

Original Article

Comparison of Postnatal Health Indicators in Infants of Mothers With and Without Oral Glucose Tolerance Test

Esra Demirci Ecevit, RN, MSc

First and Emergency Aid Program, Gedik Vocational School, Istanbul Gedik University, Istanbul, Turkey

Nuran Aydin, RN, PhD

Business Analyst Manager at MLPCARE, Istanbul, Turkey

Correspondence: Esra Demirci Ecevit, RN, MSc, First and Emergency Aid Program, Gedik Vocational School, Istanbul Gedik University, Istanbul, Turkey E-mail: esra.ecevit@gedik.edu.tr

Abstract

Objective: This study was conducted using a comparative cross-sectional design to compare the postnatal health indicators of infants born to mothers who did and did not undergo the oral glucose tolerance test (OGTT).

Methods: Mothers between the ages of 20-35 who had no chronic diseases, had body mass index within the normal range, gained weight during pregnancy within the limits described in the literature, had no consanguineous marriage and had a vaginal delivery between 37-41st weeks and their infants were included in the study. Information was obtained from the mothers with the data collection form and the Latch Breastfeeding Diagnostic Scale. Infants were evaluated in the first 24 hours of life by Apgar Score and for respiratory parameters, nutritional status, crying, blood sugar findings and postnatal physical anomalies.

Results: No statistically significant difference was found between the weight, height, head measurements, discharge body weights, APGAR scores, blood glucose values measured at the 30th minute, 2nd hour and 6th hour, nutritional status and respiratory patterns of the infants of mothers who had and did not have OGTT ($p > 0.05$).

Conclusion: There was no difference between the postnatal status of the infants of mothers who did and did not have OGTT. ($p > 0.05$) Limited to this study, it can be concluded that oral glucose tolerance test does not have a negative effect on the newborn.

Keywords: Gestational Diabetes, Oral Glucose Tolerance Test, Newborn.

Introduction

Diabetes mellitus (DM) is a chronic condition that causes an increase in blood sugar due to insufficient insulin production or the inability of body cells to respond effectively to insulin (Sofia, 2019). Gestational diabetes mellitus (GDM) is defined as glucose intolerance first diagnosed during pregnancy (Khan et al., 2018).

Accumulating evidence has shown that hyperglycaemia during pregnancy not only increases perinatal morbidity and mortality in mothers and children, but also increases the occurrence of the disease later in life (Wang & Yang, 2016). A study examining the

postpartum abnormal glucose tolerance of pregnant women with gestational diabetes found abnormal glucose tolerance in 150 (63.03%) of 230 pregnant women with GDM, while type 2 diabetes was observed 7.43 times more in pregnant women with GDM than in healthy pregnant women (Linhong et al., 2021).

GDM develops around 20-30 weeks of pregnancy as a result of insulin hormone desensitized by the effect of increased HPL (Human Placental Lactogen) hormone, insulin resistance and increased adiposity during pregnancy (Thomas & Anny, 2005). There are, however, a number of risk factors

that increase the risk of gestational diabetes (Lawrence et al., 2019).

One- or two-stage oral glucose tolerance test (OGTT) is used in the diagnosis of GDM. The oral glucose tolerance test is one of the most sensitive tests used to identify diabetes since the 1960s (Ilgen & Kocak, 2019). After glucose loading, deviations from the normal range in the measured glucose values are detected (Khan et al., 2018).

Gestational diabetes is a significant risk factor that can adversely affect maternal and fetal health during pregnancy. It is associated not only with short-term complications such as preeclampsia, cesarean delivery, fetal macrosomia, neonatal hypoglycemia, and hyperbilirubinemia, but also with long-term health issues including childhood obesity and metabolic syndrome in the postnatal period (Ozkaya & Kose, 2014; Hirsch et al., 2024). Many national and international organizations such as World Health Organization (WHO), American Diabetes Association (ADA), Turkish Ministry of Health, Turkish Society of Gynaecology and Obstetrics (TJOD) recommend the OGTT for GDM screening in pregnancy (Koyucu, 2018). However, various claims and assertions have recently emerged, especially in the visual and printed media, regarding the possibility that OGTT may harm infants. This seems to negatively affect pregnant women's predisposition to the test. In a study conducted with 514 women in 2017, 64.3% of women considered the test harmful and 58.7% of these women were in the risk group for GDM (Koyucu, 2018).

In another study conducted in 2019, 34.2% of the pregnant women in the study did not want to have OGTT and 28.4% thought that OGTT was harmful. Of those who thought it was harmful, 58% did not have the test or did not intend to have it. Of those who thought that OGTT was harmful, 42.9% got this idea from television and the internet, 55.7% from the people around them, and 3.8% from health professionals (Yaprak et al., 2019).

No has been found study in the literature on the effects of OGTT on infants. However, there are studies on the side effects of OGTT on the mother. According to research by Lamar, Kuehl et al., the potential side effects of OGTT include nausea (30%), vomiting

(11%), dizziness (11%), and headache and fatigue (9%) (Lamar et al., 1999). According to another study involving 300 subjects, 42% of those who had OGTT had nausea, 9% had vomiting, 22% had cold sweats and 26.3% had palpitation. In the same study, 46.3% of the participants did not want to have the test repeated (Gokbulut, 2012).

Nurses and midwives have an important role in protecting pregnant women's health. The current Nursing and midwifery regulations lists the duties such as carrying out the care and follow-up specific to pregnancy, diagnosing risky conditions that may develop during early pregnancy, applying the treatment and referring when necessary, and providing training and counselling (THD, 2011). We believe that as part of our roles and responsibilities in our work, we need to know the right approach and provide training accordingly.

Purpose of the article

In recent studies, it is seen that pregnant women do not want to have an oral glucose tolerance test and the idea that the test will have negative effects on the baby is common. However, no study has been found in the literature on the negative effects of the test on the baby. Although our study has limitations, it will contribute to the literature in this area. There will be a preliminary guide work among health professionals who counsel and guide pregnant women.

Therefore, this study aimed to compare the postnatal health indicators of infants born to mothers who did and did not undergo OGTT, and to support the use of the findings by healthcare professionals in the counselling and guidance processes provided to pregnant women.

Materials and Methods

Research design

This study was conducted using a comparative cross-sectional research design to evaluate the effects of the oral glucose tolerance test on infant health. In the study, the postnatal health indicators of newborns of mothers who underwent OGTT and those who did not were systematically compared.

Population and sample: The population of the research covered 2715 pregnant women who gave birth in the hospital between the

specified dates, and the sample included 60 women who met the inclusion criteria and agreed to participate in the research, and their infants. Power analysis was performed using the G*Power (v3.1.7) program to determine the number of samples.

Data collection: The sample was divided into two groups, 30 in the experimental and 30 in the control group. The first group (non-OGTT) included 30 mothers who had vaginal delivery and refused to have an oral glucose tolerance test but agreed to participate in the study, and their infants. The second group (OGTT) included 30 mothers who had vaginal delivery and agreed to have an oral glucose tolerance test and participate in the study, and their infants. It was determined that the first and second groups were similar in terms of their characteristics, and the groups were homogeneously distributed. In creating the sample selection criteria, care was taken to exclude pregnant women with conditions that may affect the risk factors that may result from OGTT, and the sample group was selected among women meeting the below criteria:

- Aged 20-35 years, without any chronic condition,
- Had a BMI within normal limits,
- Gained weight during pregnancy within the limits described in the literature,
- Had no consanguineous marriage,
- Had a vaginal delivery between 37-41st gestational weeks, and their infants.

Data collection tools

LATCH breastfeeding diagnostic scale, APGAR scoring and data collection form were used to collect the research data.

LATCH Breastfeeding diagnostic scale:

Developed by Deborah Jensen and Sheila Wallace in Oregon in 1993, LATCH is a measurement tool that enables rapid diagnosing of breastfeeding with its scoring system. There are 5 criteria for its evaluation:

- L(Latch on Breast), whether the infants grasp the breast,
- A(Audible Swallowing), whether infant's swallowing sound is heard.
- T(Type of Nipple), type of mother's nipple,
- C(Comfort of Breast/Nipple), mother's breast/nipple comfort,

- H(Hold/Positioning) the assistance the mother needs to place the infant in the sucking position.

Each of these criteria is scored between 0 and 2 points separately, with a total score below 10 indicating that the mother needs support in breastfeeding. In the study, the Latch breastfeeding diagnostic scale was scored by the researcher and the mother. It was determined by Okumus and Yenal (2003) that the Turkish reliability level of the Latch Breastfeeding Diagnostic Measurement tool (Cronbach Alpha 0.95, interobserver agreement 90-100%) was suitable for clinical use. Parallel to our study, Latch Breastfeeding Diagnostic Measurement Tool (Cronbach Alpha 0.92, interobserver agreement 90-97%) was found to be suitable for clinical use (Alus & Okumus, 2013).

Apgar scoring: The Apgar score was developed to determine whether a newborn needs help. Newborn heart rate, respiration, muscle tone, stimulus response and skin colour are evaluated at 1, 5 and 10 minutes. The score obtained by summing the points (0, 1, 2 points) given in each area. If the Apgar score is between 8-10, the newborn is lively and strong, if the score is between 4 and 7, the infants needs oxygen and stimulation, and if it is below 4, it indicates severe oxygen deficiency (Tezel et al., 2015).

Data Collection Form: This form was developed by the researchers to compare postnatal health indicators in infants of mothers who did and did not undergo the Oral Glucose Tolerance Test. The form was created based on a literature review and evaluated by 10 expert nurses specialized in pediatric nursing and obstetric nursing. For each item, the Content Validity Ratio (CVR) and the overall Content Validity Index (CVI) were calculated. A minimum CVR value of 0.78 and a CVI value above 0.85 were targeted. Reliability analysis was conducted using KR-20 and KR-21 coefficients; both values being above 0.70 indicated that the form was sufficiently reliable.

Ethical considerations: The study was commenced after obtaining the ethics committee approval from Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (Date: 24.11.2015- Number: 10840098-604.01.01-E.3879), and the permission of the Office of

the Chief Physician of the Turkish Ministry of Health Kartal Dr. Lütfi Kırdar Training and Research Hospital, where the research will be carried out. The study was carried out on a voluntary basis, and informed consents were obtained from the mothers before the data were collected.

Data analysis: Data analysis was done with IBM SPSS 23 software at %95 confidence level. Spearman correlation, Mann Whitney, Kruskal Wallis, which are non-parametric test techniques, were used in the study. In the study, the relationship of the measurements was analysed with the Spearman correlation test, and the differences in the measurements according to the demographic variables were analysed with the Mann Whitney and Kruskal Wallis tests.

Results

The age range of mothers participating in the study was similar in both groups. The education level of 53.4% of the mothers in the non-OGTT group was primary school or below compared to 60% of the mothers in the OGTT group with high school or higher education levels. The frequency of going to prenatal check-ups was 56.6% in mothers in the OGTT group compared to 63.3% in the non-OGTT group. Mothers in both groups mostly (46.7%-46.6%) preferred education and research hospitals during pregnancy. Pre-pregnancy and gestational BMI were normal in both groups. The descriptive characteristics of the mothers are presented in Table-1.

When the gender of the infants is examined, there were more girls in the non-OGTT group and more boys in the OGTT group. 80% of the infants in the OGTT group and 60% of the infants in the non-OGTT group were born at the 39th gestational week or later. Considering the nutritional status of the infants, it was observed that the majority of infants in both groups were breastfed by their mothers and the time between each feeding was 2 hours. 53.3% of the non-OGTT group and 60% of the OGTT group demonstrated strong crying.

No physical anomaly was observed in the infants of mothers in either group. Infants in both groups had full reflexes. There was no significant difference between the feeding patterns observed after birth and the duration of feeding in infants of mothers in either group ($p=0.999$). ($p=0.500$) Descriptive characteristics of the infants are presented in Table 2.

In infants of mothers in the non-OGTT group, 1 min. Apgar average was 7.53 and 5 min. Apgar average was 8.60. In infants of mothers in the OGTT group, 1 min. Apgar average was 8.17 and 5 min. Apgar average was 8.83. There was a statistically significant difference between 1 min Apgar score and whether the mother had OGTT. ($p=0.001$) The mean rank was 23.80 in those in the non-OGTT group and 37.20 in those in the OGTT group. Accordingly, the Apgar 1 min. attitude is higher in the OGTT group. There was no statistically significant difference between 5 min Apgar score and whether the mother had OGTT. ($p=0.176$) Apgar data of the newborns are presented in Table 3.

The respiratory pattern of the majority of infants of mothers in both groups was normal. Shallow breathing of some infants was due to labour. Subsequent respiratory evaluations of these infants were normal. Findings from the newborns' respiration evaluation are presented in Table 4.

In infants of mothers in the non-OGTT group, 30. min. average blood sugar was 64.67, 2nd hour blood sugar average was 61.53 and 6th hour blood sugar average was 61.27. In infants of mothers in the OGTT group, 30. min. average blood sugar was 60.87, 2nd hour blood sugar average was 58.43 and 6th hour blood sugar average was 61.13. There was no significant difference between the blood sugar levels of the infants of mothers in the OGTT and non-OGTT groups at the 30th minute ($p=0.091$), 2nd hour ($p=0.084$), and 6th hour ($p=0.365$) postnatally. The findings are presented in Table-5.

Table 1. Mother Descriptive Characteristics

		Had OGTT				
		No		Yes		
		n	%	n	%	p
Age	Under 21 years old	7	23.3	4	13.3	0.52
	21-25 years old	10	33.3	10	33.3	
	26-30 years	6	20	10	33.3	
	Over 30 years old	7	23.3	6	20	
Education	Elementary and below	16	53.4	12	40	0.43
	High school and above	14	46.6	18	60	
Frequency of going to prenatal check-ups	Once a month	19	63.3	17	56.6	0.99
	Twice a month	2	6.6	4	13.3	
	Thrice a month or more	0	0	0	0	
	1 in 2 months	0	0	0	0	
	Irregular	9	30	9	30	
Institution applied during pregnancy	Public Hospital	3	10	5	16.6	0.59
	Training and Research Hospital	14	46.7	14	46.6	
	Family Medicine Institution	3	10	2	6.6	
	Private Hospital	5	16.7	5	16.7	
	None	5	16.6	4	13.3	
BMI before pregnancy	Normal	30	100	30	100	
BMI during pregnancy	Normal	30	100	30	100	

Table 2. Descriptive Characteristics of The Infants

Characteristics of the infants after birth		Had OGTT				p
		No		Yes		
Gender		n	%	n	%	
Gender	Girl	21	70	12	40	0.027*
	Boy	9	30	18	60	
Gestational week	Before 39 weeks	6	20	12	40	0.15
	39 weeks and later	24	80	18	60	
Nutritional status	Accepts breastfeeding only	16	53.	18	60	0.99
	Accepts formula only	4	13.	5	16.6	
				3		

	Accepts breastfeeding + formula	10	33.3	7	23.3	
Time between two feedings	2 hours	21	70	19	63.3	
	3 hours	9	30	11	36.6	0.33
	Strong crying	16	53.3	18	60	0.33
Postnatal crying	Constant crying	10	33.3	9	30	0.50
	Weak crying	4	13.3	3	10	0.33
Presence of physical anomaly	Yes	0	0	0	0	
	No	30	100	30	100	
Presence of reflexes	Rooting reflex	30	100	30	100	
	Sucking reflex	30	100	30	100	
	Stepping reflex	30	100	30	100	
	Palmar grasp	30	100	30	100	
	Plantar grasp	30	100	30	100	
	Moro reflex	30	100	30	100	
Asymmetric tonic neck		30	100	30	100	

Table 3. Comparison Of Oral Glucose Tolerance Test Application by Newborn APGAR Scores

Had OGTT		n	Rank average	U	p
Apgar 1 min.	No	30	23.80	249.0	0.001*
	Yes	30	37.20		
Apgar 5 min.	No	30	28.25	382.5	0.17
	Yes	30	32.75		

* p<0.05 significant difference, p>0.05 no significant difference

Table 4. Findings From the Newborns' Respiration Evaluation Had Oral Glucose Tolerance Test

Variable			Test		p
			No	Yes	
Respiration pattern	Normal	n	21	27	0.122
		%	70	90	
	Superficial	n	9	3	
		%	30	10	
			n	17	

	56-61	%	56.6	56.7	
Respiratory rate	62-67	n	5	9	
		%	16.6	30	0.1
	> 67	n	8	4	91
Respiratory depth		%	26.6	13.3	
	Normal	n	22	27	
		%	73.3	90	0.1
Respiratory rhythm	Deep	n	8	3	36
		%	26.6	10	
	Normal	n	22	27	
Foam		%	73.3	90	0.5
	Arrhythmic	n	8	3	73
		%	26.7	10	
Wheezing/g roaning breathing	Yes	n	6	5	
		%	20.0	16.7	0.9
	No	n	24	25	99
Retraction		%	80	83.3	
	Yes	n	6	3	
		%	20.0	10	0.2
Nasal flaring	No	n	24	27	36
		%	80	90	
	Yes	n	1	2	
Retraction		%	3.3	6.7	0.5
	No	n	29	28	00
		%	96.7	93.3	
Nasal flaring	Yes	n	1	2	
		%	3.3	6.7	0.5
	No	n	29	28	00
		%	96.7	93.3	

* p<0.05 significant difference, p<0.05 no significant difference

Table 5: Comparison of Oral Glucose Tolerance Test Application in Terms of Blood Glucose Measurements

Had Oral Glucose Tolerance Test		n	Rank Average	U	p
30 min. blood sugar	No	30	34.30	336.0	0.09
	Yes	30	26.70		
2 h blood sugar	No	30	34.37	334.0	0.08
	Yes	30	26.63		
6 h blood sugar	No	30	32.53	389.0	0.36
	Yes	30	28.47		

* p<0.05 significant difference, p<0.05 no significant difference

Discussion

OGTT is crucial in reducing complications of GDM and improving perinatal outcomes. Reliable national and international health institutions recommend OGTT for GDM screening. Recently, however, there has been a negative attitude towards oral glucose tolerance test among pregnant women. There are many studies in the literature examining the attitudes of pregnant women towards OGTT. A study conducted with 297 pregnant women in 2020 found that the pregnant women who did not have OGTT deemed the test unnecessary, thought that the test might harm their infants and themselves, and did not have it done because the doctors did not recommend it. Other studies reviewed in the literature also found that pregnant women did not have the test because they heard in the media that the test was harmful, were not informed about the test, and thought it might be harmful (Dalgic, Asik and Ozen, 2020). In our study, 5% of the pregnant women did not want to have the test, 43% thought that the sugar test was harmful, 10% did not have the test because of what they had read about the OGTT, and 42% did not show up for a check-up during pregnancy (Cakir & Yesilcicek, 2020). Similarly, in the study by Tan and Bayyigit (2024), 46.7% of pregnant women stated that they believed the OGTT could be harmful to pregnancy and the fetus, and it was determined that those holding this belief significantly avoided undergoing the test.

Most studies in the literature observed no effect of the socio-demographic characteristics of pregnant women in their decision to have OGTT (Turan & Toker, 2020). However, some studies noted a high literacy rate in pregnant women who had OGTT (Gokbulut, 2012). In our study, no statistically significant difference was found when the relationship between education level and whether the mothers had OGTT was examined. In the study conducted by Lachmann et al. (2020), the rate of women who did not complete the OGTT was reported as 12.3%. This was found to be significantly associated with younger age (≤ 30), Black ethnic background, low socioeconomic status, high parity, obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$), and a family history of diabetes ($p < 0.05$). The most commonly reported reasons included

difficulty tolerating the test protocol (21%), psychosocial issues (22%), and challenges in attending prenatal follow-up appointments (15%).

The vast majority of pregnant women think that OGTT will harm the infants, but no definitive study has been found in the literature regarding the harms of the test to the foetus. In a study on oxidative stress levels during OGTT, no problems were found in healthy pregnant women during OGTT, but the test increased stress in pregnant women with positive test results (Mertoglu et al., 2018). In another study conducted with 80 pregnant women, an increase in oxidative stress factors was observed during OGTT in pregnant women (Yildirim et al., 2016). However, the insufficient number of subjects in both studies indicates that these results should be supported with more reliable samples. Besides, it is known that the barrier formed by the placenta prevents the passage of oxidative stress products to the foetus and protects the foetus. A study examining the effect of having prenatal screening tests on pregnancy anxiety found that having the test causes stress in pregnant women (Nacar et al., 2018).

No statistically significant difference was found between the feeding status of the infants of mothers who had and did not have OGTT. According to UNICEF's the State of the World's Children 2019 report, 44% of infants start breastfeeding within the first hour after birth. In our country, this figure was 71.3% in studies conducted in 2018 (Caylan & Yalcin, 2020). In parallel with the data, more than 50% of the newborns in both groups in our study were breastfed by their mothers, 28-30% were given formula support, and nearly 70% of the mothers fed their infants every 2 hours, and 30-36% every 3 hours. There was no difference between the groups. Mothers' breastfeeding quality was also evaluated with the LATCH breastfeeding diagnosis form and no difference was found between the two groups.

The APGAR score is a reliable method that has been used for more than 60 years to determine the newborns' status at birth. APGAR scores of newborns measured at the 1st and 5th minutes are expected to be above 7. Newborns with a score between 4 and 6 are

classified as mildly depressed, and those below 4 are classified as depressed (Kose & Ozdemir, 2013). In our study, the 1-minute Apgar scores of infants born to mothers who underwent OGTT were found to be significantly higher. However, no significant difference was observed between the groups in terms of 5-minute Apgar scores. The literature includes various findings regarding the relationship between Apgar scores and maternal glucose metabolism; however, most of these studies focus on mothers diagnosed with gestational diabetes mellitus (GDM) rather than whether OGTT was performed.

For example, a study conducted in Bangladesh reported that both 1-minute and 5-minute Apgar scores were significantly lower in infants of mothers diagnosed with GDM (Chomon et al., 2022). Similarly, a recent multicenter study found that 12.3% of neonates in the GDM group had low Apgar scores (≤ 7), and this was associated with the presence of GDM (Zhang et al., 2024). These findings suggest that maternal hyperglycemia may negatively affect the fetus's ability to adapt at birth.

However, these studies included only mothers diagnosed with GDM and are methodologically different from our research. Our study focused on whether or not OGTT was performed and also included mothers who underwent OGTT but were not diagnosed with GDM. Therefore, while findings in the literature associate low Apgar scores with the presence of GDM, our study suggests that performing OGTT itself may contribute positively to neonatal outcomes by enabling early diagnosis and follow-up.

In the studies, pregnant women mostly consulted with health staff and the rate of OGTT was higher in the pregnant women who received sufficient information (Cakir & Yesilcicek, 2020). The information sources of the mothers included in our study were mostly training and research hospitals (46.7%). However, according to a study examining the effect of famous health professionals in the media on the decision-making capability of pregnant women, there has been a decrease in the number of women having OGTT after the negative arguments about the sugar loading test in the media (Karasu, 2018).

The effect of the oral glucose tolerance test on the blood sugar of the infant after birth is unknown. In our study, the 30th minute, 2nd hour and 6th hour blood glucose values of the babies were examined and no significant difference was found between the babies of mothers who had ogtt and those who did not.

The findings suggest that negative perceptions of OGTT may influence the delivery of healthcare services. In this context, it may be beneficial for healthcare professionals to provide information about OGTT to pregnant women in a more systematic and structured manner, in order to support the early diagnosis and management of gestational diabetes. The limited evidence supporting a direct negative effect of OGTT on fetal outcomes highlights the need to reassess health policies regarding the safety and necessity of the test and to develop appropriate information strategies accordingly. Furthermore, to increase awareness of OGTT, it may be recommended to strengthen education and counseling activities through media, primary healthcare services, and prenatal follow-up programs.

Limitations of the Study: This study has several important limitations. The research is limited to patients who received care in the obstetrics department of a training and research hospital located on the Anatolian side of Istanbul and who agreed to participate in the study. Therefore, the findings cannot be generalized to patients treated in different institutions or departments. Additionally, the fact that the sample was drawn from a single centre, the limited sample size ($n=60$), and the evaluation of newborns only within the first 72 hours after birth are other limitations of the study.

Conclusion and Recommendations: Based on the findings of this study, it is noteworthy that oral glucose tolerance testing (OGTT) does not appear to have a direct negative impact on neonatal health. However, to generalize these results, further studies with larger sample sizes and pregnant women from diverse socio-demographic backgrounds are needed. In this regard, future research should employ prospective, multicentre, and randomized controlled study designs to enhance the scientific reliability and validity of the findings.

Moreover, in addition to evaluating the immediate postnatal period, monitoring infants at six months and one year of age for developmental and metabolic outcomes would be important for assessing the potential long-term effects of OGTT. Such longitudinal follow-up studies could provide more comprehensive evidence on the impact of early detection and management of maternal glucose metabolism on child health

Considering that lack of knowledge and negative perceptions regarding OGTT may affect the uptake of the test, it is recommended that healthcare professionals enhance their education and counselling efforts directed at pregnant women. Providing structured and evidence-based educational content may positively influence pregnant women's attitudes toward the test. Furthermore, community-based awareness initiatives carried out through primary healthcare services, prenatal care programs, and media channels could contribute to increasing participation rates in OGTT.

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