



A CROSS SECTIONAL STUDY ON PREVALENCE OF IMPAIRED GLUCOSE TOLERANCE & THE ASSOCIATION OF FASTING INSULIN LEVELS WITH OBESITY & OVERWEIGHT CHILDREN BETWEEN 9 TO 15 YEARS

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ABSTRACT

Introduction- Childhood obesity increases the risk of type 2 DM later in life. a study was conducted on urban school children. **Objective** was to know the prevalence of impaired glucose tolerance (IGT) in obese & overweight children aged between 5-15 years. The study was also intended to know association of DM status of parents with IGT of their children. **Material And Methods** A cross sectional study was done on 452 urban school children, where in 100 out of 452 children, were selected based on age appropriate BMI. Of these 100 children, 40 were obese, with BMI >95% & 60 were overweight with BMI of 85% to 95%. Fasting blood glucose (FBS) & oral glucose tolerance (OGTT) was done on these 100 children after obtaining informed consent & ethical committee clearance. **Results-** The overall prevalence of IGT was found to be 13% in obese & overweight children. The prevalence of IGT in overweight children was higher (16.6%) than obese children (7.5%). The prevalence of DM in overweight children was 1.66%. Children born to diabetic parents had higher prevalence of IGT (61.5%) **Conclusion-** Overweight & Obesity are the risk factors for the development of IGT. Children born to diabetic parents are at higher risk for IGT. Screening of obese & overweight children for IGT & IFG (by OGTT) is useful to identify the high risk child for type 2 DM later in life.

KEYWORDS

Obese & Overweight Children, Oral Glucose Tolerance Test, Fasting Blood Glucose, Impaired Glucose Tolerance.

INTRODUCTION:

The WHO describes "Obesity" as one of the today's most blatantly visible, yet most neglected health problems. Childhood obesity is a single marker for development of various non-communicable diseases later in life, like type 2 DM. Global prevalence of overweight and obesity in children is on the rise. Childhood obesity increases the risk of type 2 DM later in life. We conducted this study, with an intention to know the exact risk of obese & overweight children for type 2 DM & to identify these children early.

MATERIAL AND METHODS:

A cross sectional study was conducted on 452 children belonging to affluent society of Mysore city. Out of 20 affluent schools in Mysore city belonging to upper socioeconomic society (according to per capita income of the family) 2 schools were selected. Purposive sampling method was adapted for simple random sampling. Based on the age appropriate BMI, the sample size was calculated. Out of 452 children between 5 to 15 years, 100 (40 obese & 60 overweight) based on BMI corresponding to the age and sex were included in the study. Weight of each child was recorded using calibrated standard weighing scale and height was measured using a calibrated stadiometer.

Anthropometric measurements were recorded by only one of the authors with no significant intra observation variability. Detailed history in relation to diet, medications, previous CNS infections, obese parents & clinical examination of each child for the possible cause of obesity like endocrinal, syndromic or post CNS infection sequelae were considered to rule out secondary causes of obesity. The family history of DM in mother, father or grandparents was taken. Children with secondary causes of obesity & those on any medications were excluded. Data was collected in a proforma meeting the objectives of the study after obtaining informed consent and ethical committee clearance. Children were categorized based on BMI as per NCHS guidelines with respect to their age and sex.

After a 12-hour overnight fast, these 100 subjects underwent OGTT at 8:00 am. Baseline sample was obtained for measurement of fasting glucose (venous). Then glucose was given orally (1.75gm/kg body weight, up to a maximum of 75gm glucose) and another sample was obtained after 120 minutes.

Blood glucose was estimated using GOD/PAP calorimetric method by Randox autoanalyser.

As per current criteria a fasting blood glucose that exceeds 126mg/dl OR 2 hour plasma glucose during OGTT >200mg/dl is the accepted criterion for the diagnosis of DM¹.

Childhood obesity is defined as the age appropriate BMI of >95th percentile for age & sex and overweight when the BMI is 85th to 95th percentile for age & sex¹.

Prevalence of IGT was calculated & also correlation of IGT with family history of DM was done. The values have been represented only through frequencies and percentages. No statistical methods have been applied as the frequencies were low.

RESULTS:

Present study was a cross-sectional study, included 100 (60 overweight & 40 obese) children from 2 urban schools (affluent society) of Mysore city. The study population was grouped in to 2 groups - Group I include children between 5 to 10 years & Group II includes children between 11 to 15 years. There were 19 (41.3%) overweight & 27 (58.7%) obese in Group I and 41 (75.9%) overweight & 13 (24.1%) obese children in Group II.

18 out of 100 children included in the study had history of DM in the father, of which 17 children were born to diabetic father & one child was born to diabetic mother.

The mean BMI in overweight children was 21.7333 and in obese children was 24.1900.

TABLE-I Age & sex wise distribution of the study sample

Age Group	Male	Female	Total
5-10	30 (48.4%)	16 (42.1%)	46 (46.0%)
11-15	32 (51.6%)	22 (47.9%)	54 (54.0%)
Total	62	38	100

TABLE-II the prevalence of IGT based on OGTT

	TOTAL NO. OF CHILDREN SCREENED FOR OBESITY & OVERWEIGHT	No. of children subjected for OGTT		
		TOTAL	OVERWEIGHT	OBESE
	452	100	60	40
Number of children with IGT		13	10	3
prevalence of IGT		13%	16.7%	7.5%

The overall prevalence of IGT was found to be 13% in obese & overweight children.

TABLE – III Age group wise prevalence of IGT based on OGTT

AGE GROUP	study group with IGT on OGTT		
	OVERWEIGHT	OBESE	TOTAL
Group I 5 TO 10 Yrs	1 (50%)	1(50%)	2(100%)
Group II 11 TO15 Yrs	9(81.8%)	2(18.2%)	11(100%)
Total	3 (23.1%)	10 (76.9%)	13(100%)

The prevalence of IGT in Group I was 2% and in Group II was 11%. Overweight children between 11 to 15 Yrs had higher prevalence of IGT (76.9%).

TABLE – IV Association of DM status of parents with IGT of their children

Family history of DM	obese	overweight	total
No of children born to diabetic father	10 (58.8%)	7 (41.2%)	17 (100%)
No of children born to diabetic mother	0	1 (100%)	1 (100%)
Total	10 (55.5%)	8 (45.5%)	18 (100%)

The children born to diabetic mother tend to be at a higher risk for IGT. Maternal history of DM is a useful parameter in overweight & obese children

One overweight child had FBS of 146mg/dl and was diagnosed to have DM. The prevalence of DM in overweight children was 1.66%.

DISCUSSION-

According to IOTF (International obesity task force), global prevalence of overweight and obesity in children aged 5-17 years is estimated to be approximately 10%. This range from <2% in sub Saharan desert to 30% in America.³ Severe obesity in children is a major risk factor in the pathogenesis of T2 DM⁴. In India the prevalence of obesity in preschool children is 1%⁵ and in school children it is 3% to 11%. A Study done by National Foundation of India (NFI) between age groups of 4 to 18 years involving 5000 children showed the prevalence of overweight as 17.3% & obesity as 1.7%⁶. Almost 30% to 80% of obese children become obese adults. According to CDC & prevention, in 3 children born in US will become diabetic.⁷

The obvious way to prevent an epidemic of obesity related diabetes would be to emphasize the primary & secondary prevention of obesity*. So it is worth Screening of obese & overweight children for IGT & IFG.

The term “Impaired glucose tolerance” refers to a metabolic stage that is intermediate between normal glucose homeostasis & diabetes.ie (fasting blood glucose of 100 to 125 mg/dl). FBS of 99mg/dl is the upper limit of normal. IGT is a risk factor for future DM & cardiovascular disease, in part because of its correlation with insulin resistance.

Many individuals with IGT are euglycemic in their daily lives & may have normal glycated Hb levels. Individuals with IGT often manifest with hyperglycemia only when challenged with the oral glucose load used in OGTT.

The prevalence of IGT in various studies range from 7 to 35% which is comparable to 13% in the present study. The prevalence of IFG in various studies is 2.4% to 25% & it is 13% in the present study. The prevalence of IGT is more prevalent in overweight (16.6%) than obese (7.5%) children. Study by Sinha et al for the first time determined the prevalence of IGT in Obese children documenting IGT in 25% of 55 obese children (4 to 10 years) and 21% of 112 obese adolescent (11 to 18 years).

The prevalence of DM was 4% in the study by sinha when compared to 1.66% noted in our study. Atabek. et al noted the prevalence of IGT of 18% & 3% prevalence of DM in his study which is higher than the prevalence in present study (1.66%). (9) Ambadey Ramchandran in his series noted 16 out of 18 children with DM had family history of DM(10) 18 out of 100 children included in the study had history of DM in the father, of which 17 children were born to diabetic father & one child was born to diabetic mother.

18% of obese & overweight children in the present study had family history of DM, compared to 29% of subjects with family history of DM

in a series of 477 subjects by Stephanie Droabac¹¹.

The children born to diabetic mother tend to be at higher risk for IGT. Maternal history of DM is a useful parameter in overweight & obese children. Ramachandran et al 2003 observed 8.1% prevalence of IGT in his series¹² Susanna, et al has recorded 7% prevalence rate of IGT and 2.4% prevalence of DM in her study including 491 children¹³

Desmond E Williams et al have noted 2.8% prevalence rate of IFG in overweight children aged between 12 to 19 years (14)

Limitations of the study -

As the study was restricted to only the children of affluent society the results may not be generalized to all the children of 5 to 15 Yrs. As per currently accepted criteria for OGTT, the subjects should be on a well balanced diet containing approximately 50% calories from carbohydrates, 3 days prior to OGTT, (4) but all our subjects were on their regular staple diet before the day of OGTT.

CONCLUSION-

Obesity is a risk factor for the development of impaired glucose tolerance & later type 2 DM & its associated complications. Screening of obese & overweight children for IGT & IFG (by OGTT) may be useful to identify the high child for type 2 DM

What is already known- Childhood obesity increases the risk of type 2 DM in children.

What this study adds - Screening of obese & overweight children for IGT & IFG (by OGTT) is useful to identify the high risk child for type 2 DM.

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