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A cross sectional study to assess prevalence of high risk children for diabetes mellitus and its associated risk factors from selected school of Mumbai

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Abstract
Background: Diabetes Mellitus (DM) is a disease of impaired metabolism that affects the metabolism of fat, protein, and carbohydrates. Different clinical phenotypes with varied degrees of disrupted metabolism are caused through a combination(s) of insulin insufficiency and sensitivity to its activities. In 2021globally, there were around 41,600 newly diagnosed cases of T2DM in children and adolescents. The International diabetes federation (IDF) Western Pacific area and World Bank upper and middle income nations account for around 30% & 40% of all cases globally, respectively. China, India, and the United States of America have the largest estimated numbers of incident cases.
Method: A cross sectional study was carried out from selected schools of Mumbai city during 1st October to 31st October 2024. Total 360 children age from 12-16 years included in the study. Structured questionnaire, anthropometric assessment with screening tool as per guideline of American diabetes association (ADA) was used to collect data from children.
Result: Out of 360 children 44 was found to be high risk children for DM. Major risk factors were obesity 44(100%), positive family history 36 (81.81%), hypertension 16 (36.36%), followed by impaired sugar level 2 (4.5%) and insulin resistance 3(6.81%) in girl. The overall prevalence rate was 12.22% and in girls 5% while in boys 7.20%.
Conclusion: There is need to create awareness about diabetes and it's risk factors among children. Periodic screening of children with risk factors for DM should be done. There is need to promote healthy lifestyle to reduce obesity and risk of DM in children.

Keywords: Diabetes mellitus, children, diabetes screening, risk factors, BMI

Introduction
One of the greatest adversities of the 21st century is childhood obesity. The rate at which prevalence of obesity in children is increasing, it is distressing. Post covid 19 pandemic, 1 o t of 8 people were living with obesity all around the world. Since 1990 worldwide there is rise in adult obesity by more than doubled, while adolescent obesity has quadrupled. In 2022, 37 million children under the age of 5 years were found to be overweight. More than 390 million children and adolescents between ages of 5-19 year were found to be overweight (World health organization (WHO), 2024). The rise in incidence of obesity has mirrored the diabetes pandemic in children universally [1]. Children who are overweight or obese have a higher probability of being fat during their adulthood and at the risk of developing non communicable diseases including diabetes and cardiovascular disorders earlier in life [2]. (WHO, 2020) Globally, there will be around 41,600 newly diagnosed cases of T2DM in children and adolescents in 2021. The IDF Western Pacific area and World Bank upper and middle income nations account for around 30% and 40% of all incident instances globally, respectively. China, India, and the United States of America have the largest estimated numbers of incident cases [3].
Obesity is multifaceted chronic disease involving genetic, environmental, physiological, metabolic, behavioral and psychological factors. There are various factors that link diabetes with obesity. The dietary habits and lifestyle have great impact on development of diabetes in obese children. Therefore, the primary goal of any health care organization should be preventing disease rather than cure, and it should begin at a young age [4]. Early detection of at-risk children and appropriate interventions to reduce central adiposity, increase physical activity, and alter dietary habits may help prevent or postpone the onset of dm and,

consequently, lessen the burden of its related complications in India. Through a variety of IEC initiatives, DM education and awareness must be raised in children [5].

Aims and Objectives

1. To screen children
2. To identify children at risk for DM
3. To identify risk factors associated with DM in high risk children
4. To find association of various risk factors with risk of DM in children

Hypothesis

H_0 = There is no association between various risk factors with prevalence of risk of DM in children

Research Methodology

A school based cross sectional study was carried out to assess children between age p of 11 to 16 years in Mumbai; study was from 1st to 30th of October 2024. A study by Kumar *et al*. found the prevalence of pre-diabetes and diabetes in adolescent boys and girls was 12.3% and 8.4%, respectively. Based on this sample size was calculated, total 360 children were included in study. Where P = prevalence rate of the disease, ∑ = margin of error 10% of P with degree of confidence 95%.

List of children was taken from school authorities. Followed by permission from parents and children to participate in study was taken; consent and assent form were given, convenient sampling technique was used to select sample. The final sample included 360 children with 233 boys and 127 girls. Data was collected using a structured questionnaire including information regarding health history of child and family history related to DM. Assessment anthropometric parameters (height, weight, and waist and hip circumference) were done. Blood pressure was taken after a 10-minute rest with standard cuffs with a mercury sphygmomanometer in sitting position. Screening tool based on American Diabetes association (ADA) guideline was used to assess the risk of DM in children. Data analysis was done using descriptive statistics.

ADA Criteria for screening risk of DM [6]

Child is consider as high risk child for diabetes, If the child is

1. ≥ 10 years
2. Overweight or obese
3. Maternal history of diabetes or gestational diabetes
4. Family history of T2DM in parents, sibling, relatives
5. Hypertension
6. Sign of insulin resistance-Acanthosis Nigricans

Results

In present study total sample size was 360 in which 233(64.72%) children were male and 127(35.27%) children were female. Most of the children 187 (51.94%) were between age of 13-14 years, out of 360 children 121 (33.61%) were overweight and 48(13.33%) were obese. Most of the children had normal BP. Only 23 (8.8%) had raised systolic BP >120 mmHg while 10 (3.84%) had raised diastolic BP. Total 44 (12.22%) children found to be high risk for DM. It was found that children were aged between 11 and 16 years with a mean age of years 13.57±1.15 and median age of 14 years. Out of 44 subjects 26 (59.09%) were males and 18 (40.90%) were females. In the present study the prevalence of high risk children for DM was 12.22% in boys it was 7.20% and 5% in girls shows that risk of DM is more in boys. Among the high risk children 38 (86.36%) had increased waist to hip ratio, nearly half high risk children 23 (54.54%) were obese (BMI >25). Study also revealed that 36 (81.8%) high risk children had family history of DM, 16 (36.36%) high risk children had hypertension, only 3 (6.8%) female high risk children showed sign of insulin resistance.

Table 1: Distribution of children with selected risk factors N = 360

Parameter	Mean ± STD	Median	Min	Max	95% C.I .for EXP (B)	
					Lower	Upper
Age	13.57±1.15	14	11	16	13.45	13.68
Height	154.98±9.17	154	133	189	154.03	155.92
Weight	49.60±13.09	48	24.6	93.4	48.24	50.95
Bmi	20.52±4.65	19.63	12.03	38.88	20.03	21
Waist	75.81±11.59	75	52	137	74.61	77
Hip	86.17±10.67	85	64	140	85.06	87.27
Waist to hip ratio	0.87±0.06	0.88	0.72	1.24	0.86	0.87
Bp-systolic	113.13±7.60	110	100	130	112.34	113.91
Bp-diastolic	72.92±7.09	70	60	90	72.18	73.65

Table 2: Association of children with selected non modifiable risk factors N = 360

Variables	Categories	High Risk (44)	No Risk(316)	p VALUE	S/NS
Gender	Male	26	207	0.404	NS
	Female	18	109		
Age	< 14 yr	23	152	0.6	NS
	>14 yr	21	164		
Religion	Hindu	41	281	0.38	NS
	Non Hindu	3	35		
Family H/O DM	PRESENT	32	20	<0.00001	S
	ABSENT	12	296		
	ABSENT	15	58		

Table 2: Association of children with selected modifiable risk factors N = 360

Variable	Categories	High Risk (44)	No Risk (316)	p < 0.05	S/NS
Diet	Veg	32	184	0.65	**NS**
	Non veg	12	132		
Bmi	< 25	34	270	0.16	**NS**
	> 25	10	46		
Waist to hip	< 0.85	4	112	0.0004	**S**
	> 0.85	40	204		
Bp-systolic	< 120 mmhg	20	268	<0.00001	**S**
	>120 mmhg	24	48		
Bp-diastolic	< 80 mmhg	23	200	0.15	**NS**
	> 80 mmhg	21	116		
Insulin resistance	PRESENT	3	22	0.34	**NS**
	ABSENT	15	58		

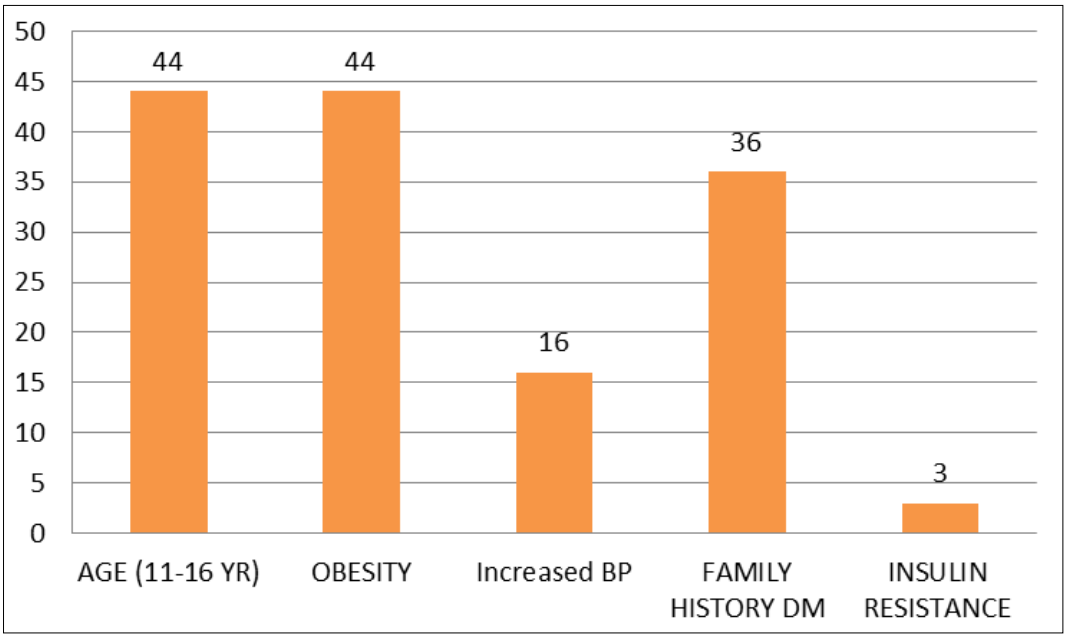

Fig 1: Distribution of high risk children according to risk factors

In present study all the high risk children were between age group of 12-16 year, were obese, 36 (81.81%) had family history of DM, while 16 (36.36%) had hypertension, and 3 (16.66%) female out of 18 had symptom of insulin resistance. In the study significant association was found in high risk children with positive family history of DM p= <0.00001, increased waist to hip ratio means abdominal obesity p= 0.0004, Increased systolic BP p= <0.00001. while other factors were not significantly associated with risk of DM in children.

Discussion

A research by Ranjani *et al*. screened for diabetes in children ages 12 to 19. According to their study, 3.7% of people were at risk for diabetes overall, 4.2% of girls had the disease, and 3.2% of boys had the disease [7]. Overall, 12.22% of children in the current study had high risk diabetes, compared to 5% of females and 7.2% of boys.

The prevalence of risk for children with a positive family history was 81.8% in the current study compared to 25% in the Chaoyang *et al*. study of US adolescents [8].

18.2% of obese children in a research by Kaur *et al*. had pre-diabetes, or impaired glucose tolerance. Currently, 54.54% of participants are overweight [9].

According to Ramachandran *et al*. [11], 18 children under the age of 15 have been diagnosed with T2DM (5 boys and 13 girls). Due to a strong family history of diabetes mellitus, screening revealed that nine of them were obese and asymptomatic. 44 children under the age of 16 (23 boys and 18 girls) in study were at risk of developing diabetes. All of these children were asymptomatic when they were screened for the disease 36(81.81%) had family history of DM. All forty-four of these high-risk kids were overweight.

Conclusion

The study investigated the risk of diabetes and its associated factors in children. According to this study, children who are obese, have a family history of DM, or have hypertension are more likely to have diabetes. This study emphasizes the need for regular health screening, lifestyle modification and appropriate management of risk factors such as obesity. The prevalence of T2DM can be decreased by regular activity and a diet which is high in fruits, vegetables, and fiber. There is need to develop and evaluate culturally sensitive intervention to reduce risk of DM and the pediatric population has to be made more aware of T2DM. Diabetes risk factors should be covered in health education. They should be informed about early warning sign and screening methods.

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