

Research Article

Determining the Effect of Gestational Diabetes Status on Breastfeeding Outcomes

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Abstract

Purpose

To determine the effect of gestational diabetes (GDM) on breastfeeding.

Method

The data were collected between March 2011 and January 2012 from 340 postpartum women in five baby-friendly hospitals in Turkey. Introduction form, an evaluation forms for breastfeeding during the first 24 hours and at the end of the first week postpartum were used. The data were evaluated with t-tests and chi-square tests.

Results

Mothers with GDM initiated breastfeeding later, had infants who were more deeply asleep when they were first held, had a less exclusive breastfeeding and had more breastfeeding problems during the first 24 hours compared with mothers without GDM. At the end of the first week, GDM mothers continued to experience breastfeeding problems such as insufficient milk and had lower exclusive breastfeeding.

Conclusion

Based on the findings, basic data for development of effective nursing breastfeeding support protocols for mother with GDM can be provided.

Keywords: Breastfeeding; Nursing; Gestational Diabetes Mellitus; Postpartum; Infant

Introduction

Feeding newborns with breast milk immediately after birth increases the production of milk by stimulating the prolactin receptors in breast tissue; it also decreases the risk of hypoglycemia in newborn infants [1]. The World Health Organization (WHO) (2001) proposed that, besides starting to breastfeed early, infants should be exclusively breastfed for the first six months, with continued breastfeeding up to two years and beyond. Supplementary food given in the early period can be the cause of various risks in newborn infants [1,2]. Research has shown that breastfeeding decreases the risk of type 2 diabetes, cardiovascular diseases, premenopausal breast cancer and ovarian cancer in mothers. It has also been found to protect newborn infants from obesity, diabetes, Crohn's disease, lymphoma and atopic dermatitis [3-7]. However, the prevalence of breastfeeding could be affected by the gradually increasing prevalence of gestational diabetes mellitus (GDM) [1,8,10]. The American Diabetes Association (ADA) estimated that 18% of pregnancies in the world are affected by GDM [9]. According to the Turkish Diabetes Foundation (2013), the incidence of GDM in Turkey is 3% [10]. A study by Tarim (2009) reported that the incidence of GDM in Turkey varies from 1.4% to 13.5% [11].

Gestational diabetes is caused because some placental hormones (estrogen, cortisol, and human placental lactogen) can have a blocking effect on insulin, a condition called insulin resistance. As the placenta grows, more of these hormones are produced, and insulin resistance becomes greater. Normally, the pancreas is able to make additional insulin to overcome insulin resistance, but when the production of insulin is not enough to overcome the effect of the placental hormones, gestational diabetes results or there may be worsening of pregestational diabetes [3-6].

Although mothers with diabetes generally prefer to breastfeed, clinical studies have shown that breastfeeding can be affected by diabetes [12-18]. GDM is thought to delay lactogenesis stage 1 (characterised by the start of lactation) and stage 2 (characterised by the increase of milk production) [1]. It also increases the risk of hypoglycaemia in newborn [1, 19, 20].

A prospective study by Hummel et al. found that the infants of mothers with GDM breastfed for a shorter period compared to the infants of healthy mothers [17]. Soltani et al. conducted a retrospective cohort study that aimed to determine breastfeeding practices in the second, fourth and sixth weeks postpartum among mothers with GDM and type 1 and 2 diabetes. Among the women in the three groups, the reasons for ending breastfeeding were the perception of insufficient milk (25%), lactation problems (13%), and maternal diseases (9%) [13].

Meanwhile, a study by Chertok, Raz, Shoham, Haddad & Wiznitzer that evaluated the effect of early breastfeeding on infants' glucose levels found that the blood sugar level of

breastfed infants was much higher than that of infants fed with formula [21].

The WHO estimated that the mortality from diabetes will increase two-fold between 2005 and 2030 [20]. Ensuring sufficient breastfeeding is a crucial responsibility that affects public health. Nurses should determine the aspects in which GDM affects breastfeeding and provide support suitable to the mothers' needs.

The aim of this study was to compare the breastfeeding patterns of mothers with and without GDM in the first 24 hours postpartum and one week later.

Materials and Methods

This is a descriptive and comparative survey. The study was conducted at five baby-friendly hospitals in Turkey between March 2011 and January 2012. A total of 340 participants (170 mothers with GDM and 170 without GDM) were part of the sample. The sample size was predetermined by using power calculation with G power programme. Eligibility criteria for participants: Primipar and multipar mothers who did not have any chronic disease and pregnancy complication other than GDM and had given term birth to a single live infant weighing 2.500 g -3.500g at least 24 hours prior to the interview. All five hospitals was determining GDM diagnosis according to American Diabetes Association criteria's [9]. Ethical approval was obtained from the Ethics Committee of Non-Interventional Research Evaluation Commission at Dokuz Eylül University. Also, written permission was obtained from mothers who agreed to be part of the study.

Data were collected in two stages using face-to-face and telephone interviews. In the first stage, the introduction form and the evaluation form for breastfeeding during the first 24 hours were completed via observation and face-to-face interviews. In the second stage, data were collected one week after the first stage through telephone interviews. For data collection introduction form, the evaluation form for breastfeeding during the first 24 hours, the evaluation form for breastfeeding at the end of the first week postpartum and criteria of Labbok and Krasovec scheme related to classification of type of breastfeeding (Figure 1).

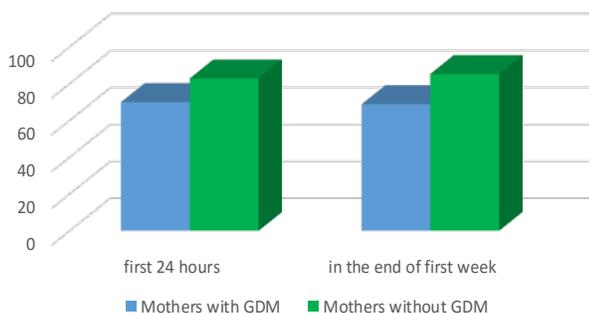
The introduction form was prepared by the researchers and contained questions on variables such as age, educational status, type of birth, number of pregnancies and previous breastfeeding experience.

The evaluation form for breastfeeding during the first 24 hours was prepared by the researchers based on an extensive literature review. It was evaluated by three professionals who work in the area of breastfeeding. The form was composed of

19 questions that aimed to determine the influence of GDM on lactogenesis 1.

The evaluation form for breastfeeding at the end of the first week postpartum was prepared by the researchers and it was also evaluated by three breastfeeding professionals. The form was composed of 15 questions on the type of breastfeeding and the problems related to breastfeeding. These questions aimed to determine the effect of GDM on lactogenesis 2.

The data were analysed using SPSS version 11.5. The level of statistical significance was set at $p < 0.05$. Independent sample t-tests and chi-square tests were applied to determine the differences between groups related to breastfeeding results in first 24 hour and in the end of first week postpartum. Type of breastfeeding were evaluated according to the criteria of Labbok and Krasovec (Figure 1) [23], and results were compared with chi-square analysis.



Graph 1. Comparison of exclusively breastfeeding of mothers with and without GDM.

Results

Mothers with GDM had an average age of 31.3 ± 5.8 , compared to 27.6 ± 5.13 for mothers without GDM ($p = 0.000$). The BMI was higher in mothers with GDM ($p = 0.000$). The two groups had similar educational backgrounds; most were primary school graduates. There were no significant differences between the groups in terms of parity ($p = 0.066$) and type of delivery ($p = 0.883$) (Table 1).

Breastfeeding patterns during the first 24 hours

About half (52.1%) of the infants of mothers without GDM breastfed at intervals of 30 minutes to 1 hour, while 67.6% of the infants of mothers with GDM breastfed at intervals of 1–3 hours ($p = 0.000$). The duration of the initial breastfeeding was shorter for infants of GDM ($p = 0.000$). The total percentage of infants who were in deep sleep or were sleepy was higher among GDM mothers' infants ($p = 0.010$). About three fourths (75.9%) of mothers with GDM and 49.4% of mothers without GDM experienced problems with breastfeeding ($p = 0.000$).

The most common problem that GDM mothers reported was insufficient milk ($p = 0.000$). A single period of breastfeeding was shorter for mothers with GDM ($p = 0.000$) and they felt more need to express breast milk ($p = 0.000$). The reason for expressing breast milk in two groups was similar due to their delay in starting lactation ($p = 0.166$). Nearly three out of 10 (29.4%) women with GDM used supplements other than breast milk ($p = 0.007$) (Table 2).

Type of breastfeeding in the first 24 hours postpartum

Seventy percent of women with GDM and 82.9% of women without GDM were exclusively breastfeeding their infants after the first 24 hours postpartum ($p = 0.007$) (Table 3).

Breastfeeding patterns at the end of the first week postpartum

Nearly all (98.8%) the mothers with GDM and 100% of the mothers without GDM were breastfeeding at the end of the first week ($p = 0.499$). In both groups, infants were generally breastfed at intervals of two hours ($p = 0.110$). Among mothers with GDM, 35.9% continued to experience problems related to breastfeeding, compared to 23.5% among mothers without GDM ($p = 0.017$). Insufficient milk secretion was continuing to be a problem in 65.6% of mothers with GDM ($p = 0.003$). About a quarter (24.7%) of mothers with GDM felt a need to express milk ($p = 0.019$). Half (50%) of the women with GDM felt the need to express milk due to insufficient milk secretion, and 34.8% of the women without GDM felt the need to express milk because their breasts were filled with milk ($p = 0.005$). Significantly more mothers with GDM used supplementary food ($p = 0.000$) (Table 4).

Type of breastfeeding at the end of the first week postpartum

Nearly seven out of 10 (68.8%) mothers with GDM and 85.3% of mothers without GDM were engaged in exclusive breastfeeding at the end of the first week postpartum ($p = 0.000$) (Table 5).

Discussion

The first breastfeeding of women with GDM was mostly delayed by up to three hours. There has been no study comparing the first breastfeeding time of healthy mothers and mothers with GDM; however, some studies have examined the problems experienced by mothers with GDM and diabetes in early breastfeeding. In a study of 84 mothers with GDM by Chertok et al. the average first breastfeeding interval was 1.5 hours [21]. Meanwhile, Simmons, Conroy & Thompson found that although mothers with GDM were given information on GDM in pregnancy and breastfeeding, 68% did not perform early breastfeeding [14].

Table 1. Introduction and obstetric characteristic of mothers (n=340).

Characteristics	Mothers with GDM (n=170)		Mothers without GDM (n=170)		t	p**
	M±SD		M±SD			
Age (years)	31.3±5.8		27.6±5.13		6.324	0.000
Body mass index	28.2±5.5		24.9±4.8		5.778	0.000
	n	%	n	%	χ ²	p*
Educational status					1.06	0.78
Primary school	127	74.7	127	74.7		
High school	37	21.8	34	20.0		
University	6	3.5	9	5.3		
Type of birth	n	%	n	%	χ ²	p**
Caesarean section	142	83.5	143	84.1	0.022	0.883
Vaginal birth	28	16.5	27	15.9		
Parity	n	%	n	%	χ ²	p*
Primipar	44	25.8	56	32.9	11.840	0.066
Multipar	126	74.2	114	67.1		

*Chi-square test **Independent sample t-test

Table 2. Comparison of breastfeeding outcomes during the first 24 hours (n=340).

	Mothers with GDM (n=170)		Mothers without GDM (n=170)		χ ²	p*
	n	%	n	%		
First breastfeeding time					40.965	0.000
15-30 minutes	3	1.8	4	2.4		
30 minutes-1 hour	35	20.6	88	52.1		
1-3 hours	115	67.6	72	42.6		
4-5 hours	8	4.7	2	1.2		
12-18 hours	9	5.3	3	1.8		
Duration of the first breastfeeding (in minutes)	M±SD		M±SD		t	p**
	6.0±3.7		7.6±4.4		-3.67	0.000
	n	%	n	%	χ ²	p*

Appearance of infant when held for the first time						
Infant was in a deep sleep	23	13.5	12	7.1	10.082	0.010
Infant was sleepy	47	27.6	49	28.8		
Infant was quiet and awake	52	33.5	80	47.1		
Infant was crying	43	25.3	29	17.1		
Experiencing breastfeeding problem					25.452	0.000
Yes	129	75.9	84	49.4		
No	41	24.1	86	50.6		
Kind of problem					62.600	0.000
Infant could not latch onto breast	5	3.8	35	15.9		
Insufficient milk	71	53.8	41	47.1		
Infant was sleepy	9	6.8	6	6.9		
Insufficient milk + sleepy infant	46	34.8	3	3.4		
It was peaceful after breastfeeding					16.808	0.000
Yes	89	52.4	119	70.0		
No	20	11.8	4	2.4		
Partially	61	35.9	47	27.6		
	M±SD		M±SD		t	p**
Average duration of breastfeeding (in minutes)	9.7±4.5		13.3±5.0		-6.912	0.000
Infants' interval between nursing	n	%	n	%	χ ²	P*
One hour	3	1.8	3	1.8	18.216	0.000
Two hours	136	81.0	161	94.7		
Longer than two hours	29	17.3	6	3.5		
Need for expressing breast milk					12.817	0.000
Yes	42	24.7	17	10.0		
No	128	75.3	153	90.0		
Reason for expressing milk					5.086	0.166
Insufficient breast milk	26	59.1	5	33.3		
Breasts are very filled with milk	8	18.2	2	13.3		
Infant does not want to breastfeed	8	18.2	6	40.0		

Use of supplements					8.052	0.007
Yes	50	29.4	28	16.5		
No	120	70.6	142	83.5		
Type of supplements given					1.342	0.719
Formula food	47	87.0	18	78.3		
Water	3	5.6	3	13.0		
Cow's milk	4	7.4	2	8.7		

Note *Chi-square test **Independent sample t-test

Table 3. Comparison of type of breastfeeding in the first 24 hours postpartum (n=340).

	Mothers with GDM (n=170)		Mothers without GDM (n=170)		χ^2	p^*
	N	%	N	%		
Type of breastfeeding after first 24 hours postpartum					16.076	0.007
Exclusive breastfeeding	119	70.0	141	82.9		
Almost exclusive breastfeeding	21	12.4	16	9.4		
High level of partial breastfeeding	20	11.8	6	3.5		
Medium level of partial breastfeeding	3	1.8	6	3.5		
Low level of partial breastfeeding	4	2.4	0	0.0		
Symbolic breastfeeding	3	1.8	1	0.6		

Note.* Chi-square test

Table 4. Comparison of breastfeeding results at the end of the first week postpartum (n=340).

	Mothers with GDM (n=170)	Mothers without GDM (n=170)		
	M±SD	M±SD	t	P^{**}
Average duration of breastfeeding (in minutes)	14.5±5.01	13.9±3.9	0.193	0.845

	n	%	n	%	χ^2	p^*
Still breastfeeding					2.012	0.499
Yes	168	98.8	170	100.0		
No	2	1.2	0	0.0		
Breastfeeding interval (in hours)					6.041	0.110
One hour	2	1.2	1	1.5		
Two hours	153	91.1	165	97.7		
Longer than two hours	11	6.5	4	2.4		
Experienced breastfeeding problems					6.212	0.017
Yes	61	35.9	40	23.5		
No	109	64.1	130	76.5		
Breastfeeding problem experienced					25.073	0.003
Insufficient mother's milk	40	65.6	9	23.1		
Infant cannot latch onto breast	6	9.8	8	20.5		
Infant was sleepy	4	6.6	8	20.5		
Infant was vomiting	3	4.9	5	12.8		
Infant was peaceful after breastfeeding					16.677	0.000
Yes	96	56.5	124	73.4		
No	16	9.4	2	1.2		
Partially	58	4.1	43	25.4		
Need to express milk					6.092	0.019
Yes	42	24.7	24	14.1		
No	128	75.3	146	85.9		
Reason for expressing milk					18.777	0.005
Insufficient mother's milk	20	50.0	1	4.3		
Breasts are very filled with milk	11	27.5	8	34.8		
Infant does not want to nurse	9	22.5	14	60.9		

Use of supplements					13.542	0.000
Yes	51	30.0	23	13.5		
No	119	70.0	147	86.5		

Table 5. Comparison of the type of breastfeeding at the end of the first week postpartum (n=340).

	Mothers with GDM (n=170)		Mothers without GDM (n=170)		χ^2	P*
	n	%	n	%		
Type of breastfeeding at the end of the first week					14.578	0.000
Exclusive breastfeeding	117	68.8	145	85.3		
Almost exclusive breastfeeding	30	17.6	13	7.6		
High level of partial breastfeeding	13	7.6	6	3.5		
Medium level of partial breastfeeding	8	4.7	6	3.5		
Low level of partial breastfeeding	0	0.0	0	0.0		
Symbolic breastfeeding	2	1.2	0	0.0		

Note. * Chi-square test

A systematic study by Taylor et al. which examined 12 studies conducted between 1966 and 2003 on the relationship between breastfeeding and type 2 diabetes mellitus (DM), found that women with type 2 DM had lower rates of breastfeeding than those without DM [15]. The delay in first breastfeeding among mothers with GDM was hypothesised to be caused by a delay in lactogenesis as a result of insufficient insulin connected to alveolar cell receptors. In addition, the authors suggested that mothers with GDM experience difficulties in early first breastfeeding due to the risk of hypoglycaemia in their infants. Despite the study was conducted at baby-friendly hospitals, supporting early breastfeeding by health professionals' especially in infants of mothers with GDM should be reconsidered again in these hospitals [1-2].

More infants of mothers with GDM were deeply asleep when they were first held, compared to infants of mothers without GDM. Deep sleep in infants could be due to their susceptibility to hypoglycaemia as a result of high insulin level that is transported from mother to baby, although this hypothesis

could not be tested because the hospitals did not take regular measurements of the infants' blood glucose levels. Chertok et al. found that 9.5% of infants born to mothers with GDM had hypoglycaemia, and that 23.8% of the infants had blood glucose levels at the border of hypoglycaemia [21]. Karabayir, Atalay, Adal & Onal retrospectively examined the files of 82 children with full-term diabetic mothers (2% type 1 DM, 5% type 2 DM, 93% GDM) and hypoglycaemia was found in 35.4% of the infants [28]. Hypoglycaemia increases their tendency to sleep, slows down infant's neuromotor movements and can weaken their sucking reflex. Decreased sucking can inhibit the milk secretion reflex, which in turn can decrease lactation [1,21,27]. Having insufficient milk was a significant problem for women in both groups in first 24 hour postpartum. Insufficient milk was defined as having soft breast, not coming any milk when breast was pressed and crying baby after breastfeeding. Soltani et al. found that women with diabetes (type 1 DM, type 2 DM, GDM) experienced problems such as inability to start lactation, insufficient milk, infant's refusal to suck and infant's loss of weight [13]. Studies examining the breastfeeding problems of

GDM mothers are limited; nevertheless, they have shown that GDM mothers experience serious breastfeeding problems, which is consistent with our study findings.

While breastfeeding at two-hour intervals was common in both groups, breastfeeding at intervals longer than two hours was high among mothers with GDM. Among mothers with GDM, frequent breastfeeding is of great importance in reducing the hypoglycaemia risk of their infants and in starting and continuing lactation, which can be delayed by GDM.¹ Youngwanichsetha and Phumdoung findings showed the significant association between neonatal hypoglycaemia and gestational diabetes [19].

Our study also found that mothers with GDM expressed milk mostly due to insufficient milk, whereas mothers without GDM expressed milk mostly because their infants did not want to breastfeed. Forster et al. had GDM pregnant undertake milk expression twice a day for at least 10 minutes from the 36th week of pregnancy until they came to the hospital to give birth. Mothers who did antenatal milk expression gave their infants less supplementary food and gave more breast milk alone during the first 24 hours. In addition, the rate of breastfeeding was higher within the period they remained at hospital. Thus, milk expression can positively affect breastfeeding results [20]. In our research mothers with GDM used many other supplements besides breast milk during the first 24 hours compared to women without GDM. Forster et al. suggested that it would be beneficial to examine milk express and similar practices to decrease the rate of giving supplements to this new-born's. The supplements given the most in both groups were water, water with sugar and cow's milk [20]. According to the TDHS 2008, among the infants less than two months old, 21.3% were given supplementary food, 4.1% were given other milk, yogurt and cheese and 18.3% were given other liquids. Our study findings are similar to these TDHS results [26].

Another important point, healthy mothers had a higher rate of exclusive breastfeeding than mothers with GDM. According to the TDHS 2003, the percentage of mothers who exclusively breastfed their infants less than six months old was 20.8%; this increased to 41.6% in the TDHS 2008 [26, 29]. It is possible that the rate of exclusive breastfeeding in both groups was higher in our study compared to the TDHS data because we evaluated breastfeeding results during the first 24 hours and conducted our study at baby-friendly hospitals. Hummel et al. also found that mothers with GDM breastfed less and had a shorter exclusive or partial breastfeeding time than healthy mothers. Among women with GDM, a delayed onset of lactation and giving newborns supplemental products can increase the risk of hypoglycaemia in their newborns [17]. This, in turn, can negatively affect exclusive breastfeeding. Similar results were obtained for the average breastfeeding period in the first week postpartum of mothers with and without GDM. The average breastfeeding period for mothers with GDM increased

at the end of the first week compared to the first 24 hours. This could be due to the infants' improved neuromotor activity, the decreased hypoglycaemia risk among infants of mothers with GDM or the infants' increased sucking strength. It could also be because the mother and infant had become used to each other and to breastfeeding.

Although breastfeeding was higher among women without GDM at the end of the first week postpartum, almost all the women participating in the study breastfed their infants. The TDHS 2008 reported that 98.5% of infants less than two months old were breastfed [26]. Despite problems of lactation in mothers with GDM and the risk of hypoglycaemia in the early period, both groups had a high rate of breastfeeding in the first week postpartum. This could be because breastfeeding is a cultural practice in Turkey and the mothers receive good social support on breastfeeding. While there was a difference in the breastfeeding interval of infants of mothers with and without GDM during the first 24 hours, this difference disappeared at the end of the first week. In particular, breastfeeding at intervals longer than two hours among mothers with GDM decreased. The regulation of breastfeeding intervals at the end of the first week could stem from the decreased risk of hypoglycaemia in infants of mothers with GDM and from the infants' strengthened sucking reflex. It could also be due to the increasing attachment between the mother and the infant, the breastfeeding behaviour becoming routine and a decreased intake of supplementary products.

But at the end of the first week, more GDM mothers were still experiencing breastfeeding problems. The problem of insufficient milk continued in women with GDM but decreased in women without GDM. This could stem from the delay of the lactogenesis 2 process in women with GDM, which is characterised by abundant milk secretion. Therewith parallel the most common reason for expressing milk in the end of first week in GDM mothers, was insufficient milk. This suggests that the delay in lactogenesis 1 in women with GDM also affected lactogenesis 2 [30].

Compared with the first 24 hours, there was a decrease in giving supplements among mothers without GDM. Continued use of supplementary liquids in the group with GDM could be caused by a delay in lactogenesis 2, stemming from GDM and insufficient milk. In a study by Soltani et al. 14.9% of women with DM gave supplements at the first breastfeeding; this increased to 19.1% at the end of the first week [18]. This increase in giving supplements shows that breastfeeding problems in women with DM gradually increased. In our study, giving supplements among women with GDM was similar in two measurement. At the end of the first week, a higher proportion of healthy mother's breastfed their infants with only mother's milk compared to mothers with GDM. These results suggest that nurses should support and improve exclusively breastfeeding in GDM mothers.

Limitations

This study has a few limitations. First, postpartum infant blood sugar records were limited, so hypoglycaemia was estimated based on the mothers' interpretation of the infants' behaviour (decreased muscular tonus, sleepy or not sleepy) and insufficient milk supply was determined based on the mothers' views related to breast fullness.

Conclusion

Nurses should be aware of their unique position to support first breastfeeding, so to prevent a delay in lactogenesis and the risk of hypoglycaemia in infants of GDM mothers. Initiatives (such as expressing milk) should be planned and implemented to increase mother's milk in women with GDM who experience more breastfeeding problems, rather than starting supplementary nutrients immediately. Also global initiatives should be structured for improving breastfeeding in GDM mothers. Further consideration must be given to how these women should be supported. There should be organisation strategies to support mothers with GDM related to breastfeeding antenatal and postnatal and to provide early preparation related to risks that may occur.

Declaration of Conflicting Interests

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