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ORIGINAL ARTICLE

Association of Gestational Diabetes and Childhood Obesity

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ABSTRACT

Background: Maternal gestational diabetes is a commonly reported complication of pregnancy. Gestational diabetes has been highlighted as a risk of childhood obesity. There are various indicators which can assist in prediction of childhood obesity including waist circumference and body mass index measurements.
Objective: To assess the relationship of gestational diabetes with childhood obesity.
Study Design: Prospective comparative study
Place and Duration of Study: Balochistan Institute of Child Health Services, Quetta from 1st March 2022 to 31st October 2023.
Methodology: Four hundred children were enrolled, 200 children who were born to mothers with gestational diabetes while they were pregnant with the child under enrollment were termed as GDM group while the other 200 children who were born to mothers with no gestational diabetes during their pregnancy with the child under enrollment, were termed as non-GDM group Anthropometric data including stature/stature ratio, arm circumference, waist circumference, body mass, sitting height, body mass index, bioelectrical impedance was documented. The inclusion criteria of the study participants were based on the fact that either the obese child attending the OPD was born to a gestational diabetic mother or not. Children within the age of 6-12 years were included in the study. In addition to this child lifestyle including time for physical activity, sports, minutes of moderate-to-vigorous physical activity (MVPA), sedentary time, steps/day, diet and nutrition through food frequency chart were assessed.
Results: The majority of children were boys with a percentage of 52% and 59% in non-GDMA and GDM groups respectively. The children presented in GDM group were excessively breast fed in comparison to other groups. However, the comparison was not significantly varied. The BMI, waist circumference and height of the obese children from both groups showed that children in GDM group were having increased waist circumference as well as decreased height and higher BMI values those non-GDM group children. There was a positive association of maternal GDM with childhood adiposity variations of childhood indicators specifically within the 6-9.5 years.
Conclusion: Maternal GDM is a critical risk factor of obesity and overweight condition in childhood leading to a high frequency of obesity in children.
Keywords: Association, Gestational diabetes, Childhood obesity

INTRODUCTION

Childhood Obesity (CO) has escalated intensely all over the globe.[1] Developing as well as developed countries are facing its adverse results including early age diabetes (Type 1) and other health complications. The most documented factor for impacting childhood obesity is prenatal, perinatal as well as postnatal environment.[2] The fact that intrauterine-exposure to the offspring to maternal gestational diabetes places the offspring on a high risk of adverse outcomes which includes childhood obesity.[3-12]

Maternal gestational diabetes is a commonly reported complication of pregnancy. It affects around 1-28% of the world pregnant women.[4] A study from India in collaboration with American diabetes Association have highlighted the risk of childhood obesity and gestational diabetes in formation of type 1 diabetes in children[5] whereas other studies have clearly identified a strong correlation between gestational diabetes and childhood obesity for formation of comorbidities in children.[6-12] The increased gestational diabetes might be due to the increased prevalence of asymptomatic type 2 diabetic population in developing and developed countries.[2]

There are various indicators which can assist in prediction of childhood obesity including waist circumference and BMI measurements.[13] The present study was formulated for examining the association of childhood obesity with maternal gestational diabetes and to self-report the indicators of childhood obesity including BMI, waist circumference in addition to the body fat. The current study targeted children within 9-12 years for assessing childhood obesity.

The reason behind this age to be most vulnerable for development of obesity because of previous clinical/biochemical environment including maternal gestational diabetes as well as external lifestyle factors including higher consumption of fatty and fried items. The results of this study were extremely helpful in understanding the association between the maternal gestational diabetes and childhood obesity and therefore identifying the factor which if avoided can lead to a healthier and health preventive outcomes of a child.

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MATERIALS AND METHODS

This prospective comparative study was conducted at Balocistan Institute of Child Health Services, Quetta from 1st March 2022 to 31st October 2023. The research received ethical clearance through the hospital ethical board. The study sample was extracted from the OPD settings through a well-structured based questionnaire and interviewing the child and its parent. Each session between the child and parents was prior informed with a proper informed consent being taken from the school administration and well as the parents of the children. The participants based on the fact that either the obese child attending the OPD was born to a gestational diabetic mother or not and age of 6-12 years were included. A total of 400 children were enrolled in the study after calculating the sample size based on the frequency of obesity in children as 8.5%. The sample size was calculated using sample size calculation available software wherein 80% power of test, 95% CI and 5% margin of error was applied. Out of the 400 enrolled children, 200 children who were born to mothers with gestational while they were pregnant with the child under enrollment were termed as GDM group while the other 200 children who were born to mothers with no gestational during their pregnancy with the child under enrollment, were termed as Non-GDM group. On gaining permission to proceed with the study each child completed. Anthropometric data including – stature/stature ratio, arm circumference, waist circumference, body mass, sitting height, BMI, bioelectrical impedance was documented. In addition to this child lifestyle including time for physical activity, sports, minutes of moderate-to-vigorous physical activity (MVPA), sedentary time, steps/day, diet and nutrition through food frequency chart were assed. The parent's history regarding the mode of delivery, gestational diabetes, levels of glucose during pregnancy were also questioned during parent interviewing. The children who were suspected of type 1 diabetes

or any other comorbidity through their clinical information were further requested to give 1cc blood wherein their Fasting blood sugar, Homa IR, as well as HbA1C levels were identified as well as any other related biochemical analysis as per advised through pediatrician. The total number of calories consumed was calculated for each child through the food frequency charts. All the relevant data was entered in form of coding in the SPSS from version 26.0 from where it was further analyzed in form of mean ± SD, frequencies and percentage represented through Chi-square values with p value <0.001 as significant and 95% confidence of interval.

RESULTS

The demographic as well as their anthropometric measurements showed significant variance among both groups. The majority of children were boys with a percentage of 52% and 59% in non GDMA and GDM groups respectively (Table 1). The children presented in GDM group were excessively breast fed in comparison to other groups. However, the comparison was not significantly varied. The BMI, waist circumference and height of the obese children from both groups showed that children in GDM group were having increased waist circumference as well as decreased height and higher BMI values those non-GDM group children (Table 2). There was no significant variance among children daily fruit intake, however GM group children were taking higher number of vegetables with 93% taking twice a day. Only 6% Non GDM children were consuming higher vegetable than 3 or more times daily (Fig. 1)

Table 1: Demographic and Physical characteristics of Maternal and Child enrolled in accordance with the gestational diabetes status. (n=400)

Characteristics	Non GDM Group (n=200)	GDM Group (n=200)	P value
Obese children	78	82	--
Overweight	67	66	--
Normal weight	51	56	--
Maternal features			
Age at delivery(years)	29.8±2.92	30.4±3.56	0.951
Weight gain during gestation (kg)	17.23±6.71	18.7±5.86	0.885
Children Attributes			
Boy n (%)	104(52%)	118(59%)	<0.001
Girl n (%)	96(48%)	82(41%)	
Age (years)	10.9±1.2	9.1±2.5	<0.001

There was a positive association of maternal GDM with childhood adiposity variations of childhood indicators specifically within the 6-9.5 years of Childs age with a β score values significantly> zero and as +0.10 (95% CI: 0.02–0.19). Children with Maternal gestational diabetes mothers had a higher risk of obesity and had a significant association with the Overweight and obesity formation that those children having non gestational diabetic mothers as the cent5ralised obesity and body fat was found with higher odds ratio in GDM group compared with those children born to mother with no gestational diabetes (Table 3). The current study evidently presented high number of obese children in GDM group as compared to Non GDM group with significantly increased number of obese children with central obesity and high body fat (Fig. 2).

Table 2: Comparison of childhood feeding and height/weight among non-GDM and GDM groups

Characteristics	Non-GDM Group	GDM Group	P value
Mode of infant feeding			
Exclusive breastfed	80 (40%)	88 (44%)	0.021
Breast fed and formula	88 (44%)	84 (42%)	
Exclusive formula fed	32 (16%)	28 (14%)	
Outdoor activity (hour/day)	2.13±0.87	1.21±0.92	0.111
Birth BMI (kg/m^2)	13.4	13.6	<0.001
Height, cm	119± 9.17	118±9.75	0.50
Z-score for height-for-age	0.70±1.01	0.76±1.02	0.25
Weight (kg)	22.2 ± 5.98	23.2 ± 6.92	0.011
Z-score for weight-for-age	0.46 ± 1.21	0.71 ± 1.27	0.001
Body mass index (kg/m^2)	15.8 ± 2.33	16.3 ± 2.60	<0.001
anthropometric measurements of obese and overweight children			
BMI(kg/m^2)	26.4±1.9	29.5±2.1	<0.001
Height (cm)	119 ± 9.17	109 ± 9.76	0.50
Z-score for height-for-age	0.69 ± 1.11	0.75 ± 1.11	0.25
Weight (kg)	41.2 ± 3.99	43.1 ± 3.91	0.011
Z-score for weight-for-age	0.46 ± 1.22	0.71 ± 1.27	0.001
Waist circumference (cm)	26.1 ± 6.09	29.2 ± 6.77	<0.001

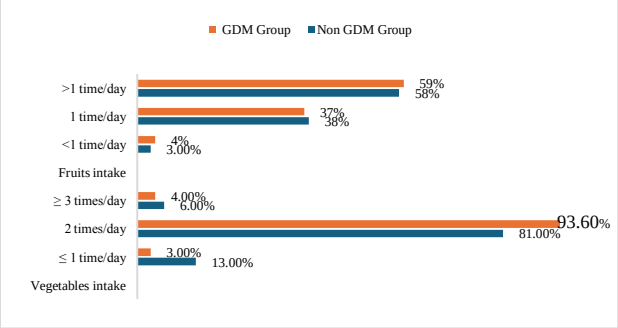

Fig. 1: Comparison of food frequency GDM and non-GDM groups two groups

Table 3: Odds ratios for childhood overweight, obesity, central obesity and high body fat by maternal GDM status

Outcomes			Odds ratios (95% CIs)		
			Model 1	Model 2	Model 3
Overweight	Non-GDM Group	67/200	1.00	1.00	1.00
	GDM Group	66/200	1.61 (1.21–2.14)	1.56 (1.15–2.11)	1.43 (1.03–1.96)
Obesity	Non GDM Group	78/200	1.00	1.00	1.00
	GDM Group	82/200	1.74 (1.23–2.47)	1.65 (1.15–2.41)	1.18 (1.15–1.25)
Central-obesity	Non GDM Group	11/200	1.00	1.00	1.00
	GDM Group	81/200	1.61 (1.01–2.54)	1.61 (0.98–2.63)	1.61 (0.95–2.71)
Increased body fat	Non GDM Group	67/200	1.00	1.00	1.00
	GDM Group	134/200	1.61 (1.18–2.18)	1.55 (1.12–2.02)	1.48 (1.04–2.09)

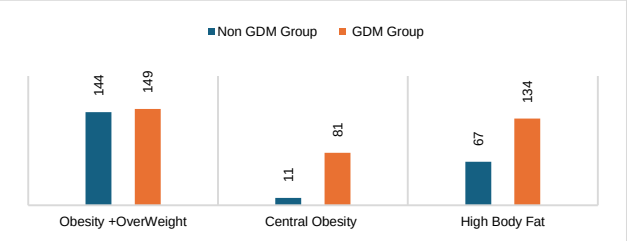

Fig. 2: Comparison of obesity measurements within GDM and non GDM group children (P value <0.001)

DISCUSSION

It has been elaborated the fact that children born to gestational diabetic mothers are at a higher risk of macrosomia and are larger for gestational age at birth with increased tendency of obesity formation as well as comorbidities as diabetes in them.[14] The current study result also supports similar findings with increased risk presentation of body fat and waist circumference in children with gestational diabetic mothers. There are various studies to defend this fact wherein positive association between maternal gestational diabetes and childhood obesity have been detailed.[15-18]

The current research focused on a substantial number of participants for comparison of the BMI level between children born to gestational diabetic mothers and to those born to those having no gestational diabetes. The analysis of the results interpreted that within various multi factors most significantly gestational diabetes as well as lifestyle broughtplays a major role in infant growth due to metabolic imprinting. Literature around the globe has evidently proved this fact not only from the observational data established from human studies but also through experimental data retrieved from animal models .[19,20]

The increased risk of obesity in children with gestational diabetic mothers might be due to the reason that excessive nutrients from mothers to fetus are delivered through placenta including maternal glucose, however the insulin cannot cross the placenta.[21] Offspring's affected by GDM are more prone to obesity and insulin resistance.[20,21] In the current study as well as previous research it was also describe that obesity in children is also related with lifestyle changes including over nutrition and lack of physical activities. The present study also found the similar results in coordination with previously reported data.[20,21]

CONCLUSIONS

Maternal GDM is a critical risk factor of obesity and overweight condition in childhood leading to a high frequency of obesity in children. The gestational diabetes in mother of offspring's born is independent risk factor from various important confounders including body mass index, gestational-weight gain, and childhood lifestyle factors.

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