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MATERNAL AND PERINATAL OUTCOMES DURING THE COVID-19 EPIDEMIC IN PREGNANCIES COMPLICATED BY GESTATIONAL DIABETES

ZAPLETI PRI PORODU PRI NOSEČNOSTNI SLADKORNI BOLEZNI V SLOVENIJI V ČASU EPIDEMIJE COVID-19

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ABSTRACT

Introduction: Gestational diabetes (GDM) is one of the most common complications in pregnancy, with a prevalence that continues to rise. At the time of the COVID-19 epidemic, immediate reorganisation and adjustment of the system was needed. Telemedicine support was offered in order to provide high-quality treatment to pregnant women. However, the success of the treatment is unknown. We therefore aimed to evaluate COVID-19 epidemic effects on pregnancy outcomes in GDM.

Methods: The maternal outcomes (insulin treatment, gestational weight gain, caesarean section, hypertensive disorders) and perinatal outcomes (rates of large and small for gestational age, preterm birth and a composite child outcome) of women visiting a university hospital diabetes clinic from March to December 2020 were compared with those treated in the same period in 2019.

Results: Women diagnosed with GDM during the COVID-19 epidemic (n=417), were diagnosed earlier (23.9 [11.7–26.0] vs. 25.1 [21.8–26.7] gestational week), had higher fasting glucose (5.2 [5.0–5.4] vs. 5.1 [4.8–5.3] mmol/l) and earlier pharmacological therapy initiation, and had achieved lower HbA1c by the end of follow-up (5.1% (32.2 mmol/mol) [4.9% (30.1 mmol/mol)–5.4% (35.0 mmol/mol)] vs. 5.2% (33.3 mmol/mol) [5.0% (31.1 mmol/mol) – 5.4%·(35.5 mmol/mol)], p<0.001) compared to a year before (n=430). No significant differences in perinatal outcomes were found.

Conclusions: Although GDM was diagnosed at an earlier gestational age and higher fasting glucose concentration was present at the time of diagnosis, the COVID-19 epidemic did not result in worse glucose control during pregnancy or worse pregnancy outcomes in Slovenia.

Keywords:
gestational diabetes, COVID-19, perinatal outcomes, LGA, early screening, telemedicine

IZVLEČEK

Uvod: *Nosečnostna sladkorna bolezen (NSB) predstavlja enega od najpogostejših zapletov v nosečnosti. Incidenca v svetu in Sloveniji se povečuje ter predstavlja vse večje breme za zdravstveni sistem. V času epidemije COVID-19 je bilo treba nemudoma reorganizirati in prilagoditi obravnavo nosečnic v želji po zagotavljanju nemotene oskrbe in istočasno v luči zajezitve širjenja virusa. V Sloveniji je presejanje potekalo po standardnem postopku, standardno obravnavo pa je deloma nadomestilo telemedicinsko spremljanje. Doslej ni znano, v kolikšni meri je nekoliko prilagojen način obravnave v času epidemije vplival na uspešnost zdravljenja NSB, zato nas je zanimalo, kakšni so glikemični in perinatalni izidi zdravljenja žensk z NSB v času epidemije v primerjavi z enakim obdobjem leto poprej.*

Metoda: *Maternalne (zdravljenje z inzulinom, porast telesne mase med nosečnostjo, carski rez, hipertenzivne motnje) in perinatalne izide (rojstvo otrok, premajhnih ali prevelikih za gestacijsko starost, prezgodnje rojstvo, kompozit neonatalnih izidov, tj. hipoglikemija, zlatenica, distocija ramen mrtvorojenost, neonatalna smrt) žensk z NSB, ki so se zdravile v diabetološki ambulanti od marca do decembra 2020, smo primerjali z izidi žensk, zdravljenimi v enakem obdobju 2019.*

Rezultati: *V času epidemije COVID-19 (N = 419) je bila diagnoza NSB postavljena bolj zgodaj kot v enakem obdobju 2019 (N = 430) (gestacijska starost: 23,9 [11,7-26,0] vs. 25,1 [21,8-26,7]). Ob tem so imele ženske ob diagnozi višjo koncentracijo glukoze v krvi na tešče (5,2 [5,0-5,4] vs. 5,1 [4,8-5,3] mmol/l). V času epidemije COVID-19 so potrebovale zdravljenje z inzulinom bolj zgodaj in so v povprečju dosegle nižje vrednosti HbA1c ob prvem pregledu (5,1 % (32,2 mmol/mol) [4,9 (30,1 mmol/mol)-5,4 % (35,0 mmol/mol)] vs. 5,2 % (33,3 mmol/mol) [5,0 (31,1 mmol/mol)-5,4 % (35,5 mmol/mol)], p < 0,001). Pomembnih razlik v perinatalnih izidih nismo odkrili.*

Sklepi: *Kljub temu da je bila diagnoza NSB v času epidemije COVID-19 postavljena bolj zgodaj in so imele posameznice višje koncentracije glukoze na tešče ob diagnozi, pa rezultati ne kažejo slabše glikemične kontrole v času epidemije niti slabših perinatalnih izidov.*

Ključne besede:
nosečnostna sladkorna bolezen, COVID-19, porodni zapleti, zgodnje presejanje, telemedicina

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1 INTRODUCTION

Gestational diabetes (GDM) is one of the most common metabolic disorders in pregnancy. The growing number of GDM women (1, 2) represents an increasing burden on a healthcare system that was already under extreme strain as a result of the COVID-19 epidemic. Nevertheless, women had to be provided with continued care during the epidemic. If untreated, GDM is associated with an increased rate of short- and long-term foetal and maternal complications (3). However, the management of pregnancies complicated by GDM involves a multidisciplinary approach and, as such, represents a considerable burden on the healthcare system (4) and on pregnant women themselves (5).

The COVID-19 epidemic changed established approaches of GDM screening, diagnosis and management. Most international diabetes societies recommended avoiding the oral glucose tolerance test (OGTT) in order to minimise the possibility of infection (6–8), with one professional society acknowledging the cost of missed GDM cases (9).

There is still not much known about the effects of the COVID-19 pandemic on pregnancy outcomes for women with GDM. To the best of our knowledge, there exists only one study showing worse glycaemic control during the COVID-19 lockdown, in France (10), as well as an Irish study (11) showing no difference in obstetric and neonatal outcomes. In this retrospective study, we therefore aimed to evaluate the impact of the COVID-19 epidemic on glycaemic control as well as on pregnancy outcomes among women with GDM at a large university hospital diabetes clinic. We hypothesised that glycaemic control and, consequently, pregnancy outcomes would worsen during the COVID-19 pandemic in comparison with the same period one year before.

2 METHODS

The glycaemic data was retrospectively acquired from hospital records generated during normal care at Ljubljana University Medical Centre, Slovenia. We included all women who received a GDM diagnosis between 12 March and 31 December 2019 and 2020. No other inclusion or exclusion criteria were applied. Screening for GDM has been universal in Slovenia since 2011. This did not change during the COVID-19 epidemic. A GDM diagnosis is made according to the IADPSG criteria (12).

Standard-of-care treatment involves a multidisciplinary lifestyle approach involving group education on diet and exercise, and four-point home blood glucose profile monitoring with a target capillary fasting glucose concentration <5.3 mmol/l and a postprandial capillary glucose <6.7 mmol/l. If these targets are not achieved at least within 14 days of lifestyle intervention, insulin therapy is initiated. Visits to diabetes clinic are usually scheduled three to five weeks apart. During the COVID-19 epidemic, the same protocol was followed; however, many consultations were performed via telemedicine (phone calls and emails). During the first lockdown between 12 March and 31 May 2020, only first visits were performed at our clinic, while education and follow-up visits were performed via telemedicine. After the lockdown, lifestyle education was mainly performed via telemedicine; however, the majority of the first and follow-up visits were performed at our clinic. In March 2020, we established a special email and telephone service for women with GDM. Women with GDM also regularly visit their primary care gynaecologists and, in cases of pregnancy complications or important concomitant diseases, obstetricians at secondary or tertiary centres. During the COVID-19 epidemic, there were no major changes to the way care was delivered by gynaecologists or obstetricians, except for the possible rescheduling of visits due to COVID-19 infection.

This study has been conducted in accordance with the guidelines of the Declaration of Helsinki and Good Clinical Practice. The study was approved by the Slovenian Ethics Committee, case no 0120-576/2020/3.

2.1 Variables

We gathered data from the records on parameters of glycaemic control and perinatal outcomes of all women with singleton gestations who had been diagnosed with GDM between March 2019 and December 2020 and who were tracked at our centre. In Slovenia, the epidemic was declared on 12 March 2020, with a complete lockdown lasting until 31 May.

We captured data on pre-specified parameters, based on the core set of variables in GDM recently identified by an expert group and previous research (13–15). Data on GDM diagnosis and management was collected from patient files and data on pregnancy outcomes was collected from the National Perinatal Registry. Excessive gestational weight gain (GWG) was assessed according to the IOM guidelines (16). Pre-specified maternal and perinatal outcomes included maternal hypertensive disorders (gestational hypertension or preeclampsia), caesarean section, birth weight, gestational age, incidence of large for gestational age (LGA) birthweight, small for gestational weight (SGA) birthweight, preterm birth, birth trauma, incidence of neonatal hypoglycaemia, neonatal jaundice, neonatal death and stillbirth. LGA was defined as having a birth weight >90th centile and SGA was defined as having a birth weight <10th centile, both using locally derived standardised centiles, adjusted for the infant's sex and gestational age. Preterm birth was defined as giving birth before the 37th week of gestation. Neonatal hypoglycaemia was defined as a capillary blood glucose

level <2.6 mmol/l on more than one occasion at least four hours after birth.

2.2 Statistical analysis

For the purpose of this study, the data of women diagnosed with GDM after March 2020, when the COVID-19 lockdown was declared, and those who delivered before the 31 December 2020 was compared with women who were diagnosed with GDM after March 2019 and gave birth before the end of 2019. Women whose pregnancy spanned COVID-19 and pre-COVID-19 periods were excluded from the analysis. In addition, in order to specifically assess the impact of the COVID-19 lockdown period on glycaemic control in women with GDM, we scrutinised glycaemic parameters in women who had been diagnosed with GDM during the first lockdown (12 March to 31 May 2020) and compared them the parameters observed during the same time period in 2019 (Figure 1).

To compare outcomes between the two groups of women, we used Student's t-test for normally distributed variables or the Mann–Whitney test for non-normally distributed variables as appropriate. Associations between categorical variables were assessed using the Chi square test. Bivariate logistic regression was performed to predict the maternal and perinatal odds ratio (OR). Rare outcomes were joined in a composite perinatal outcome. The data was analysed using SPSS Statistics version 21 (IBM, Armonk, NY, USA).

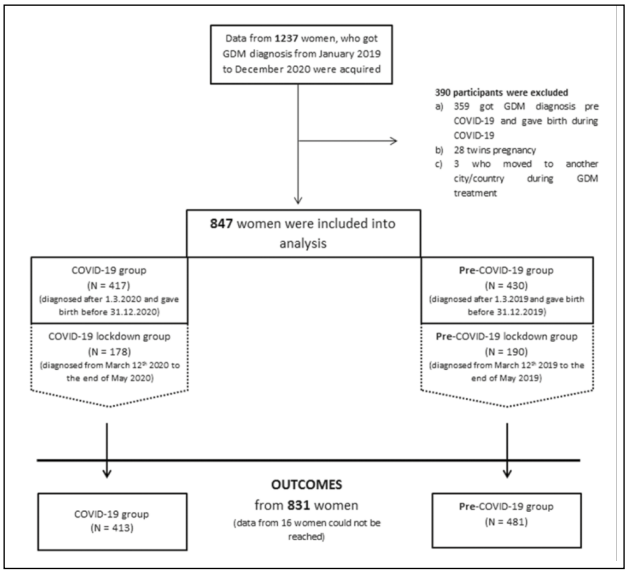

Figure 1. Flowchart of the study.

3 RESULTS

3.1 GDM diagnosis and glycaemic control during the COVID-19 epidemic

Women with GDM diagnosis and delivery during the COVID epidemic (N=417) were compared with those with a GDM diagnosis and delivery during the same period in 2019 (N=430) (Figure 1). The number of births in Slovenia did not differ significantly in 2019 and 2020 (19,141 and 18,628, respectively). However, the proportion of women screened for GDM was higher in 2020 than in 2019 (18.4% vs. 16.4%) (17). This trend was seen also at our centre, where the number of women treated for GDM was numerically higher in 2020 compared to 2019 (949 vs. 912, p=0.113).

During the COVID-19 epidemic, GDM diagnosis was made at an earlier gestational age than in 2019 (Table 1). COVID-19 and pre-COVID-19 groups of women did not differ significantly in terms of pre-pregnancy BMI or in GWG during pregnancy (Table 2). However, insulin therapy was needed more frequently and was initiated at an earlier gestational age. Fasting glucose concentration at the time of GDM diagnosis was higher during the COVID-19 epidemic, although glycaemic control, estimated by the HbA1c, was significantly lower throughout the pregnancy.

During the 11-week lockdown period, there were 178 new cases of GDM diagnosed. This compared to 190 in the same time period in 2019 (Table 2). During lockdown, the percentage of newly diagnosed GDM cases in early pregnancy was even more pronounced, with almost half of all GDM cases diagnosed before the 14th gestational week (Table 1). Although the need for treatment with long-acting insulin increased, overall insulin use was not significantly higher. Women diagnosed with GDM during the lockdown maintained a lower HbA1c throughout the pregnancy compared to women diagnosed with GDM a year before.

Table 1. General characteristics of women with gestational diabetes mellitus (GDM) before and during the COVID-19 epidemic.

	Whole sample		**Lockdown sample**	
	COVID-19 N=417	**Pre-COVID-19 N=430**	**COVID-19 N=178**	**Pre-COVID-19 N=190**
Age (years)	32.6±5.1	32.6±5.2	32.5±4.9	32.0±4.6
Pre-pregnancy BMI, kg/m^2	25.0 [22.1-28.4]	24.5 [21.6-29.0]	25.0 [22.1-27.6]	25.2 [22.1-29.4]
BMI>30 kg/m^2, % (n)	18.7 (76)	21.3 (90)	15.3 (27)	22.6 (43)
GWG, kg	11.0 [8.0-15.0]	11.0 [7.0-15.0]	11.0 [7.0-15.0]	11.0 [7.0-15.0]
Gestational age at diagnosis (weeks)	**23.9 [11.7-26.0]*** **	**25.1 [21.8-26.7]**	**15.0 [10.4-24.9]*** **	**24.6 [11.6-26.4]**
Gestational age at diagnosis (weeks), % (n)	**** a**		**** a**	
≤14	31.2 (130)	19.2 (82)	49.4 (88)	31.6 (60)
14-24	21.6 (90)	13.3 (57)	20.2 (36)	13.7 (26)
>24	47.2 (197)	67.5 (289)	30.3 (54)	54.7 (104)
Family history of diabetes, % (n)	52.7 (214)	52.0 (222)	49.1 (86)	55.8 (106)
GDM in previous pregnancy, % (n)	29.9 (60)	28.0 (58)	35.1 (34)	32.3 (31)
Parity, % (n)				
Nulliparous	44.8 (187)	46.3 (199)	39.3 (70)	41.6 (79)
Multiparous	55.2 (230)	53.7 (231)	60.7 (108)	58.4 (111)

GDM – gestational diabetes mellitus, BMI – body mass index, GWG – gestational weight gain.
Data is presented as mean±SD or median [interquartile range] unless otherwise indicated.
[a]Comparison between groups across all three categories
*P<0.05, **P<0.01, *** P<0.001

Table 2. Glycaemic parameters during the COVID-19 epidemic compared with those from the same period in 2019.

	Whole sample		**Lockdown sample**	
	COVID-19 N=417	**Pre-COVID-19 N=430**	**COVID-19 N=178**	**Pre-COVID-19 N=190**
Number	N=417	N=430	N=178	N=190
Fasting glucose/	5.2**	5.1	5.3**	5.2
0 min OGTT, mmol/l	[5.0-5.4]	[4.8-5.3]	[5.1-5.5]	[5.0-5.3]
60 min OGTT, mmol/l	10.1	9.9	10.1	10.1
	[9.1-10.7]	[9.1-10.6]	[9.3-10.9]	[9.0-10.6]
120 min OGTT, mmol/l	9.1	9.0	9.2	9.0
	[8.6-9.7]	[8.6-9.6]	[8.6-9.5]	[8.6-9.5]
HbA1c first visit during follow-up, %	4.9***	5.0	4.9*	5.0
	[4.8-5.1]	[4.8-5.2]	[4.8-5.1]	[4.8-5.2]
mmol/mol	30.1	31.1	30.1	31.1
	[29.0-32.2]	[29.0-33.3]	[29.0-32.2]	[29.0-33.3]
GA first visit	28.0***	29.6	20.1***	29.0
during follow-up, week	[16.4-30.0]	[26.5-31.4]	[14.9-28.9]	[17.9-31.3]
Average HbA1c between first and last visit, %	4.9***	5.1	4.9	5.0
	[4.8-5.2]	[4.9-5.4]	[4.8-5.2]	[4.9-5.2]
mmol/mol	30.1	32.2	30.1	31.1
	[29.0-33.3]	[30.1-35.5]	[28.4-33.3]	[30.1-33.3]
HbA1c last visit, %	5.1***	5.2	5.2**	5.3
	[4.9-5.4]	[5.0-5.4]	[4.9-5.4]	[5.0-5.5]
mmol/mol	32.2	33.3	33.3	34.4
	[30.1-35.0]	[31.1-35.5]	[30.1-35.5]	[31.1-36.6]
GA last visit, week	35.6	35.9	35.4	36.0
	[34.3-37.0]	[34.6-37.1]	[34.0-36.9]	[34.4-37.1]
Number of visits	4.0***	3.0	5.0***	3.0
	[3.0-5.0]	[3.0-4.0]	[3.0-6.0]	[3.0-5.0]

	Whole sample		Lockdown sample	
	COVID-19 N=417	Pre-COVID-19 N=430	COVID-19 N=178	Pre-COVID-19 N=190
Insulin treatment, % (n)	23.3* (97)	17.4 (75)	23.6 (42)	17.4 (33)
Insulin initiation, week	28.1** [20.6–31.7]	30.6 [27.1–33.6]	22.2** [14.7–29.1]	31.1 [21.3–33.7]
Long-acting insulin, % (n)	19.4*** (81)	10.0 (43)	20.2** (36)	9.0 (17)
Long-acting insulin – final dose, IU	12.0 [8.0–21.0]	14.0 [10.0–26.5]	14.0 [10.0–21.5]	16.0 [12.0–30.0]
Short-acting insulin, % (n)	12.5 (52)	11.9 (51)	12.9 (23)	12.7 (24)
Short-acting insulin – final dose, IU	18.0 [11.0–30.0]	12.0 [9.0–24.0]	24.0 [14.0–36.0]	12.0 [8.0–25.5]

OGTT – oral glucose tolerance test, HbA1c – glycated haemoglobin, GA – gestational age, IU – international units.
Data is presented as median [interquartile range] unless otherwise indicated.
Calculations for OGTT 60 and OGTT 120 are not given due to insufficient numerus within each category.
*P<0.05, **P<0.01, ***P<0.001

3.2 Maternal and perinatal outcomes during the COVID-19 epidemic

There was no increase in the risk of any of the maternal or perinatal outcomes studied (Table 3) during the COVID-19 epidemic. The percentage of infants born large for gestational age was numerically higher during the COVID-19 pandemic; however, the difference was not statistically significant. There was a numerically lower incidence of a composite perinatal adverse event, including offspring hypoglycaemia, hyperbilirubinemia, birth trauma, stillbirth and neonatal death; however, the difference was not statistically significant. For rare maternal and perinatal outcomes, the adjusted odds ratios have not been assessed due to the high likelihood of overfitting the model.

The average gestational weight did not differ during the COVID-19 epidemic compared to a year before (3426±521 vs. 3366±567 g). Similarly, gestational age at birth did not differ (39.0±2.1 vs. 39.0±2.0 week).

Table 3. Comparison of maternal and perinatal outcomes during the COVID-19 epidemic compared with those from the same period in 2019.

Outcome	COVID-19	Pre-COVID-19	OR [95% CI]	AOR [95% CI]
	No/total no (%)	No/total no (%)		
Maternal				
Hypertensive disorders	27/417 (6.5)	25/430 (5.8)	1.12 [0.64–1.97]	N/A
Excessive GWG	130/403 (32.3)	118/410 (28.8)	1.18 [0.87–1.59]	1.16 [0.85–1.58]
Caesarean section	98/411 (23.8)	100/417 (24.0)	0.99 [0.72–1.37]	0.99 [0.71–1.39]
Induction of labour	130/412 (31.6)	142/419 (33.9)	0.90 [0.67–1.20]	0.89 [0.66–1.20]
Perinatal				
LGA	58/398 (14.6)	49/419 (11.7)	1.29 [0.86–1.94]	1.24 [0.81–1.90]
SGA	17/398 (4.3)	26/419 (6.2)	0.67 [0.236–1.26]	N/A
Preterm birth (<37 weeks)	34/399 (8.5)	33/419 (7.9)	1.09 [0.66–1.80]	1.04 [0.62–1.74]
Hypoglycaemia	7/412 (1.7)	16/418 (3.8)	0.43 [0.18–1.07]	N/A
Hyperbilirubinemia	55/413 (13.3)	56/418 (13.4)	0.99 [0.67–1.48]	0.96 [0.63–1.45]
Child composite adverse outcome[a]	61/410 (14.9)	72/418 (17.2)	0.84 [0.58–1.22]	0.80 [0.54–1.17]

GWG – gestational weight gain, LGA – large for gestational age, SGA – small for gestational age.
AOR are adjusted for age, parity, pre-pregnancy BMI, gestational age at GDM diagnosis and insulin treatment.
[a]Child composite adverse outcome includes hyperbilirubinemia, hypoglycaemia, birth trauma, stillbirth and neonatal death.
Methods used for induction of labour: induction of labour with vaginal prostaglandin E2 or intracervical placement of Foley catheter or amniotomy.

4 DISCUSSION

We found that, despite the heavy burden on the health system and minor changes to the way care was delivered, glycaemic and perinatal outcomes among women being treated for GDM did not worsen during the COVID-19 epidemic in Slovenia. It may be that early GDM screening with timely pharmacological intervention was crucial for providing good glycaemic control and pregnancy outcomes during the critical period of the COVID-19 epidemic.

Our data shows at least as good glycaemic control during the epidemic when compared to the year before. This contrasts with the French report (10), despite the two centres having comparable standard-of-care treatment protocols. Moreover, in our study a lower percentage of women needed insulin treatment compared to the French cohort, although insulin was introduced earlier. We hypothesise that the main reason behind better glycaemic profile during the COVID-19 epidemic in our study was earlier GDM diagnosis and, consequently, the earlier introduction of pharmacological treatment, since French women were already at the 31st week of gestation at baseline (10). A less likely reason for better glycaemic control might be good access to healthcare professionals via telemedicine services. Reports from individuals with type 1 or type 2 diabetes using technology tools that enable good glucose monitoring also showed a better glycaemic profile during the COVID-19 lockdown (18–19).
In contrast to Italy (20–21), which was, like Slovenia, one of the few countries that maintained the same GDM diagnostic criteria during the COVID-19 epidemic, the prevalence of GDM did not significantly increase at our centre. However, there was a substantial increase in the proportion of GDM diagnoses based on fasting glucose concentration ≥5.1 mmol/l in early pregnancy in 2020. Zanardo et al. (20) included only women with a GDM diagnosis between 16 and 18 or 24 and 28 weeks of pregnancy. However, they showed that the experience of lockdown in the first trimester was a contributing factor in increasing GDM prevalence. It may be that the fasting glucose was elevated even before the 16th gestational week.

Similarly, in our study the average fasting glucose concentration during screening was higher during the COVID-19 epidemic compared to the year before. It is well accepted that higher levels of anxiety during the epidemic may have caused hormone changes, resulting in increased glucose. In addition to this, many people increased sedentary behaviour, restricted their movement (22) and had lower craving control with increased snack intake during the COVID-19 lockdown (23), which was in contrast to the strengthening of protective factors against COVID-19 infection (24, 25). All these factors might have predisposed pregnant women to increased fasting glucose concentration and GDM manifestation at an earlier gestational age. In the present study, we also demonstrate that women did not gain excess weight during the COVID-19 epidemic, although in two studies an increase in GWG during the COVID-19 epidemic was found (21, 26). Again, our hypothesis is that early GDM diagnosis and subsequent care enabled women to engage in healthy lifestyles that may have prevented them from excess GWG and its complications. This is also important because lower maternal BMI has been shown to be a significant determinant of a later child's BMI (27).

Nevertheless, despite higher fasting glucose concentration during the GDM screening period in the course of the COVID-19 epidemic, our first measurement of HbA1c in women with GDM was lower. Unfortunately, we do not determine HbA1c together with glucose concentration from the same blood sample. The first HbA1c values reported were therefore determined later, after women received education on healthy lifestyles and after they had already started with self-blood glucose monitoring. It may be that women diagnosed with GDM better understood the value of health during the epidemic and the need to avoid additional contact with the health system, and followed the guidelines more strictly. However, this hypothesis would need to be examined through further studies.

There is only a small amount of data available on perinatal outcomes. The Irish study (11) showed no difference in maternal, foetal and neonatal outcomes in women with GDM treated during the COVID-19 epidemic. In contrast, data from Oxford suggests worse perinatal outcomes during the COVID-19 epidemic (28). However, it should be noted that the UK and Ireland changed their diagnostic criteria during the COVID-19 epidemic, which first of all resulted in a substantial decrease in GDM diagnosis. Most importantly, the impact of the COVID-19 epidemic on perinatal outcomes cannot be separated from a change to diagnostic criteria. To our knowledge, our study is the first to look at the clinical outcomes in women with GDM where only the way care was delivered was adjusted to the COVID-19 epidemic, not the diagnostic criteria. We did not find a worsening of glycaemic control even though we switched to telemedicine care; and most importantly, no increase in the incidence of perinatal adverse outcomes was found. There were no significant changes in the occurrence rates of LGA or SGA. Our hypothesis is that early diagnosis according to the IADPSG criteria, although controversial (29–30), at a time when other malformations are also diagnosed (31) may allow for an early achievement of normoglycaemia, with regular follow-up visits helping women to continue with healthy lifestyles, despite increased fasting glucose concentration at the time of GDM diagnosis. Contrary to the results of Sweeting et al. (32), which showed that early GDM diagnosis did not substantially improve perinatal outcomes, we assume that worse perinatal outcomes may be prevented at our

centre by having universal early GDM screening in place, therefore providing timely pharmacological treatment to those at high risk of perinatal complications. Whether early screening is also that beneficial outside the context of an epidemic is still a matter of discussion.

During the COVID-19 epidemic, there were changes to the clinical practice recommendations for GDM diagnosis (6, 32). The guidelines mainly focused on risk factor-based screening, avoiding OGTT and finding a single-step procedure involving different cut-offs of fasting glucose concentration, random glucose concentration or HbA1c (33–36). Our findings suggest that discussion around OGTT was far less important than previously thought, since during the COVID-19 epidemic a substantially greater proportion of women had elevated fasting glucose levels in early pregnancy and did not even need OGTT. Data from the prospective study from a London clinic also suggest that adopting GDM screening guidelines during COVID-19 greatly reduces the detection rate of GDM (37) and could therefore increase the risk of adverse perinatal outcomes.

4.1 Strengths and limitations of this study

Our study is one of the first to provide an insight into glycaemic and pregnancy outcomes during the COVID-19 epidemic in a large sample of women with GDM. Unfortunately, our data comes from a single diabetes centre only.

The main limitation of the study was its retrospective design, nor do we have data on whether the proportion of women with a missed GDM diagnosis increased during COVID-19 epidemic. Moreover, based on our data, as all our patients received treatment for GDM, it is impossible to ascertain whether perinatal outcomes of women diagnosed with GDM in early pregnancy would have been worse if they had received treatment at a later gestational age or received no treatment at all. This analysis only included women with GDM treated at our diabetes centre, since there is no national diabetes registry in Slovenia. It is therefore not possible to make generalisations on a nationwide level and, since the number of adverse perinatal outcomes was small, in comparison with the perinatal outcomes of both cohorts, the risk of type II statistical error is increased. Nevertheless, we tried to minimise this risk by introducing the composite adverse event variable.

5 CONCLUSIONS

This study aimed to assess the impact of the epidemic on GDM diagnosis and treatment, but also its impact on pregnancy follow-up and delivery. However, this meant that we limited the sample of the studied women to a narrow range. We acknowledge the selection bias we introduced, i.e. towards including mainly those women with later onset GDM who were able to give birth before the end of 2020. To overcome this bias, we separately analysed the lockdown sample, since this time period (March to May 2020) enabled us to better capture the cases of early GDM diagnosis, since all women, regardless of the time of GDM diagnosis, had the same probability of being included in the sample.

In conclusion, we have demonstrated that early screening of GDM enabled identification of an increased number of women with GDM and of women at risk of adverse perinatal outcomes in the first trimester of pregnancy during the COVID-19 epidemic. More insulin therapy was needed in women with GDM, and insulin was initiated at an earlier gestational age. However, no adverse effects on pregnancy outcomes were noted.

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CONFLICTS OF INTERESTS

The authors declare that no conflicts of interest exist.

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ETHICAL APPROVAL

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