

## Type 2 diabetes and weight dynamics in young: current view

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### Inception of Health Problem Awareness

Type 2 Diabetes was considered to be the disease of adults before 1985. With the explosion in number of cases in children with Type 2 diabetes in particular and diabetes as a whole, this is no longer the case. Early research presented a handful of cases and was inevitably met with scepticism. But as time passed the number of cases with Type 2 Diabetes in young adults grew exponentially and the global research community started to take notice. It was found that children from poor backgrounds and indigenous population tend to be effected more than their peers. In 1998 the head of Diabetes division Frank Vinicor Centre for Disease Control (CDC) convened a group of senior epidemiologists and endocrinologists to develop a gold standard for diagnosis of Diabetes type 2 in children. They reported that majority of effected children who were obese, belonged to Mexican American, African American or indigenous heritage having one or both parents with type 2 diabetes and were from disadvantaged environments. However, because of the crude immune markers available at the time to differentiate between types of diabetes this task seemed un-surmountable.<sup>1</sup>

### Difficulties in Calibrating Diabetes in Young

Obesity is the leading cause of development of insulin resistance which leads to lipid disorder, arterial hypertension and glucose metabolism disorders but most dangerously metabolic syndrome. It is now well known that the development of these complications begin at a very young age in the obese. The difficulty arises of calibration of insulin resistance in children because tests like euglycaemic hyperinsulinaemic clamp, frequently sampled intravenous glucose tolerance test and steady state plasma glucose are not appropriate for children because of the time consuming treatment requiring IV infusion and frequent blood sampling. The most commonly used method in children is the measurement of insulin and glucose concentrations during fasting and oral glucose tolerance test. This test

is not well standardized, there is lack of clear cut limit for diagnosing insulin resistance. Moreover the published research points towards different mechanisms of developing insulin resistance in children and adults. In the study by Skoczen et al they analysed 11 central obesity related genes like FTO and 33 type 2 diabetes related genes like TCF7L2. The results showed that insulin resistance may develop early in childhood obesity and that changes in both gene expression sets may lead to the development of insulin resistance and subsequent development of metabolic syndrome in very young children.<sup>2</sup>

### Health Burden in Pakistan

A study conducted in Hazara,<sup>3,4</sup> Pakistan among school going children showed the prevalence of obesity to be 4.78% with male to female ratio 1:1.2. The prevalence of obesity was higher among children of private schools as compared to government schools. Among children of age 12-14 years the prevalence was 49% while among 6-7 years old prevalence was 20.26%. The burden found in this study is similar to other developing countries. Another study conducted in Karachi revealed the overall burden of overweight and obesity to be 5.7 consistent with National Health Survey of Pakistan.<sup>3</sup>

A study conducted in Lahore, Pakistan showed that 17% children were overweight and 7.5% were obese. Higher prevalence of obesity was observed in boys than girls. Children from high socioeconomic status (SES) were significantly more likely to be overweight and obese compared to those from lower SES.<sup>5</sup>

### Importance of WHO guidance

The prevention of type 2 diabetes is directed towards tackling the obesity pandemic which involves reversing eating and entertainment trends in the wider paradigm of home, school and the community. These trends have resulted in increase in caloric intake and decrease in energy expenditure by children. It is important to comply with World Health Organisation recommendations about exclusively human milk until 6 months for the child and continue breast feeding for 2 years along with

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complimentary feeding.<sup>6</sup>

Nexus of Metabolic Syndrome and Type 2 Diabetes Study by Koskinen J et al concluded that associations of metabolic syndrome (MetS) in adults were predicted by MetS in children as young as 5 years age. They also used body mass index (BMI) which provided essentially the similar results compared to the conventional model of metabolic syndrome.<sup>7</sup>

The association between continued metabolic syndrome (MetS) and adult outcomes showed that the risk of type 2 diabetes was significant for 8-10 and 14-16 year old males as well as 8-10 and 17-18 year old females. They also reported from Princeton Lipid research study that children and young adults 5-19 year old with metabolic syndrome were more likely to have type 2 diabetes at the age of 25 to 30 years later as adults. They also contrasted their study results with longitudinal study of Pima Indians which showed earlier correlation between childhood and young adults' metabolic syndrome and type 2 diabetes development in adults. This in their view was due to increased risk of development of diabetes in Pima Indians.<sup>7</sup>

### **Impact of Lifestyle on Obesity**

The high prevalence of diabetes in the young globally has lead researchers to focus on physical activity, sedentary lifestyle and healthy diet in an effort to control this pandemic. Martin A et al looked at the previously mentioned factors and the consequent obesity and it's effects on cognitive function and school achievement. Their Cochrane review included more than two thousand children and adolescents. What they concluded was that they could partially assess the effect of the life style intervention including obesity management, community activity interventions geared towards obese and overweight children regarding their executive functioning i.e. cognitive function and academic achievement. School based dietary interventions may have a beneficial effect as far as the general school achievement of children with obesity is concerned.<sup>8</sup>

In Lahore, Pakistan a study conducted on 1860 children aged 5 to 12 years revealed that overweight and obesity was significantly associated with higher parental education, both parents working, fewer siblings, fewer person's in child's living room and residence in high-income neighbourhoods.<sup>9</sup>

### **Current View on Obesity in Young and resultant Health effects in Adults**

An update to 2010 US Preventive Services Task Force (USPSTF) on screening for obesity in children older than 6 years old was published in 2017. They used the statistics of 2000 CDC growth charts as their base which showed 17% of children and adolescents aged 2 to 19 years in the United States had obesity where as 32% were overweight. Apart from the physical morbidities for example cardiovascular disease and asthma the recommendations also took into account the mental health burden including bullying and teasing based on the child's weight. They postulated that the obesity in children and adolescents may continue into adulthood along with the resultant morbidities like cardiovascular disease and type 2 diabetes.<sup>10</sup>

Similarly in a study in Dera Ismail Khan, Pakistan among 6-11 years old children, metabolic syndrome was identified in 22.95% of obese children. The phenomenon of 'nutritional transition' meaning westernisation of food prevalent in developing countries including Pakistan like sweetened beverages and fast food has led to exponential rise in obesity in population who were unaware of the problem in recent past.<sup>11</sup>

To combat this problem USPSTF found that intensive, comprehensive behavioural interventions comprised of 26 hours or more in children 6 years or older resulted in weight change that lasted up to 12 months. Their final conclusion was that clinicians should screen for obesity in children 6 years or older and offer to refer them to comprehensive, intensive behavioural interventions.<sup>10</sup>

### **Longitudinal Connection between Early Age Obesity and Adult type 2 Diabetes**

Bjerregaard LG et.al explored the dynamics of weight change in young and the subsequent development of type 2 diabetes in adults. They investigated whether remission of overweight before early adulthood reduces the risk of development of type 2 diabetes. The study conducted included more than 62 thousand Danish men whose weight and height were measured at 7 and 13 years of age and in early adulthood (17-26 years of age). Overweight individuals were defined by criteria set out by Centre for Disease Control and Prevention. Data regarding type 2 Diabetes was obtained from National Health Registry of Denmark. Being overweight at 7 years, 13 years of age and early adulthood was positively

associated with risk of type 2 diabetes development. These associations were stronger at older ages at overweight and at younger ages at diagnosis of type 2 diabetes. Men who had remission of overweight before the age of 13 years had a risk of developing type 2 diabetes between 30 to 60 years of age which was similar to men who had never been overweight. Compared to men who had never been overweight, men who have been overweight between 7 years and 13 years of age but not during adulthood had a higher risk of developing type 2 diabetes. But the risk was lower than men who had been persistently overweight. Interestingly, men who had an increase in body mass index between 7 years of age and early adulthood had a higher risk of type 2 diabetes compared to men whose weight was normal at 7 years of age.

They concluded that childhood overweight at 7 years of age showed increased association with risk of type 2 diabetes development only if they continued to be overweight until puberty or later ages.<sup>12</sup>

These developments conclude that the development of type 2 diabetes is linked to obesity from ages as young as 7 years. This is a worrying statistic as in developing countries the management and interventions for overweight and obese young are not well developed. The detection of such individuals is also not well documented on a large scale in Pakistan. There is an urgent need to establish a plan to combat this pandemic on a large scale.

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