomes of 50 pregnant women with coronavirus disease (COVID-19)

Neonates born outcomes	N (%)	
Sex	Female	12 (24%)
	Male	36 (74%)
Birthweight (g)	Low birth weight (<2500g)	6 (12.5%)
	Average birth weight (2500-4000)	42 (87.5%)
	Fetal macrosomia (>4000g)	-
Pregnancy	Single	47 (97.9%)
	Twin	1 (2%)
Apgar score (1 min)	7 ≥	48 (96%)
	7 <	2 (4%)
Apgar score (5 min)	7 ≥	48 (96%)
	7 <	2 (4%)

Perform covid testing for baby	Yes	5 (10%)
	No	44 (88%)
Signs and symptoms of covid-19	Yes	0
	No	50 (100%)
NICU	Yes	4 (8%)
	No	44 (88%)
	Death	2 (4%)

Discussion

This descriptive study was undertaken to ascertain maternal and neonatal outcomes in patients with Covid-19 disease. Fifty pregnant women became infected with Covid-19 in Rafsanjan city along this period. Two maternal deaths were observed in this group; also, 3 infant deaths were reported in these individuals.

In some studies, in spite of severe symptoms, maternal death from COVID-19 has not been observed [19]. Also, Chen et al. (2020) investigated 9 pregnant women with Covid-19 and reported no death of maternal Covid-19 [10].

Other maternal outcomes were hypertension 4 (8%), dental infection 5 (10%), maternal obesity 9 (18%), intrauterine growth retardation 9 (18%), and urinary tract infection 9 (18%). In this regard, Askary et al. (2021) reported that 2 out of 16 pregnant women with Covid-19 had hypertension [20]. Yan et al. (2020) studied 116 pregnant women with Covid-19 and reported 5 (4.3%) hypertension and 2 (2.4%) abnormal fetal growth [21]. In general, studies have indicated that viral pneumonias in pregnant women are associated with an elevated risk of fetal growth retardation (FGR).

Considering delivery mode in the current study, 21 (42%) were vaginal delivery and 29 (58%) were cesarean section. The the prevalence of cesarean delivery was observed to be lower than the valre reported by Chenet al. (2020) and Yuet al. (2020) studies on pregnant women with Covid-19 (100%) [10,13]. This may be owing to the country's policies on physiological and normal delivery. In a study by Zhu et al. (2020), 7 pregnant women gave birth by cesarean section and two via vaginal delivery [22].

Studies have demonstrated that viral infection and physiological changes in a pregnant mother with Covid-19 often cause side effects, the most common being Preterm delivery. In the present study, 8 cases of preterm delivery and 2 cases of subsequent neonatal death occurred. In this regard, in the study by Azh et al. (2021) on 133 pregnant women with Covid-19, 12 cases of preterm delivery were documented [23]. The rate of preterm delivery was 31.25% in study of Askary et al (2020) [20] and 40% in China [24]. The cause of preterm delivery in a recent study was the use of retroviral drugs for sick mothers.

The most common symptom of Covid-19 in pregnancy in the study was cough and malaise. In pregnant women, their tolerance to hypoxia diminishes due to a weakened immune system and physiological changes in the respiratory system (lowered diaphragm height and increased oxygen consumption).

In the study by Chen et al. (2020), pregnant women experienced cough (44%), dyspnea (33%), and malaise (22%) [10]. The most common signs and symptoms of Covid-19 disease in pregnant women appear to include fever, cough, and malaise.

In the present study, 5 infants were tested for Covid-19, but only one positive test was reported, which, in line with other studies, indicated that no vertical infection was seen in Covid-19.

The results of Zhu et al. (2020) study on 10 newborns revealed that Covid-19 test were not positive until 9 days after birth [22]. In this study, infection transmission was not reported vertically but through contact with an infected family [25].

The death of two infants was also reported in the present study. Azh et al. (2020) reported death of 4 infants from 133 pregnant mothers [23]. In this regard, Moayaet al. (2010) also examined 7 pregnant mothers in one of hospitals of Tehran, where the death of a baby was documented [26].

Infant death also appears to be associated with preterm delivery. In other words, high rates of preterm birth would lead to increased neonatal mortality.

In the present study, only 6 low birth weight infants were born and the rest were average birth weight. Chen et al. (2020) evaluated nine infants born to mothers with Covid-19 disease. They found that 4 infants were preterm delivery and 2 infants weighed less than 2500 grams [10]. Note that mothers of blood type O+ were the most affected by COVID-19. The results of Azh et al. (2021) on 133 pregnant women revealed that blood groups O+ had the highest incidence [23]. In the present study, an increase in Covid-19 disease was observed in pregnant women with hypothyroidism, thalassemia minor and anemia, respectively, a finding worth considering. On the other hand, most cases of infection were seen in mothers who ate less red meat during pregnancy. Most pregnant women experienced maternal obesity, intrauterine growth restriction, and urinary tract infection, which were among the most common complications observed.

Conclusion

This study found no severe maternal and neonatal complications in pregnant woman with COVID-19 infection. There was a high rate of moderate severity with COVID-19 in pregnant woman, with average birth weight in neonates. None of the neonates showed symptoms of covid-19 and 88% of neonates presented negative covid test result. Since COVID-19 is a new disease, so follow-up in long time is essential to find late effects of COVID-19 on the babies. Even though our study limitation was the small sample size, we believe that the results of the present study reported important points to better understand maternal and neonatal outcomes in pregnant woman with COVID-19 infection. Our results indicated useful information to help healthcare systems to develop methods and protocols for safe and healthy maternal delivery during COVID-19 infection.

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Conflict of interest

None declared.

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Ethical Considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki for research involving human participants. Before the initiation of the study, the research protocol was reviewed and approved by the Ethics Committee of Rafsanjan University of Medical Sciences.

Code of Ethics

This study was approved by the ethics committee of the Rafsanjan University of Medical Sciences (RUMS) under code: IR.RUMS.REC.1400.047.

Authors' Contributions

Soudeh Khanamani Falahati-Pour, Soheila Pourmasumi and Hadis Ahmadirad: Contributed to the design and implementation of the research and played significant roles in drafting, writing, and revising the manuscript; Reza Vazirinejad and Vahid Mohammadi Shahrokhi: Contributed to data analysis and interpretation; Tayebeh Mokhtari Sorkhani, Fatemeh Baghery and Fatemeh Amin, Azita Manshoori: Participated in data collection. All authors have read and agreed to the published version of the manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

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