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ARTICLE

Thrombocytopaenia and COVID-19 infection during pregnancy increases the risk of preeclampsia: a multicentre study



BIOGRAPHY

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KEY MESSAGE

Although COVID-19 infection does not seem to be a risk factor for low platelet counts in pregnant women, the risk is increased with smoking and in women with Rh negative blood group B. In case of pregnancy with thrombocytopaenia, COVID-19 infection carries an increased risk of preeclampsia.

ABSTRACT

Research question: Is a low platelet count related to an increased risk of severe disease in pregnant women with active severe acute respiratory syndrome coronavirus 2 infection?

Design: A cross-sectional multicentre study in pregnant women with COVID-19 confirmed by polymerase chain reaction, antigen test, antibody test, or all.

Results: A total of 153 pregnant women with COVID-19 were included in the study, of whom 12.4% had thrombocytopaenia. Pregnant women with thrombocytopaenia were on average 3.1 years older (95% CI 0.18 to 6.38) than women without thrombocytopaenia. Pregnant smokers had a higher risk of thrombocytopaenia than non-smokers (OR 6.55, CI 95% 1.29 to 33.13). B Rh negative (B Rh⁻) pregnant women had a much higher risk of thrombocytopaenia than pregnant women with other blood groups (OR 16.83, CI 95% 1.42 to 199.8). Pregnant women with thrombocytopaenia had a much higher risk of suffering from preeclampsia (OR 16.2, CI 95% 1.35 to 193.4).

Conclusions: COVID-19 infection is not a risk factor for a low platelet count in pregnant women, although the risk is increased by smoking and in women with blood group B Rh⁻. In case of pregnancy with thrombocytopaenia, COVID-19 infection leads to an increased risk of preeclampsia.

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INTRODUCTION

In late 2019, numerous cases of bilateral pneumonia of unknown cause were first detected in the Chinese city of Wuhan. The causative agent was subsequently identified to be a new type of coronavirus (WHO, 2019; Huang et al., 2020). The International Committee on Taxonomy of Viruses named it 'severe acute respiratory syndrome coronavirus 2,' (SARS-CoV-2), as it is related to the virus that caused the 'severe acute respiratory syndrome' (SARS) pandemic in 2003 (Gorbalenya et al., 2020). On 30 January 2020, the World Health Organization (WHO) declared the new coronavirus pneumonia epidemic a public health emergency of international concern (Shrivastava and Shrivastava, 2020). On 11 February 2020, the WHO announced that the official name of the disease would be 'COVID-19', a shortened version of 'coronavirus disease 2019' (WHO, 2020).

Its main routes of transmission are through small respiratory droplets containing the virus, either by inhalation (Dashraath, 2020) or by contact with mucous membranes. Transmission is also possible by inhalation of aerosols and by objects on which the virus has been deposited (Was and Christian, 2020).

The most common symptoms are fever, cough, tiredness and loss of taste or smell. The most severe symptoms are respiratory distress, loss of speech or mobility, as well as confusion and chest pain (Guan et al., 2020; Xu et al., 2020). On admission, between 63% and 83% of patients had lymphopaenia, and up to 36% had thrombocytopenia, with 5% having platelet counts less than $100,000 \times 10^9/l$. Thirty-seven per cent of patients had elevated serum glutamic-oxaloacetic transaminase (aspartate aminotransferase) levels and 21% had elevated serum glutamic pyruvic transaminase (alanine aminotransferase) levels. Elevated C-reactive protein levels were found in up to 60.7% of patients, and elevated D-dimer in up to 46.4% (Huang et al., 2020).

During the course of a normal pregnancy, the body undergoes physical and psychological changes, focused on adapting and adjusting to the demands of the development of a human being inside the woman's uterus. These changes take place progressively (Xu et al., 2020).

At the cardiovascular level, blood volume increases and blood is redistributed to send more flow to the uterus and placenta, up to 25% of the cardiac output. Cardiac output increases by up to 50% between the 16th and 20th week of pregnancy. On the other hand, blood pressure decreases physiologically to compensate for these increases, reaching its lowest point between 16 and 20 weeks, and then gradually increasing to practically normal figures in the last trimester. This decrease in blood pressure is caused by increased levels of nitric oxide, progesterone and relaxin, which decrease vascular smooth muscle tone (Kazma et al., 2020).

During gestation, erythrocytes increase as a result of increased erythropoietin production but in lesser proportion to the increase in plasma volume; therefore, haemoglobin concentration decreases. Dilutional anaemia occurs, with a decrease of 1–2 g/dl of haemoglobin in the second trimester, stabilizing in the third trimester (Chandra et al., 2012).

A physiological decrease occurs in the platelet count during pregnancy owing to haemodilution, increased consumption in peripheral tissues and increased aggregation caused by elevated thromboxane A₂. Physiological thrombocytopenia is moderate and not related to maternal or fetal effects; however, if it is related to other pathologies, it may have consequences on maternal–fetal health and require specific monitoring and treatment. Gestational thrombocytopenia accounts for 70–80% of cases of thrombocytopenia in pregnancy, hypertensive disorders for 20% and immune thrombocytopenic purpura for 3–4% (Ciobanu, 2016).

COVID-19 has been associated with an increased risk of severe disease in elderly patients and those with chronic comorbidities. Studies of previous pandemics and influenza virus suggest that pregnant women may be at increased risk of morbidity and mortality associated with infection (Narang, 2020). Physiological changes during pregnancy include increased heart rate and oxygen consumption, decreased lung capacity, increased clotting factors and decreased cellular immunity, which may increase the risk of more severe disease compared with healthy adults (Mertz, 2013), as well as dysregulation of ACE2,

the pathway used by SARS-CoV-2, to enter the cell. Binding of SARS-CoV-2 to ACE2 decreases angiotensin 1-7 levels, which worsens the vasoconstriction, inflammation and procoagulant effects that occur in preeclampsia. Therefore, some studies have suggested that preeclampsia may be common in pregnant women with COVID-19 (Boushra et al., 2021).

Thrombocytopenia seems to be common in non-pregnant women hospitalized with COVID-19 (Xu et al., 2020). Limited research on thrombocytopenia in pregnant women with COVID-19 has been conducted; therefore, insufficient studies are available on which to establish a solid basis for a higher incidence. Also, evidence that this is indicative of a more severe evolution of the infection is lacking (Kim et al., 2020; Le Gouez et al., 2020; Rasmussen et al., 2020). Some studies, however, have established a relationship between a lower platelet count and a greater severity of the disease, as well as mortality in non-pregnant women (Lippi et al., 2020).

Other causes that produce moderate to severe thrombocytopenia, such as gestational thrombocytopenia, preeclampsia, HELLP syndrome and immune thrombocytopenia, among others, must be taken into account (Zitiello et al., 2020).

Platelet transformation during preeclampsia includes the following: thrombocytopenia, increased volume and increased platelet microaggregates (may precede the onset of the disease), and an increase in the activity of thromboglobulin (platelet factor 4), which is considered an expression of platelet activity when related to 24-h protein levels. It has been suggested that this entity presents with an increase in platelet consumption, to which the imbalance between thromboxane, prostacyclin and nitric oxide contributes, with predominance of the aggregating power of the former. For some, platelet damage is a trigger and not a result. In addition, the alteration of placental circulation is a reason for platelet stimulation, through the increase of frictional stress and inadequate trophoblastic invasion with abnormal arterial flow (Aldeborg et al., 2021).

It is important to conduct a platelet study before administering neuroaxial analgesia

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as up to one-third of patients with COVID-19 present thrombocytopenia, compared with 7–12% of pregnant patients without concurrent infection (Bauer et al., 2020). Although the platelet count may be altered in pregnant women with COVID-19, neuroaxial analgesia administered during labour is allowed. If the platelet count is extremely low, however, administration is contraindicated until platelet values are increased to a safe range (Tang et al., 2020).

Several hypotheses about thrombocytopenia have been presented in pregnant women with Covid-19: direct infection of bone marrow cells; destruction of haematopoietic progenitors by cytokine storm; destruction of platelets by immune complexes and induction of autoantibodies; lung damage itself; increased platelet consumption; and induced by certain drugs (ribavirin, fluoroquinolones and hydroxychloroquine) (Kim et al., 2020; Zhang et al., 2020).

Owing to the paucity of studies and the different existing hypotheses, it was considered necessary to analyse this subject in further depth. Therefore, in the present study, the relationship between thrombocytopenia in pregnant women and COVID-19, its prevalence, its possible causes and the influence it has on the severity of the disease, as well as possible gestational complications, were examined.

MATERIALS AND METHODS

Participants

A cross-sectional study was conducted in pregnant women with COVID-19 at the Dr Peset University Hospital in Valencia, Spain, La Fe University and Polytechnic Hospital in Valencia, Spain, and the General University Hospital in Castellón, Spain. Ethics approval from the Research Ethics Committee of each of the three hospitals was obtained before conducting the study (Dr Peset University Hospital: approval code 142/20 dated 17 December 2020; General University Hospital in Castellón: approval code January 2021, dated 25 January 2021; La Fe University and Polytechnic Hospital: approval code 2021-247-1, dated 28 April 2021. The work was carried out in accordance with the World Medical Association's Declaration of Helsinki, and written informed consent was obtained from all patients.

The inclusion criteria were pregnant women with COVID-19 confirmed by polymerase chain reaction, antigen test, antibody test, or all, who agreed to participate in the study after the study protocol had been explained to them. Under-age pregnant women were excluded. Diagnosis of HELLP syndrome or other microangiopathy of pregnancy was also considered as exclusion criteria. After applying these criteria, a total of 153 pregnant women with COVID-19 were included in the study.

For the analysis of thrombocytopenia, the definition of a platelet count of less than 150,000 platelets per microlitre of blood was taken into account (American College of Obstetricians and Gynecologists, 2016).

Statistical analysis

The Kolmogorov–Smirnov goodness-of-fit test was used to study the normality of the data distribution. Quantitative data are presented using central tendency and dispersion statistics and qualitative variables are expressed as absolute value and percentage (%).

Student's t-test or analysis of variance were used to compare the values of continuous variables. Pearson's correlation coefficient was used to establish the relationship between continuous variables, and chi-squared test and odds ratio were used to establish the association between categorical variables.

For all tests, a significance level of less than 0.05 was accepted in bilateral comparison. IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp, Armonk, NY, USA) was used for data analysis.

RESULTS

After data collection, 153 pregnant women with COVID-19 were included in the study, of whom 12.4% had thrombocytopenia. The results referring to the characteristics of the pregnant women under study are presented in TABLE 1.

The age of women with thrombocytopenia was significantly higher (Student's t-test; $P = 0.024$) than those without. Pregnant women with thrombocytopenia were on average 3.1 years older (95% CI 0.18 to 6.38) than those without.

A statistically significant association was found between smoking and thrombocytopenia (chi-squared test; $P = 0.011$). Pregnant smokers had 6.55 times higher risk of thrombocytopenia than pregnant non-smokers (95% CI 1.29 to 33.13). Similarly, a statistically significant association was found between blood group and thrombocytopenia (chi-squared test; $P = 0.005$). Pregnant women with blood group B Rh– had a 16.83 times higher risk of thrombocytopenia than those with other blood groups (95% CI 1.42 to 199.8). A statistically significant association was also found between preeclampsia and thrombocytopenia (chi-squared test; $P = 0.004$). Pregnant women with thrombocytopenia had 16.2182 times higher risk of preeclampsia than those without (95% CI 1.35 to 193.4). No association, however, was found between thrombocytopenia and gestational diabetes or the different APGAR scores of newborn babies.

The relationship between thrombocytopenia and maternal haemoglobin, urea, creatinine and liver

TABLE 1 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

Characteristics	Thrombocytopenia	Mean (SD) or n (%)	P-value
Thrombocytopenia		19 (12.4)	
Dr Peset Hospital, Valencia		49 (32)	
La Fe Hospital, Valencia		49 (32)	
General Hospital, Castellón		55 (36)	
Gestational age (COVID date), days		219.7 (74.8)	
Gestational age (delivery), days		272.0 (18.4)	
Age, years		32.3 (5.72)	
Age, years	No	31.9 (5.97)	0.024 ^a
	Yes	35.0 (4.44)	

^a Student's t-test.

TABLE 2 RELATIONSHIP BETWEEN THROMBOCYTOPAENIA AND OTHER MATERNAL ANALYTICAL VARIABLES BEFORE COVID-19, DURING INFECTION AND AFTER COVID-19

Variables	Thrombocytopenia	Infectious period	P-value ^a
		Mean (SD)	
Maternal haemoglobin, g/dl	No	9.4 (5.14)	0.172
	Yes	12.0 (1.3)	
Maternal red blood cells, 10 ⁶ /μl	No	3.55 (3.79)	0.276
	Yes	3.98 (0.55)	
Maternal urea, mg/dl	No	11.6 (9.3)	0.006 ^b
	Yes	20.6 (6.6)	
Maternal creatinine, mg/dl	No	0.40 (0.28)	0.339
	Yes	0.66 (0.09)	
Total bilirubin, mg/dl	No	0.18 (0.23)	0.003 ^b
	Yes	0.32 (0.20)	
Q5 Maternal SGOT, U/l	No	5.9 (11.4)	0.224
	Yes	12.29 (7.4)	
Q6 Maternal SGPT, U/l	No	12.18 (3.22)	0.801
	Yes	17.5 (4.65)	
Maternal GGT, U/l	No	3.14 (2.7)	0.801
	Yes	4.50 (7.21)	

^a Student's t-test.

^b Statistically significant. GGT, gamma-glutamyl transferase; SGOT, serum glutamic-oxaloacetic transaminase; SGPT, serum glutamic pyruvic transaminase.

function during the infectious period is presented in TABLE 2. Statistically significant increases were found in urea ($P = 0.006$) and bilirubin ($P = 0.003$) in the women under study during the infectious period.

A statistically significant decrease in platelets was observed from the first to the second trimester, as well as from the second to the third trimester (paired student's t-test; $P = 0.009$). This effect is presented in FIGURE 1.

No association was found between thrombocytopenia and preterm delivery (chi-squared test; $P = 0.816$). No significant differences were found between maternal age and preterm delivery (Student's t-test; $P = 0.983$). Similarly, no significant difference was found between platelet counts and preterm delivery (Student's t-test; $P = 0.626$).

Statistically significant differences were found in the first-trimester

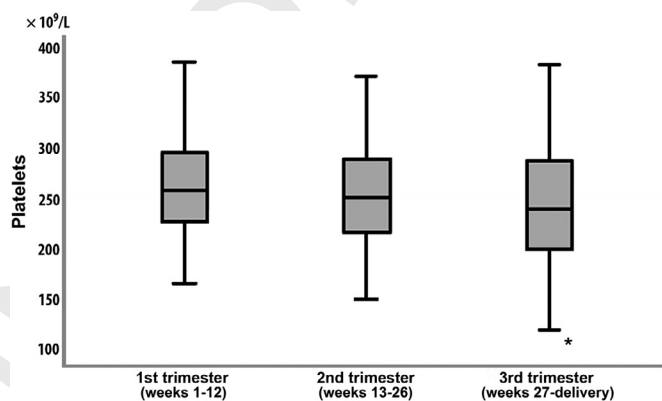


FIGURE 1 Box-and-whisker plot of platelet count in the three gestational trimesters. Paired student's t-test was used for comparisons between trimesters. *, statistical significance ($P = 0.009$).

platelet counts of women who had low haemoglobin (Student's t-test; $P = 0.003$). These women had, on average, $39.53 \times 10^9/l$ more platelets (95% CI 13.45 to 65.61).

In pregnant women who had low haemoglobin in the infectious period, statistically significant increases were found in the platelet count in the second (Student's t-test; $P = 0.003$) and third trimester (Student's t-test; $P = 0.037$). In the second, those with low haemoglobin had on average $41.69 \times 10^9/l$ (95% CI 15.01 to 68.38) and in the third, on average $49.04 \times 10^9/l$ (95% CI 2.97 to 95.1).

A statistically significant positive correlation was found between platelet count in the infectious period and haemoglobin in the same period ($\rho = 0.442$; $P = 0.036$). Similarly, a statistically significant positive correlation was found between infectious period lymphocytes and infectious period haemoglobin ($\rho = 0.527$; $P < 0.001$). No correlation was found between platelet count and haemoglobin.

As seen above, a statistically significant association was found between blood group and thrombocytopenia (chi-squared test; $P = 0.005$). Pregnant women with blood group B Rh- had a 16.83 times higher risk of thrombocytopenia than those with other blood groups. Statistically significant differences were found in the platelet count in the infectious period in group B Rh- compared with others (analysis of variance; $P = 0.003$) (FIGURE 2).

Pregnant women who had postpartum haemorrhage had a statistically significant decrease in the platelet count in the second (Student's t-test; $P = 0.008$) and third trimesters (Student's t-test; $P < 0.001$). In the second trimester, they had on average $55.52 \times 10^9/l$ (95% CI 25.42 to 85.63 $\times 10^9/l$) and in the third trimester $93.43 \times 10^9/l$ (95% CI 62.47 to 124.39 $\times 10^9/l$) platelets.

No statistically significant differences were found in platelet counts for types of delivery or APGAR. No correlation was found between platelet counts and cord pH.

No correlation was found between platelet count and D-dimer or C-reactive protein. A weak statistically significant

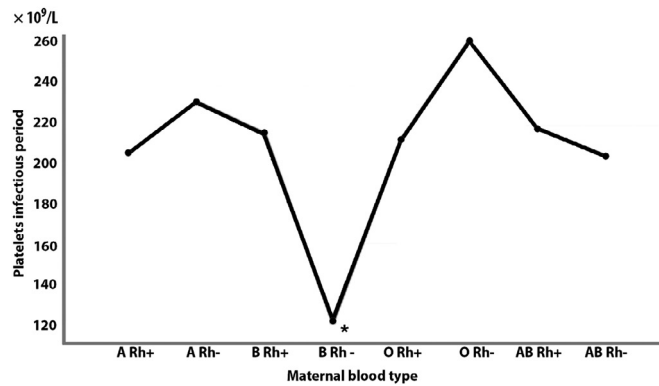


FIGURE 2 Maternal blood group and mean platelet count in the infectious period. Analysis of variance test was used for comparisons between groups. *, statistical significance ($P = 0.003$).

negative correlation was found between first-trimester platelet count and newborn APGAR ($\rho = -0.235$; $P = 0.024$). A statistically significant negative correlation was also found between platelet count at delivery and maternal activated partial thromboplastin clotting time ($\rho = -0.348$; $P = 0.006$).

An analysis of prothrombin time showed a statistically significant negative correlation with first trimester ($\rho = -0.256$; $P = 0.013$), third trimester ($\rho = -0.312$; $P = 0.006$) and delivery ($\rho = -0.352$; $P = 0.006$) platelet counts.

No statistically significant correlation was found in platelet counts for heparin, non-steroidal anti-inflammatory drugs or antibiotics.

DISCUSSION

A greater number of studies are being published on the effect of SARS-CoV-2 infection in pregnancy. Understanding the repercussions helps us to establish appropriate measures to prevent and treat possible complications.

We found a significant increase in the age of women with thrombocytopenia compared with those who did not have thrombocytopenia. These data are consistent with the study by Reese *et al.* (2018), in which the mean platelet count in young patients (age 15–19 years) was significantly higher than in women aged 20–44 years.

We were able to verify that pregnant women who smoke have a 6.54 times greater risk of presenting thrombocytopenia than those who do not smoke. This result contradicts

that found in previous studies in non-pregnant smoker patients (Pedersen *et al.*, 2019; Jayasuriya, 2020), which report a significant increase in platelet count compared with non-smokers, which seems to suggest that COVID-19 infection may influence the results. This question could not be investigated as no studies were found on the relationship between thrombocytopenia and smoking in pregnant women with and without COVID-19.

A recent publication in China (Wu *et al.*, 2020) suggests that patients with blood group A have a greater susceptibility to SARS-CoV2 infection compared with patients with blood group O, who have less susceptibility. In contrast, a study conducted in Burriana, Castellón, Spain (Domènech-Montoliu *et al.*, 2021), suggested no appreciable relationship between ABO group and the incidence of infection. This also indicates that participants in group B reported more symptoms and severity than other groups. Another study conducted in New York (Anderson *et al.*, 2021) refuted any relationship between blood group and susceptibility to infection or severity of infection, given the prospective characteristics and the large sample size of this study.

Lippi *et al.* (2020) found a significant relationship between the severity of COVID-19 and thrombocytopenia. Patients with thrombocytopenia were five times more at risk of a more severe presentation. The percentage of patients with more severe disease in our study was similar to that reported by Yan *et al.* (2020). In contrast, the percentage of asymptomatic pregnant women was almost three times higher in the present study. Only three patients had

been hospitalized because of covid-19 pneumonia. In analysing gestational diabetes, we found no correlation with thrombocytopenia, coinciding with the study by Maconi *et al.* (2014), in which they also found no significant relationship between pregnant women with gestational diabetes and platelet count.

In women with gestational complications, pregnant women with thrombocytopenia had a 16.182 times higher risk of preeclampsia than those without. Hypertensive states of pregnancy constitute one of the most important causes of gestation-related thrombocytopenia. Although the causes of platelet decline are uncertain, platelet aggregation, which is increased in hypertensive patients, possibly due to vasospasm and microangiopathy, is thought to be involved (Fogerty, 2018). Although no evidence has been published, it would be interesting to analyse whether this relationship is bidirectional and thrombocytopenia could develop subsequent to preeclampsia.

The platelet count in pregnant women varies in the different trimesters, with a gradual decrease as the pregnancy progresses (Reese *et al.*, 2018; Zitiello *et al.*, 2020). In agreement with these studies, we found a statistically significant decrease in platelets from the first to the third trimester. Furthermore, we found a significant negative correlation between gestational age at the time of infection and platelet count in the infectious period.

In the present study, 42.9% of the pregnant women were treated with low-molecular-weight heparins, of whom 7.6% suffered thrombocytopenia; a value that does not seem to be caused by heparin, according to other studies mentioned above (Reese *et al.*, 2018; Zitiello *et al.*, 2020). Although heparin can reduce the number of platelets in an unintended way (heparin-induced thrombocytopenia [HIT]), we did not find statistically significant relationship in platelet counts for heparin or the use of non-steroidal anti-inflammatory drugs or antibiotics, coinciding with the study by Greer *et al.* (2005), which also did not associate any case of heparin-induced thrombocytopenia. On the other hand, only one published study analysed the influence of blood group on the risk of HIT (Ray *et al.*, 2021), finding

no significant differences between the different groups.

Haemogram tests showed that those with low haemoglobin had increased platelet count ($39.53 \times 10^9/l$) compared with those with normal haemoglobin ranges. This may be due to iron deficiency, which can lead to a thrombocytosis ratio in iron-deficient patients of up to 33%, with a strong negative correlation with the severity of anemia (*Maryala and Vaddiparti, 2021*). Untreated iron-deficiency anaemia causes elevated levels of erythropoietin, which is postulated to cause an increase in platelets, in addition to erythrocytes, owing to the proliferation of bone marrow progenitor cells they have in common. This is probably caused by a similar amino acid sequence between erythropoietin and thrombopoietin (*Brissot et al., 2021*). We cannot affirm, however, that this is the cause, as blood iron values were not systematically collected from pregnant women. Other studies postulate that thrombocytopenia may also occur in iron deficiency anaemias (*López and Macaya, 2013; Brissot et al., 2021*). The iron sequestration that can be seen in inflammatory conditions may be associated with thrombocytopenia. This could justify the finding in our study of a statistically significant positive correlation between platelet count during the infectious period and haemoglobin during the same period.

Liang and Acharya (2020) have shown that, in addition to thrombocytopenia, liver enzymes, LDH, D-dimer and C-reactive protein in patients infected with SARS-CoV2 are elevated. Pregnant women seem to present similar signs and symptoms, as well as altered laboratory values compared with the rest of the population. In the present study, we found a similar percentage of C-reactive protein determined in the infectious period and that of thrombocytopenia and COVID-19 pneumonia.

We found a statistically significant negative correlation between platelet count and maternal activated partial thromboplastin clotting time. When prothrombin time was analysed, a statistically significant negative relationship was found with first trimester, third trimester and delivery platelets. This relationship clearly corresponds to the phases of haemostasis. In theory, although coagulation mechanisms are

divided into different phases, they are all closely related, whereby activated platelets accelerate plasma coagulation, and coagulation activation products in turn induce platelet activation (*Alamin, 2021; Sierra et al., 2022*).

In the study by *Wang et al. (2017)*, gestational age at delivery was significantly lower in patients with hypertensive disorders and immune thrombocytopenia compared with patients with pregnancy-associated thrombocytopenia. We found no significant difference, however, between platelet counts and preterm delivery, nor an association between thrombocytopenia and preterm delivery. Also, we observed no significant relationships between maternal age and preterm delivery, compared with the study by *Fuchs et al. (2018)*, in which the lowest risk of prematurity was in mothers aged between 30 and 34 years. Preterm delivery was mostly spontaneous in young women (aged 20–24 years), whereas, in women older than 40 years, it was most frequently iatrogenic.

Pregnant women who had postpartum haemorrhage had a statistically significant decrease in the platelet count in the second and third trimesters. These results are in agreement with several studies that found significant differences between lower platelet counts and postpartum haemorrhage (*Biguzzi et al., 2012; Carlson et al., 2017; van Dijk et al., 2021*).

The study by *Wei et al. (2021)* found that COVID-19 is associated with preeclampsia, stillbirth and preterm delivery compared with patients without COVID-19. In addition, they showed that symptomatic COVID-19 was associated with an increased risk of caesarean section and preterm delivery compared with asymptomatic COVID-19, with a greater association with preeclampsia, gestational diabetes, preterm delivery and low birth weight in the case of severe symptoms. We have not, however, been able to verify any of these points in our work as we did not observe statistically significant differences with these variables.

The median APGAR test in the study by *Yan et al. (2020)* at min 1 was 9, and at min 5 was 10. In the present study, no statistically significant relationships were found between platelet count and

types of delivery or APGAR. Although not significant, the APGAR at 1 min of those with thrombocytopenia was lower, although at 5 min, it recovered and at 10 min it was 10, which seems to suggest that COVID-19 infection could influence fetal wellbeing, although this point should be confirmed in further research.

In conclusion, the prevalence of thrombocytopenia found in our study was similar to the prevalence described for the pregnant population without COVID-19 infection; therefore, we consider that infection is not a risk factor for platelet count. However, the main findings of the present work are that increased age, smoking and blood group B Rh– are risk factors for thrombocytopenia in pregnant women with COVID-19 and that pregnant women with thrombocytopenia have a 16-fold increased risk of preeclampsia. Finally, the results of our study seem to suggest that COVID-19 infection in pregnant women could influence fetal wellbeing, although this point should be confirmed in further research.

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