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Research Article

Maternal Weight Indices and Glycemic Control in Gestations Affected by Type 2 DM Clinical Outcomes

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Abstract

Background: *a common clinical case scenario and a clinical challenge for the obstetrician the existence of gestational medical disorder very critical such as type 2 DM. having various clinical risks at maternal and fetal levels and requires tight glycemic control in severe cases to avoid hazardous outcomes.*

Aim: *To investigate and assess the impact of type 2 DM glycemic control and body weight changes on clinical obstetric outcomes.*

Methodology a retrospective clinical research trial conducted on 115 study subjects in which cases were categorized into two research groups according to existence of type 2 DM at Ain Shams University Maternity Hospital from March 2018 till March 2019 type 2DM research group involved 38 study subjects and controls were 77 study subjects research data variables were gathered and statistically analyzed from hospital records.

Results: *Multivariable regression analysis showed that first trimester HbA1C (%) was associated with an increased risk of large for gestational age (OR 1.73; 95% CI [0.37-1.92]), an increased risk of pre-eclampsia (OR 1.31; 95% CI {0.89-1.63]) , an increased risk of neonatal ICU admission (OR 1.37; 95% CI [0.67-1.89]); and an increased risk of neonatal hypoglycemia (OR 1.62; 95% CI [1.29-2.75]).*

Conclusions: *Maternal glycemic control levels and obesity are the cornerstone clinical issues that affect the presence of adverse obstetric clinical events however it is recommended that future research studies should be conducted in a multicentric fashion with larger sample sizes, putting in consideration racial and ethnic differences.*

Introduction

Type 2 DM as a clinical category DM is considered one of the most common and challenging clinical cases scenarios face by obstetricians at surgical and management pathways levels. Multifactorial issues are considered to affect the maternal and fetal physiological statuses and pregnancy events due to affection of both systems by the glycemic control levels before and during gestation. Furthermore at every stage of pregnancy there are possible hazardous and unfavorable obstetric out comes could develop from improper control of glycemic status .preconceptive an first trimesteric poor glycemic control of Type 2DM could reveal and represent in a number of complexities and issues such as miscarriages and congenital fetal malformations ,however another more challenging issue of research interest is the impact of poor glycemic control at cellular and molecule; AR levels on developing fetus causing a spectrum of congenital anomalies due to early insult of the multipotent embryonic cells [1-3].

Maternal physiological changes with increased diabetogenic hormonal levels and changes is another challenging issues making glycemic control more critical and demanding to be achieved within a reasonable time and in safe management approach to avoid any sudden unfavorable poor glycemic control events such as ketonic comas and hypoglycemic comas due to poor maternal oral intake particularly if there is coexisting hyper emesis gravidarum that could accelerate the pathophysiological development of maternal adverse clinical outcomes. Various challenging and critical obstetric issues such as preeclampsia, macrosomia and preterm labor are correlated to existence of DM type 2 during pregnancy [4-6].

Furthermore the cornerstone correlated risk factor to type 2 DM is the maternal body weight before conception and gestational weight gain pattern that reflect the metabolic changes and the dietary habits in those category of cases and is considered an issue that requires a multidisciplinary management form such as an integral and coordinated efforts for the obstetrician ,dietician ,and anesthesiologist to consider the least risky course of management and the most suitable agents to be implanted at each stage of pregnancy [7-9].

Realistically in Egypt type 2 DM control and management is considered an interesting research aspect since Egypt is classified as one of the highest countries with the greatest prevelanaces of type 2 DM that could be due to dietary habits and life style patterns besides the genetic and ethnic background existing within the Mediterranean region. HbA1c is considered a biomarker of great value to reflect the effectiveness and proper glycemic control in cases presenting in outpatient clinics in retrospective manner since it gives clinically useful data on how well there was proper glycemic control over the previous 3 months [10-13].

Aim

To investigate and assess the impact of type 2 DM glycemic control and body weight changes on clinical obstetric outcomes.

Methodology

A retrospective clinical research trial conducted on 115 study subjects categorized into 2 research groups type 2DM research group involved 38 study subjects and controls were 77 study subjects at Ain Shams University Maternity Hospital from March 2018 till March 2019 all gestations that are not known to have pre-existing DM were Screened for DM during first gestational trimester by implementing fasting blood glucose and HbA1c assay, and consequently after 24 gestational weeks using 75 grams oral glucose tolerance testing protocol. gestational outcomes were reviewed from the hospital medical records and were gathered to statistically analyzed in comparison to normal research control gestations.

Statistical Analysis

Data were collected, revised, coded, and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when their distribution found parametric and median with inter-quartile range (IQR) when their distribution found non-parametric. Also, qualitative variables were presented as number and percentages. The comparison between groups regarding qualitative data was done by using Chi-square test. The comparison between two independent groups with quantitative data and parametric distribution were done by using Independent t-test while data with non-parametric distribution were done by using Mann-Whitney test. multivariate logistic regression analysis was used to assess the relation between risk factors and HbA1c in patients with T2DM. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant at the level of < 0.05.

Results

	T2DM No. = 38	Control No. = 77	Test value	P-value	Sig.
Age (years)	35.3 ± 4.25	31.1 ± 4.53	4.771*	<0.001	HS
Duration of diabetes (years); Median (IQR)	3.1 (0.73-5.8)	--	--	--	--
Pre pregnancy weight (kg); mean ± SD	89.4 ± 15.25	70.27 ± 18.9	5.425*	<0.001	HS
Pre pregnancy BMI (kg/m^2)	35.6 ± 7.25	27.9 ± 6.35	5.833*	<0.001	HS
Normal < 25	2 (5.3%)	21 (27.3%)			
Overweight (25 - 29.9)	9 (23.7%)	26 (33.8%)	12.299•	0.002	HS
Obese (≥ 30)	27 (71.1%)	30 (39.0%)			
HbA1c (%) first trimester; mean ± SD	7.13 ± 1.69	--			
Less than 7%	21 (55.3%)	--	--	--	--
More than or equal 7%	17 (44.7%)	--			
HbA1c (%) second trimester	5.97 ± 0.93	--			
Less than 6.0%	31 (81.6%)	--	--	--	--
More than or equal 6.0%	7 (18.4%)	--			
Receive treatment	32 (84.2%)	--			
Metformin	7 (18.4%)	--	--	--	--
Insulin	6 (15.8%)	--			
Metformin + Insulin	25 (65.8%)	--			

•: Chi-square test; *: Independent t-test

Table 1: Baseline characteristics in the two studied groups.

Table 1 reveals and displays that there was highly statistically significant difference found between both research groups as regards age, pre pregnancy weight and BMI. (p values <0.001, <0.001, <0.001, and 0.002 consecutively) being statistically significantly higher among type 2 DM research group.

	T2DM No. = 38	Controls No. = 77	Test value	P-value	Sig.	Adjusted OR (95% CI) ǂ
Weekly gestational weight gain (kg/wk)	0.13 ± 0.10	0.18 ± 0.11	2.361	0.019	S	
Pregnancy induced hypertension	5 (13.2%)	2 (2.6%)	4.964	0.025	S	1.43 (1.06 - 2.27) *
Pre-eclampsia	6 (15.8%)	2 (2.6%)	6.841	0.008	S	1.34 (1.17 - 2.45) *
Polyhydramnios	5 (13.2%)	2 (2.6%)	4.964	0.025	S	2.33 (1.69 - 3.67) *
Recurrent UTI	7 (18.4%)	4 (5.2%)	5.145	0.023	S	1.29 (1.09 - 2.2) *
Recurrent vaginal infection	4 (10.5%)	1 (1.3%)	5.209	0.022	S	1.77 (1.29 - 2.67) *
Gestational age at delivery (weeks)	37.4 ± 2.17	38.7 ± 1.89	3.302	0.001	HS	
Induction of labor	10 (26.3%)	8 (10.4%)	4.888	0.027	S	1.65 (1.31 – 2.33) *
Steroids given	6 (15.8%)	3 (3.9%)	4.989	0.025	S	1.28 (0.96 - 1.82)
Pre term labour	11 (28.9%)	9 (11.7%)	5.275	0.021	S	1.53 (1.22 - 2.67) *
Mode of delivery						
CS	24 (63.2%)	27 (35.1%)	8.136	0.004	HS	1.67 (1.32 -1.98)
NVD	14 (36.8%)	50 (64.9%)				Ref.
Primary CS	14/24 (36.8%)	14/27 (18.2%)	4.81	0.028	S	
Emergency CS	10/24 (26.3%)	13/27 (16.9%)	1.415	0.234	NS	
Neonatal weight	3173 ± 517	3211 ± 627	0.323	0.747	NS	
Large for gestational age	9 (23.7%)	5 (6.5%)	7.033	0.008	HS	1.99(1.66-2.39) *
Macrosomia	6 (15.8%)	3 (3.9%)	4.989	0.025	S	1.02(0.76-1.38)
Small for gestational age	3 (7.9%)	11 (14.3%)	4.64	0.031	S	0.76(0.60-0.94) *
Outcome						
Life birth	37 (97.4%)	76 (98.7%)	0.265	0.606	NS	
Still birth	1 (2.6%)	1 (1.3%)				
NICU admission	9 (23.7%)	6 (7.8%)	5.665	0.017	S	1.57 (1.32 -2.43) *
Shoulder dystocia	3 (7.9%)	1 (1.3%)	3.297	0.069	NS	2.19 (1.14-4.87) *
Respiratory distress	7 (18.4%)	4 (5.2%)	5.145	0.023	NS	1.58 (1.21-2.35) *
Neonatal hypoglycemia	6 (15.8%)	2 (2.6%)	6.841	0.008	S	1.89 (1.69 - 2.86) *
Neonatal jaundice	11 (28.9%)	8 (10.4%)	6.353	0.012	S	1.23 (1.03-1.95) *

ǂ: Odds ratio were adjusted for age, BMI and gestational age weight gain

Table 2: Comparison between the two research groups as regards pregnancy outcome.

Table 2 interestingly reveals and displays the gestational outcomes in which weekly gestational weight gain, pregnancy induced hypertension, preeclampsia, polyhydramnios, recurrent UTI and recurrent vaginal infection were statistically significantly higher within type 2 DM research group (p values =0.019, 0.025, 0.008, 0.025, 0.023, and 0.022 consecutively). Furthermore, induction of labor, steroid administration and preterm labor were statistically significantly higher within type 2 DM research group (p values =0.027, 0.025, and 0.021 consecutively). As regards mode of delivery Normal vaginal delivery was statistically significantly higher within the control research group whereas cesarean delivery was higher in highly statistically significant manner (p value =0.004). As regards neonatal outcomes it is revealed and displayed that NICU admission, neonatal hypoglycemia, neonatal Jaundice was statistically significantly higher among type 2 DM research group (p value =0.017, 0.008, and 0.012 consecutively).

	Multivariate logistic regression analysis					
	Macrosomia	LGA	Pre-eclampsia	C-section	NICU admission	Neonatal hypoglycaemia
Age	0.92 (0.86–1.18)	0.93 (0.91–1.08)	1.07 (0.97–1.09)	1.03 (0.92–1.06)	1.04 (0.93–1.12)	0.95 (0.92–1.12)
Pre-pregnancy BMI	1.07 (0.96–1.32)	1.17 (1.13–1.29) *	1.03 (0.95–1.28)	1.19 (1.12–1.36) *	1.11 (0.91–1.08)	0.91 (0.87 – 1.25)
Weekly GWG	2.61 (0.25–43.8)	2.23 (0.81–16.7)	2.88 (0.25–18.62)	1.53 (0.51–5.81)	4.22 (0.87-17.80)	1.89 (0.67–2.28)
First trimester A1c	1.45 (0.92-1.69)	1.73 (0.37–1.92)	1.31 (0.89–1.63)	0.83 (0.72–1.21)	1.19 (0.55–1.38)	1.62 (1.29–2.75) *
Last trimester A1C	1.41 (0.73–2.90)	1.86 (1.25–3.69) *	1.11 (0.57–1.79)	1.42 (1.18–2.49) *	1.37 (0.67–1.89)	1.47 (0.56–2.47)

Data were presented as odds ratio and 95% Confidence interval (CI)
*: Significant at P < 0.05

Table 3: Multivariate logistic regression analysis.

Table 3 reveals and displays Multivariable regression analysis showed that first trimester HbA1C (%) was associated with an increased risk of large for gestational age (OR 1.73; 95% CI [0.37-1.92]), an increased risk of pre-eclampsia (OR 1.31; 95% CI {0.89-1.63]) , an increased risk of neonatal ICU admission (OR 1.37; 95% CI [0.67-1.89]); and an increased risk of neonatal hypoglycemia (OR 1.62; 95% CI [1.29-2.75]), whereas pre-pregnancy BMI was associated with an increased risk of macrosomia (OR 1.07; 95%CI [0.96-1.32]); an increased risk of LGA (OR 1.17; 95%CI [1.13- 1.29]); and an increased risk of caesarean-section (OR 1.19; 95% CI [1.12-1.36]). The third trimester HbA1C (%) was associated with an increased risk for LGA [OR 1.86, 95% CI [1.25- 3.69)]; and an increased risk for Caesarean -section (OR 1.42, 95% CI [1.18-2.49]) after adjusting for age, pre-pregnancy BMI, gestational weight gain and first trimester HbA1C (%).

Discussion

Gestational weight gain is a unique physiologically complex biological phenomenon that interacts with the fetal growth and development furthermore metabolic diseases such as type 2 DM have a major impact on the cores of development of fetal growth rate and alters the fetal intrauterine glycemic environment causing hyperinsulinemia issues .Not a negligible fact that type 2 DM is powerfully correlated to the maternal BMI and is considered a cornerstone risk factor in the pathophysiological development of insulin resistance in a gradual manner that causes type 2 DM development with its metabolic and adverse clinical sequale at maternal and fetal levels [14-16].

The current research study findings revealed and displayed a highly statistically significant difference found between both research groups as regards age, pre-pregnancy weight and BMI. (p values <0.001, <0.001, <0.001,and 0.002 consecutively) being statistically significantly higher among type 2 DM research group interestingly it was revealed and displayed by the current research study findings that weekly gestational weight gain, pregnancy induced hypertension, preeclampsia ,polyhydramnios ,recurrent UTI and recurrent vaginal infection were statistically significantly higher within type 2 DM research group (p values =0.019, 0.025, 0.008, 0.025, 0.023, and 0.022 consecutively). furthermore, induction of labor, steroid administration and preterm labor were statistically significantly higher within type 2 DM research group (p values =0.027, 0.025, and 0.021 consecutively). As regards mode of delivery Normal vaginal delivery was statistically significantly higher within the control research group whereas cesarean delivery was higher in highly statistically significant manner (p value =0.004). As regards neonatal outcomes it is revealed and displayed that NICU admission, neonatal hypoglycemia, neonatal Jaundice was statistically significantly higher among type 2 DM research group (p value =0.017, 0.008, and 0.012 consecutively).

Furthermore the Multivariable regression statistical analysis performed in the current research study data findings revealed and displayed that first gestational trimester HbA1C (%) was correlated and linked with raised clinical risk of large for gestational age (OR 1.73; 95% CI [0.37-1.92]), a raised risk of pre-eclampsia (OR 1.31; 95%

CI {0.89-1.63]) , an elevated risk of neonatal ICU admission (OR 1.37; 95% CI [0.67-1.89]); and a raised risk of neonatal hypoglycemia development (OR 1.62; 95% CI [1.29-2.75]), whereas pre-pregnancy BMI have been correlated with an increased risk of macrosomia (OR 1.07; 95%CI [0.96-1.32]); an increased risk of LGA (OR 1.17 ; 95%CI [1.13-1.29]); and an increased risk of caesarean-section (OR 1.19; 95% CI [1.12-1.36]). The third trimester HbA1C (%) was associated with an increased risk for LGA [OR 1.86, 95% CI [1.25- 3.69)]; and an increased risk for Caesarean -section (OR 1.42, 95% CI [1.18-2.49]) after adjusting for age, pre-pregnancy BMI, gestational weight gain and first trimester HbA1C (%).

A prior research study similar to the current research revealed and displayed that type 2 DM during gestation is correlated and linked to greater clinical risk of maternal and neonatal complications in comparison to normal gestations recruited as research controls besides prior research groups of investigators revealed and displayed that type 2 DM is correlated to hypertensive developmental issues during pregnancy and infections within the genitourinary system, increased liquor volume abnormalities, raised requirements for induction of labor, prematurity and caesarean mode of delivery. those findings show great harmony and similarity to the current research study findings denoting that type DM during pregnancy is correlated to adverse clinical obstetric outcomes those finding could be justified by the fact that DM is associated with metabolic abnormalities that are represented in the form of increased liquor productivity that could cause over distension of the uterus and premature labor with its various well known clinical issues particularly at neonatal levels .Hypertensive issues during gestation are usually closely correlated to increased maternal BMI that justifies the current research findings as regards the greater risk of pathological development of preeclampsia in pregnancies affected by type 2 DM with raised BMI [17,18].

Another research group of investigators conducted a clinical research study priory similar to the current research as regards a methodology and approach revealed and displayed that neonates of gestations affected by type 2 DM had greater incidences of large for gestational age, hypoglycemia, NICU admission, jaundice, and respiratory distress [2,7,9].

Furthermore a prior research study was conducted aiming to reveal and display the impact of glycemic control on development of large for gestational age fetuses it have displayed that cases with gestational DM and poorly controlled diabetic cases had more liability in statistically significant fashion to develop large for gestational age fetuses and neonate in comparison to cases having a well-controlled glycemic indices, those findings show great harmony to the current research study as regards the correlation between type 2 DM and risk of large for gestational age development those findings could be justified by the fact that fetuses within gestations of poor glycemic control develop hyperinsulinemia that subsequently causes pathologically accelerated fetal growth patterns affecting the normal fetal weight gain rate during the course of pregnancy [1,4,5].

Another research group of investigators conducted a similar research study to the current research on type 1 DM cases during gestation and have shown that well controlled glycemic indices all though the three gestational trimesters is correlated to lower occurrence of adverse events such as preeclampsia, and shoulder dystocia and reduced NICU admission in cases that were properly controlled preconceptionally with lower BMI [3,9,12,14].

Conclusions and recommendations

The current research study reveals and displays the importance and influence of glycemic control and prepregnanacy and gestational weight gain on various pregnancy clinical outcomes that could negatively impact the health status at maternal and neonatal levels. Furthermore, future research studies should be performed in a multicentric fashion to be more representable of the various type 2 DM issues on pregnancy putting in consideration the racial, ethnic differences besides the management protocols that were implemented for glycemic control in this category of cases. Tha6t could aid in enhancement and improvement of clinical guidelines for better management and early predictability of adverse pregnancy outcomes om maternal, fetal and neonatal levels.

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