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Nutritional Status in a Patient with Gestational Diabetes Mellitus and Pregnancy Outcome

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Abstract

Introduction: Both maternal nutritional status and GDM have impact on pregnancy outcome. But, data from Bangladesh in this issue is still scarce. To design and utilize national obstetric health care, nutritional status of GDM women and its impact in the birth weight of babies should be evaluated and therefore, this study was designed.

Methods: This prospective cohort study was conducted in the department of Obstetrics and Gynecology at BIRDEM General Hospital-2, Dhaka to evaluate the nutritional status of GDM women and its impact on pregnancy outcomes. Results: The mean age of the patients in the study was 29.71± 5.06 years. The mean age, Mid Upper Arm Circumference (MUAC,) and Body Mass Index (BMI) were significantly higher in GDM mothers (p <0.05). Additionally, gestational weight gain between 28 weeks and before delivery was significantly higher in GDM mothers (p <0.001). The mean birth weight of the newborns was also higher in the GDM group (3.23±0.46vs. 2.97±0.37 kg) (p <0.05). Macrosomic neonates were observed only in the GDM group (4.36%). APGAR score was significantly better in non-GDM mothers' babies (p <0.05). Babies of GDM mothers had a significantly higher proportion of birth asphyxia, septicemia, pneumonia, Intrauterine Growth Retardation (IUGR), and Neonatal Intensive Care Unit (NICU) admissions (p <0.05). Macrosomic mothers had significantly higher BMI and higher gestational weight gain (p<0.05).

Conclusion: Mothers with GDM had a higher rate of bad pregnancy outcomes and that macrosomia was linked to a higher BMI.

Keywords: BMI, MUAC, GDM and pregnancy outcome, Macrosomia, Prospective Cohort Study.

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Introduction:

Birth weight (BW) is an essential deterrent determinant of an infant's well-being. Several factors, including the mother's genetic characteristics, socio-cultural, demographic, and behavioural factors, body mass index (BMI), gestational weight gain (GWG), etc. contribute to the birth weight of the infant.[1] Diabetes mellitus is a global health problem. The prevalence of GDM ranges from 8.2% in rural Bangladesh to 12.9% in urban Bangladesh.[2]

It directly or indirectly controls maternal and foetal outcomes during pregnancy. The body mass index (BMI) is a good indicator of nutritional status in a population. In developing countries like Bangladesh, this indicator provides a method that can help guide intervention to help eradicate many preventable diseases.[3] A number of factors that determine a baby's birth weight include maternal height, malnutrition, obesity, parity, ambient attitude, maternal haemoglobin concentration, and glucose intolerance of the mother. Maternal BMI is the most important factor in birth weight.[4] Gestational diabetes can cause alterations in the physiology of pregnancy and even after its end. Maternal body mass index (BMI), which is one of the best markers of nutritional status, can be one of many variables that affect fetal growth.[5] Glycemic status alters maternal and foetal nutritional status. Normal pregnancy is a non-pathological condition characterised by complex hormonal adaptations to ensure sufficient glucose is available to meet the dietary requirements of a growing foetus without causing maternal hypoglycaemia.

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Hyperglycemia, a hallmark of diabetes, is a significant cause of maternal and fetal complications in pregnancies of women with any type of diabetes. Maternal overweight and obesity are associated with adverse outcomes for offspring in later life. Causal biological effectors are uncertain.[6] A prospective study shows mean maternal weight and BMI are better predictors of birth weight than maternal height.[7] Another study revealed that primiparity, too little weight gain, and gestational age of fewer than 37 weeks at delivery were significantly associated with LBWN.[8] A higher gestational weight gain is related to higher neonatal birth weight. The relationship between maternal GWG and neonatal body fat at birth depended on maternal BMI before pregnancy.[9] The decreased protein in diet, increased psychological and physiological stress and decreased socioeconomic conditions of married Bangladeshi women are some of the other possible reasons for the decreased BMI.[3] Therefore, optimal maternal weight gain is essential for a better outcome.[10] Unfortunately, little clinical research on this topic has been conducted in Bangladesh's tertiary centres. The current study assesses the mother's nutritional status with GDM and its outcome during pregnancy.

Methodology:

A prospective cohort study was conducted in the outpatient Obstetrics & Gynaecology Department, BIRDEM General Hospital-2, Dhaka for one year (July 2018- June 2019), to determine nutritional status in patients with gestational diabetes mellitus (GDM) and pregnancy outcome. After careful history taking, examination, and appropriate investigations fulfilling inclusion and exclusion criteria (pre-existing diabetes mellitus, uncontrolled diabetes, and/or not receiving regular anti-diabetic medication), 275 pregnant women with GDM who visited for ante-natal care (ANC) at 27-28 weeks of pregnancy were considered the exposed group, and 150 pregnant women without GDM who visited for ANC at 27-28 weeks of pregnancy were considered the unexposed group). The study population was followed to observe the outcome at the time of delivery and at 6 weeks of puerperium. A purposive sampling was incorporated. Considering Zá=1.96, Zâ=2.33, 99% power of the test and non-response rate and attrition due to follow-up, we took 275 GDM mothers as an exposed group. At the same time, 150 non-GDM women as an unexposed was taken in the study. The nutritional status was measured during the first ANC visit and the first follow-up by BMI, MUAC, and Hb% level. Study subjects were weighed using the same weight machine (adult) with the minimum amount of clothing after correcting for zero error. The height was measured by keeping the women standing on level ground, without footwear, against a wall, using a measuring tape to the nearest 0.5 cm. The maternal weight and height obtained were used to calculate the maternal BMI (kg/m). Similarly, unclothed newborns were weighed immediately after delivery using a baby weight machine. The categorisation of BMI was done according to the operational definition. The third-trimester weight gain was found by taking the weight at 27 to 28 weeks and subtracting it from the final weight at the end of the pregnancy, which was taken when the woman was admitted to the hospital to give birth. The birth weight of a newborn was recorded. Neonates were classified as small, normal, or large for gestational age by operational definition. Low birth weight, macrosomia, and exceptionally large babies were evaluated. At the 6th week of puerperium (when they came for post-natal follow-up), OGTT was done to check the persistence of diabetes. All data were collected and recorded using separate case record forms. The collected data were checked for errors before being analyzed with the statistical software SPSS 22. Quantitative data were expressed as mean and standard deviation, and qualitative data were expressed as frequency and percentage. The association between categorical variables was determined by the Chi-Square (÷2) test. The difference between continuous variables was determined by the student t-test. A p-value of d".05 was considered statistically significant. Ethical clearance was obtained from the Ethical Review Board of BIRDEM General Hospital. Written informed consent was taken from each participant enrolled in the study. The purpose and procedures were briefly explained to all participants. There was no chance of any physical adverse effect as no intervention was performed. There was no possibility of mental or social harm in the study. All sorts of confidentiality were ensured. No money was given to study participants. The patient herself had all rights to continue or discontinue the study procedure.

Operational Definitions

Gestational diabetes mellitus[11]:

Perform a 75 g OGTT with plasma glucose measurement when a patient is fasting and at 1 and 2 h, at 24 to 28 weeks of gestation in women not previously diagnosed with diabetes. OGTT was performed in the morning after

an overnight fast of at least 8 h. The diagnosis of non-GDM was made when any of the following plasma glucose values were met or exceeded:

Fasting: 92 mg/dL (5.1 mmol/L)

1 h: 180 mg/dL (10.0 mmol/L)

2 h: 153 mg/dL (8.5 mmol/L)

Nongestational diabetes mellitus[11]:
Perform a 75-g OGTT, with plasma glucose measurement when a patient is fasting and at 1 and 2 hours, at 24 to 28 weeks of gestation in women not previously diagnosed with diabetes. OGTT was performed in the morning after an overnight fast of at least 8 hours. The diagnosis of non-GDM was made when any subsequent plasma glucose value was below this cut-off point:

Fasting: 92 mg/dL (5.1 mmol/L)

1 h: 180 mg/dL (10.0 mmol/L)

2 h: 153 mg/dL (8.5 mmol/L)

2.1.3 Nutritional status according to BMI[12]

Underweight: less than 18·5 kg/m2 underweight;

Normal: 18·5–23 kg/m2

High: >23

Small for gestational age neonates[13]: Birth weight is below the 10th percentile of gestational age.

Large for gestational age neonates[13]: Birth weight above the 90th percentile of gestational age.

Low birth weight [14]: Low birth weight was defined as a weight at birth of <2500 gm.

Macrosomia[14]: Macrosomia was defined as a weight at birth of >4000 gm.

Exceptionally large baby[14]: An exceptionally large baby is defined as a birth weight of 4500 g or more, excluding the syndrome of a diabetic mother and the infant of a mother with gestational diabetes.

UTI[15,16]: A urinary tract infection (UTI) is a collective term for infections that involve any part of the urinary tract. Significant bacteriuria (greater than or equal to 10(5)CFU/ml.

Results:
Table I shows the sociodemographic profile of pregnant mothers with or without GDM. The mean age of the patients in our study was 29.71±5.06 years (18-43 years), whereas mothers with GDM had a significantly higher mean age, para and gravida compared to non - GDM

Table-I

Socio-Demographic profile of the study subjects (n=425)

Variables	GDM(n=275)	Non-GDM(n=150)	All (n=425)	p-value
Age (in years) mean±SD	30.6±5.34	28.08±4.03	29.71±5.06	<0.001**
The duration of marriage (in years)mean±SD	8±4.65	5.28±2.29	7.04±4.19	<0.001**
Para mean±SD	1.61±1.36	1.12±0.99	1.44±1.27	<0.001**
Gravida mean±SD	2.66±1.41	2.36±1.44	2.55±1.43	0.04**
Age of last child (in years)mean±SD	3.02±2.93	2.56±2.66	2.86±2.85	0.111**
ANC visit N(%)	<0.001*			
Regular	196 (71.27)	150 (100)	346 (81.41)	
Irregular	79 (28.73)	0 (0)	79 (18.59)	
Education status N(%)	0.012*			
illiterate	15 (5.45)	0 (0)	15 (3.53)	
Primary	58 (21.09)	24 (16)	82 (19.29)	
SSC and above	202 (73.45)	126 (84)	328 (77.18)	
Socio-economic status N(%)	0.08*			
Lower	9 (3.27)	0 (0)	9 (2.12)	
Middle	24 (8.73)	24 (16)	48 (11.29)	
Upper	242 (88)	126 (84)	368 (86.59)	

Values are expressed as mean±SD and in parentheses as percentage (%) of columns in total.
*Pearson chi-squared Test (c^2) was performed ** Student t-test was performed

mothers (p<0.05). Besides, GDM mothers had significantly lower literacy levels and regularity in ANC visits (p <0.05). However, the socioeconomic status and age of the last child were comparable between the groups (p=0.012).

Table II shows the nutritional status of the study subjects. GDM mothers had a significantly higher mean of MUAC and BMI compared to non-GDM mothers during both the 28th week of pregnancy and at the time of delivery. But the mean BMI remained significantly higher in the GDM group. The weight gain of mothers with GDM from the 28th week to delivery was significantly higher (10±1.8 kg vs 8.84±2.05 kg. However, although there was a significantly higher proportion of high BMI levels at the 28th week of pregnancy in mothers with GDM compared to mothers without GDM, no significant differences were observed at the time of delivery.

Figure I shows the treatment modalities of GDM mothers. A maximum (56%) of mothers with GDM were treated with diet and insulin, while 44% were controlled with diet alone.

Table III shows the biochemical parameters of the study subjects. The biochemical status of the study patients showed that the mothers of GDM had significantly higher mean FBS, 2HABF, and HbA1C compared to the mothers of non-GDM (p-value <0.001), although both groups had well-controlled blood glucose, having mean FBS, 2 hours after 75g glucose and HbA1C within the normal limit. Haemoglobin levels were significantly lower among mothers with GDM in comparison to non- GDM mothers.

Table IV shows the maternal outcomes of mothers with GDM and without GDM. LUCS was the most commonly performed mode of delivery in both groups, although mothers with GDM had a significantly higher frequency compared to mothers without GDM (95.64 vs 84%, p-value <0.001). Besides, GDM mothers had a significantly higher proportion of pre-term delivery, PROM, hypothyroidism, required blood transfusion and duration of hospital stay.

Table-II

Nutritional status of the study subjects (n=425)

Parameters	GDM(n=275)	Non-GDM(n=150)	All (n=425)
Height (metre) mean±SD	1.54±0.05	1.57±0.05	1.55±0.05
MUAC at 28th week (cm) mean±SD	30.70±2.63	29.40±2.83	30.24±2.77
Weight at 28th week (kg) mean±SD	60.20±8.36	57.78±12.34	59.35±10
Weight at delivery (kg) mean±SD	70.20±8.43	66.62±12.06	68.94±10
Weight Gain (kg) mean±SD	10±1.8	8.84±2.05	9.59±1.97
BMI at 28th week N (%)			
Low (<18.5)	6 (2.18)	6 (4)	12 (2.82)
Normal (18.5-22.99)	19 (6.91)	99 (66)	118 (27.76)
High (e”23)	250 (90.91)	45 (30)	295 (69.41)
mean±SD	25.34±3.07	23.40±4.70	24.65±3.84
BMI at delivery N (%)			
Low (<18.5)	1 (0.36)	0 (0)	1 (0.24)
Normal (18.5-22.99)	9 (3.27)	9 (6)	18 (4.24)
High (e”23)	265 (96.36)	141 (94)	406 (95.53)
mean±SD	29.58±3.18	27±4.60	28.67±3.94

Values are expressed as mean±SD and percentage (%) over column in total.

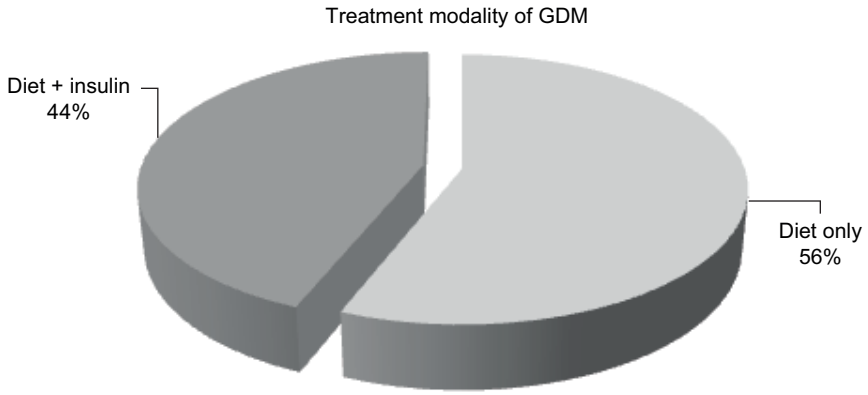

Fig.-1: *Distribution of patients with GDM according to their modality of treatment (n = 275)*

Table-III

Hb% and blood sugar of study subjects (n=425)

Parameters	GDM (n=275)	Non-GDM (n=150)	All (n=425)	p-value*
Haemoglobin (g/dL) mean±SD	10.88±0.93	11.60±0.79	11.13±0.95	<0.001
Fasting blood glucose (mmol/L) mean±SD	5.59±1.55	4.70±0.55	5.27±1.36	<0.001
2 hours after 75g glucose (mmol/L) mean±SD	6.90±2.62	5.21±0.61	6.30±2.28	<0.001
HbA1C (%)mean±SD	5.96±1.21	4.64±0.50	5.50±1.20	<0.001

Values are expressed as mean±SD.
*Student t-test was performed

Table-IV

Maternal outcome of study subjects (n=425)

Variables	GDM(n=275)	Non-GDM(n=150)	All (n=425)	p-value
Mode of delivery N (%)	<0.001*			
LUCS	263 (95.64)	126 (84)	389 (91.53)	
NVD	12 (4.36)	24 (16)	36 (8.47)	
Complications of pregnancy* N (%)				
Pre-term	34 (12.36)	8 (5.33)	42 (9.88)	0.02*
PROM	15 (5.45)	2 (1.33)	17 (4)	0.038*
UTI	60 (21.82)	10 (6.67)	70 (16.47)	<0.001*
Pregnancy-induced hypertension (PIH)	41 (11.27)	14 (9.33)	55 (12.94)	0.102*
Hypothyroidism	35 (12.73)	9 (6.0)	44 (10.35)	0.03*
Oligohydramnios	3 (1.09)	0 (0)	3 (0.71)	0.555*
Complications of delivery* N (%)				
Blood transfusion required	154 (56)	53 (35.33)	207 (48.71)	<0.001*
ICU admission needed	3 (1.09)	0 (0)	3 (0.71)	0.555*
The duration of hospital stay (in days) N (%)				
<3	3 (1.09)	12 (8)	15 (3.53)	<0.001*
3-5	125 (45.45)	54 (36)	179 (42.12)	
>5	147 (53.45)	84 (56)	231 (54.35)	
mean±SD	6.34±2.02	2.48±1.07	4.97±2.54	<0.001**

Values are expressed as mean±SD and percentage (%) over column in total.
*Pearson chi-squared Test (c^2) was performed
**Student t-test was performed

Table V shows the foetal outcome of mothers with and without GDM. Non-GDM mothers all had live birth babies, whereas GDM mothers had 2.18% IUDs and 1.09% still-born babies. The mean birth weight of the babies was significantly higher in the GDM group compared to the non-GDM (3.23±0.46 vs 2.97±0.37 kg, p<0.001). All 12 macrocosmic babies in this study, were delivered by GDM mothers. APGAR score at the 5th minute was significantly better in newborns of non-GDM mothers (p <0.05). Besides, babies of GDM mothers had a significantly higher proportion of birth asphyxia, septicaemia, pneumonia, IUGR and NICU admissions (p 0.05).

Figure 2 shows the persistence of hyperglycemia in mothers with GDM at 6 weeks postpartum. at 6 weeks of puerperium, 17.82% of GDM mothers had persistent hyperglycaemia (Diabetes Mellitus).

Table VI shows the relationship between maternal nutritional status and the birth weight of newborns. Mothers of macrocosmic babies had significantly higher mean BMI and weight gain compared to low or normal birth weight babies. Furthermore, with a p-value of 0.05, mothers of 91.67% of macrosomic babies had a high BMI (23). Mothers with GDM who had higher MUAC, weight gain, and BMI delivered more newborns with higher birth weight and macrosomic babies, which were statistically significant (p <0.05).

Table VII shows the relationship between maternal nutritional status and complications of pregnancy. There is no significant association in GDM mothers between UTI, PROM, and Oligohydramnios in relation to MUAC, BMI at 28 weeks of pregnancy, and haemoglobin level. However, BMI prior to delivery was associated with UTI (p =.001).

Table VIII shows an association between maternal nutritional status and mode of delivery. LUCS was the most common way to give birth in both groups, but GDM mothers had significantly higher mean values for MUAC, BMI at 28 weeks of pregnancy, BMI just before delivery, and haemoglobin level than non-GDM mothers. The values of LUCS were statistically significant (p.05).

Table-V

Foetal outcomes of the study subjects (n=425)

Variables	GDM(n=275)	Non-GDM(n=150)	All(n=425)	p-value
Baby N (%)				
Live birth	266 (96.73)	150 (100)	416 (97.88)	0.025*
Still born	3 (1.09)	0 (0)	3 (0.71)	0.555*
IUD	6 (2.18)	0 (0)	6 (1.41)	0.094*
Birth weight (in kg) N (%)				
Low birth weight (<2.5kg)	17 (6.18)	9 (6)	26 (6.12)	0.034*
Normal (2.5-4.0 kg)	246 (89.45)	141 (94)	387 (91.06)	
Macrosomia (>4.0 kg)	12 (4.36)	0 (0)	12 (2.82)	
mean±SD	3.23±0.46	2.97±0.37	3.14±0.45	<0.001**
APGAR score at 5th minute N (%)				
0-3	6 (2.18)	0 (0)	6 (1.41)	<0.001*
4-6	43 (15.64)	6 (4)	49 (11.53)	
7-10	226 (82.18)	144 (96)	370 (87.06)	
Foetal complication* N (%)				
Birth asphyxia	49 (17.82)	7 (4.67)	56 (13.18)	<0.001*
IUGR	11 (4)	1 (0.67)	12 (2.82)	0.047*
Jaundice	19 (6.91)	6 (4)	25 (5.88)	0.223*
Septicaemia	12 (4.36)	1 (0.67)	13 (3.06)	0.034*
Pneumonia	13 (4.73)	1 (0.67)	14 (3.29)	0.024*
Patent ductus arteriosus (PDA)	3 (1.09)	0 (0)	3 (0.71)	0.555*
Neonatal death	4 (1.45)	0 (0)	4 (0.94)	0.138*
NICU admission Needed	49 (17.82)	6 (4)	55 (12.94)	<0.001*

Values are expressed as mean±SD and percentage (%) over column in total. *Pearson chi-squared Test (c^2) was performed ** Student t-test was performed

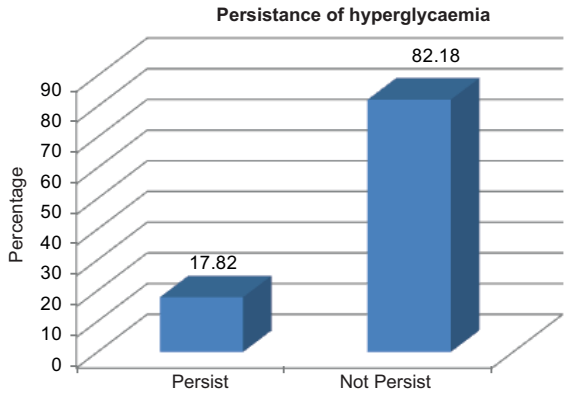

Fig.-2: *Persistence of hyperglycemia in mothers with GDM at 6 weeks postpartum (n = 275)*

Table-VI

Association between the birth weight of newborn and the nutritional status of the mother (n = 425)

Parameters	Birth weight (in gm)			p-value
	<2500(n=26)	2500-4000(n=387)	>4000(n=12)	
MUAC at 28th week (cm) mean±SD	29.98±3.0	30.20±2.78	32.55±1.23	0.014**
Weight at 28th week (kg)mean±SD	54.88±11.18	59.57±9.95	63.25±7.06	0.028**
Weight at delivery (kg)mean±SD	63.19±11.50	69.22±9.88	72.58±6.14	0.005**
Weight Gain (kg)mean±SD	8.31±1.49	9.33±1.56	9.65±1.99	0.003**
BMI at 28th week N (%)	0.003*			
Low (<18.5)	3 (11.54)	9 (2.33)	0 (0)	
Normal (18.5-22.99)	12 (46.15)	105 (27.13)	1 (8.33)	
High (e”23)	11 (42.31)	273 (70.54)	11 (91.67)	
mean±SD	23.42±4.78	24.68±3.80	27.03±1.78	0.026**
BMI at delivery N (%)	<0.001*			
Low (<18.5)	0 (0)	1 (0.26)	0 (0)	
Normal (18.5-22.99)	7 (26.92)	11 (2.84)	0 (0)	
High (e”23)	19 (73.08)	375 (96.90)	12 (100)	
mean±SD	26.99±5.02	28.71±3.87	30.99±1.44	0.011**

Values are expressed as mean±SD and in parentheses percentage (%) over column in total *Pearson chi-squared Test (c^2) was performed ** One way ANOVA was performed

Table-VII

Association between maternal nutritional status and Complications of pregnancy (UTI, PROM, Oligohydramnios (n=425)

Parameters	Complications of pregnancy								
	UTI (n=70)			PROM (n=17)			Oligohydramnios (n=3)		
	GDM (60)	Non GDM (10)	P value	GDM (15)	Non GDM (2)	P value	GDM (3)	Non GDM (0)	p-value
MUAC at 28th week (cm) N (%)									
Normal (<28 cm)	5(8.3)	4(40)	.992* ns .575** ns	1(6.7)	1(50)	.807* ns .583** ns	0(0)	_	.599* ns
Over weight (≥ 28cm)	55(91.7)	6(60)		14(93.3)	1(50)		3(100)	_	
Mean ±SD	30.35±2.7	28.90±3.10		30.17±25	29±2.83		30.53±.92	_	
BMI at 28th week N (%)									
Low (<18.5)	3(5)	0(0)	.055* ns .016** Sig.	1(6.7)	0(0)	.473* ns .593** ns	0(0)	_	.189* ns
Normal (18.5-22.99)	7(11.7)	3(30)		1(6.7)	2(100)		1(33.3)	_	
High (≥23)	50(83.3)	7(70)		13(86.7)	0(0)		2(66.7)	_	
Mean ±SD	24.83±3.56	26.73±8.93		24.69±3.77	21.18±1.03		23.61±1.83		
BMI before delivery N (%)									
Low (<18.5)	1(1.7)	0(0)	.001* Sig. .408** ns	1(6.7)	0(0)	.000* Sig. .719** ns	0(0)	_	.944* ns
Normal (18.5-22.99)	6(10)	0(0)		1(6.7)	0(0)		0(0)	_	
High (≥23)	53(88.3)	10(100)		13(86.7)	2(100)		3(100)	_	
Mean ±SD	28.88±3.91	30.59±8.54		28.53±4.35	24.44±1.59		27.16±2.44	_	
Haemoglobin (gm/dl)									
Anaemic (<11)	41(68.3)	0(0)	.266* Sig. .102** ns	7(46.7)	0(0)	.467* ns .477** ns	3(100)	_	.026* ns
Normal (>11)	19(31.7)	10(100)		8(53.3)	2(100)		0(0)	_	
Mean ±SD	10.95±.87	12.00±.00		10.53±1.06	11.40±.00		10.60±.00	_	

Values are expressed as Mean±SD and within parenthesis percentage (%).

*Pearson chi-squared Test (c^2) was performed

*p value for GDM mothers, level of significant at <0.05

**p value for Non-GDM mothers, level of significant at <0.05

Table-VIII

Association between maternal nutritional status and Mode of delivery (n=425)

Parameters	Mode of Delivery					
	LUCS (n=389)			NVD (n=36)		
	GDM (263)	Non GDM (126)	P value	GDM (12)	Non GDM (24)	p-value
MUAC at 28th week (cm) N (%)						
Normal (<28 cm)	21(8)	42(33.3)	<0.001	2(16.7)	6(25)	0.571
Over weight (≥ 28cm)	242(92)	84(66.7)		10(83.3)	18(75)	
Mean ±SD	30.72±2.62	29.20±2.71	<0.001	30.67±3.31	30.50±3.27	0.779
BMI at 28th week N (%)						
Low (<18.5)	6(2.3)	6(4.8)	<0.001	0(0)	0(0)	0.053
Normal (18.5-22.99)	17(6.5)	27(69)		2(16.7)	12(50)	
High (≥23)	240(91.3)	33(26.2)		10(83.3)	12(50)	
Mean ±SD	25.39±3.14	23.15±4.94	<0.001	24.84±1.32	24.67±2.89	1.00
BMI before delivery N (%)						
Low (<18.5)	1(.4)	0(0)	0.209	0(0)	0(0)	-
Normal (18.5-22.99)	9(3.4)	9(7.1)		0(0)	0(0)	
High (≥23)	253(96.2)	117(92.9)		12(100)	24(100)	
Mean ±SD	29.59±3.25	26.85±4.9	<0.001	29.21±.72	27.78±2.44	0.327
Haemoglobin (gm/dl)						
Anaemic (<11)	92(35)	18(4.3)	<0.001	12(100)	12(50)	0.003
Normal (>11)	171(65)	108(85.7)		0(0)	12(50)	
Mean ±SD	10.92±.93	11.77±6.3	<0.001	10.00±.00	10.70±.31	<0.001

Values are expressed as Mean±SD and within parenthesis percentage (%).

Pearson chi-squared Test (c^2) for categorical variables and independent sample t-test for continuous variables were performed

P values were measured at <.05 level of significance.

Discussion:

The average age of our study patients was 29.71±5.06 years (18-43 years). GDM mothers had a significantly higher mean age (30.6 ±5.34 years) and gravida (2.66 ±1.41) compared to non-GDM mothers (p values 0.05).A study by Sumit et al. found that pregnant women complicated with GDM were significantly older (30.25 ± 4.71 years) than non-GDM mothers (25.43 ± 4.86 years).[17] A study by Rajput et al., also found that GDM was significantly associated with maternal age e"25 years and gravida e"3.[18] Various other authors also reported similar findings.[19,20] GDM mothers had a significantly higher mean MUAC and BMI compared to non-GDM mothers during both the 28th week of pregnancy and at the time of delivery. Furthermore, mothers with GDM had significantly gained weight at the time of delivery compared to weight in the 28th week of pregnancy. However, although there was a significantly higher proportion of high BMI levels at 28 weeks of pregnancy in mothers with GDM compared to non-GDM mothers (p-value <0.001), no significant differences were observed at the time of delivery (p-value 0.316). It might be because of adding foetal weight during maternal BMI calculation. LUCS was the mode of delivery performed

the most frequently in both groups, although mothers with GDM had a significantly higher frequency compared to mothers without GDM (95.64 vs. 84%, p-value <0.001), which was comparable to various other studies. However, complications associated with GDM, such as foetal macrosomia or maternal hypertension, may increase the likelihood of caesarian section. Because macrosomia is associated with shoulder dystonia, it is particularly important to diagnose it before labor.[19-21] In this study, hypothyroidism was significantly prevalent among GDM mothers compared to non-GDM (12.73 vs 6%, p=0.03). Many studies have evaluated the association between hypothyroidism and the risk of gestational diabetes. The results are often conflicting, as some reports found such an association.[22-24], while others failed to demonstrate this connection.[25] In a Bangladeshi study by Shahid et al., they found no association of thyroid autoimmunity with the development of GDM nor any role of the presence of goitre or positive family history of TD in glucose intolerance during pregnancy.[25] Hypothyroidism appeared to negatively affect glucose homeostasis by inducing insulin resistance. Pregnant women with hypothyroidism have further exacerbated insulin resistance and thus have an increased risk of gestational diabetes. Furthermore, the current study found a higher prevalence of PIH among mothers with GDM than mothers without GDM, although without any significant difference (11.27 vs 9.33, p=0.102). Like my research project, several other studies also found no clear association between GDM and PIH,[26,27] except for the way of insulin resistance, which is present in NIDDM due to â-cells dysfunction. In a Bangladeshi study by Sayeed et al., a higher frequency of GDM was also found in subjects with hypertension without statistical significance (10 vs 6.6%, p=0.52).[26] However, more work is needed to determine the proportion of PIH and hypothyroidism among mothers with GDM. Identifying the relationship between these diseases could help with the early diagnosis and treatment of these disorders. Foetal macrosomia is one of the major outcomes of complicated pregnancy with GDM.[21] Following other studies, this study also showed that GDM significantly increased the risk of delivering babies with foetal macrosomia. Mothers delivered the 12 macrosomic babies in this study with GDM. Furthermore, the mean birth weight of the babies was significantly higher in the GDM group compared to the non-GDM (3.23±0.46 vs 2.97±0.37 kg, p-value <0.001). Furthermore, 91.67% of mothers of macrosomic babies had a high BMI (23) with a p-value of 0.05.Sumit et al. found that mothers with complicated GDM had a higher rate of macrosomia (16.7 vs. 1.5% in controls) and a significantly higher mean birth weight (3.3 vs. 2.51 kg in controls, p-value 0.001).[17] Maternal obesity likely contributes to macrosomia via mechanisms including increased insulin resistance (even in women who do not have diabetes), resulting in higher foetal glucose and insulin levels. Placental lipases metabolise triglycerides in the maternal blood, allowing free fatty acids to be transferred in excess to the growing foetus. Several other studies.[21,28,29] have found that fetal overgrowth is linked to obesity in the mother. Hence, optimising weight before pregnancy is ideal; individual and public health measures should be in place to encourage women to have a normal body weight before pregnancy. Maternity and newborn care providers should be aware of the increased risk among obese women, encourage lifestyle modifications that decrease gestational weight gain and manage abnormal glucose metabolism to optimise foetal growth. It is important to reduce intrapartum complications and neonatal sequelae (such as birth trauma and hypoglycemia). In this study, babies of GDM mothers had a significantly higher proportion of birth asphyxia, septicaemia, pneumonia and IUGR (p-value <0.05). Furthermore, the APGAR score in the 5th minute was significantly worse in the baby of the GDM mother (p-value <0.05). Therefore, admissions to the NICU were also higher in women with GDM than in women without GDM. At six weeks of puerperium mothers, only 17.82% of mothers with GDM had persisted with DM. Most mothers with GDM were treated with diet and insulin (56%), but 44% were only treated with diet.A review by Negrato et al stated that about 2 to 17.8% of pregnant women with gestational diabetes may develop permanent diabetes later in life. As normal pregnancy progresses, insulin resistance increases and the reserve of pancreatic â-cells reserve is stressed with the aim of maintaining glycaemia within normal ranges; gestational diabetes occurs when â-cells fail to maintain glycaemia in these ranges. However, at delivery, when the placenta that exerts the major anti-insulin effect is removed, usually glucose homeostasis is restored.[30] This research had some limitations. All the samples were not in a similar

age group. The sample size might not be representative enough to generalise the findings. The study was conducted for a limited period of time. Since the study group was made up of pregnant women who went to BIRDEM Hospital, BMI could not be separated from weight gain during pregnancy.

5. Conclusion:

This study observed a higher BMI, MUAC, and a higher gestational weight gain in GDM compared to non-GDM mothers. GDM mothers were observed with a higher frequency of adverse pregnancy outcomes, including macrosomia, IUD, stillbirth, birth asphyxia, septicaemia, etc. Macrosomia was associated with a higher BMI for mothers. Mothers of GDM should be advised to avoid excessive weight gain during pregnancy. This study observed a higher BMI, MUAC, and a higher gestational weight gain in GDM compared to non-GDM mothers. GDM mothers were observed with a higher frequency of adverse pregnancy outcomes, including macrosomia, IUD, stillbirth, birth asphyxia, septicaemia, etc. Macrosomia was associated with a higher BMI for mothers. Mothers of GDM should be advised to avoid excessive weight gain during pregnancy. Mothers with GDM are prone to higher weight gain and bad neonatal outcomes. Therefore, the obstetrician must be vigilant and prepared for proper care of the newborns. Obstetricians try to control patients' sugar in a euglycaemic state. This is important to avoid foetal complications.

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Conflicts of Interest: Nothing to declare.

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