



# Influence of Maternal Factors on Childhood Obesity

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## ABSTRACT

The cases of childhood obesity have been precipitating at a startling rate globally. While some are obese from birth, others have a high propensity to put on weight in the early years of life. Obesity at an early age is likely to lead to obesity in adulthood which is linked to severe co-morbidities such as metabolic syndrome, type 2 diabetes and cardiovascular disease. Such long term effects on health can be checked by identifying the risk factors and ensuring an early intervention. Etiology studies of childhood obesity in some populations have looked into the role of maternal factors among the different modifiable and non-modifiable reasons behind the same. In this study, the different maternal factors starting from pre-conception to pregnancy, infancy and childhood were evaluated and compared between mothers of obese and lean children in the age bracket of 0-10 years in the population of Delhi NCR. A random sample of 529 mothers across Delhi NCR was surveyed using a structured questionnaire. The study indicates that pre-pregnancy obesity, gestational weight gain during pregnancy and duration of breast feeding are factors that may affect the weight status of children.

**Keywords:** Feeding pattern, Gestational weight gain, Maternal factors, Obesity.

## INTRODUCTION

The obesity epidemic is prevalent in all segments of the population. It is a condition of excessive or abnormal fat accumulation in adipose tissue to a degree that may impair health. It is one of the major risk factors for some of the most common non communicable diseases such as hypertension, diabetes, cardiovascular diseases, respiratory diseases, gout and arthritis (1). Once a matter of concern for developed countries, it has now become a bigger problem in the low and middle income countries of Asia and Africa (2). According to the latest report of WHO, the prevalence of obesity worldwide has nearly tripled since 1975(2).

India too is in the midst of a fast spreading epidemic. It is indeed a paradox that obesity is becoming a worrisome issue whilst we are still dealing with under nutrition (3).

The cases of childhood obesity have precipitated due to changing patterns of physical activity and unhealthy diet. While some are obese at the time of birth, others have a high propensity to put on weight in the early years of life. It has been seen that 50 to 80% of obese children grow up into obese adults. In fact, complications of adult obesity are worsened if obesity begins in childhood. Obesity affects the psychological health of a child (4). Such long term effects on health can be checked by identifying the risk factors and ensuring an early intervention (5). Factors affecting obesity have been a subject of several studies that have established obesity to be a multifactorial disease involving a complex interplay of genetics, lifestyle and environment. Genetic variation per se may not be a predictor for obesity, but the genetic profile may regulate the impact of environmental factors on obesity in an obesity conducive environment by virtue of the gene-environment interactions (6). In fact, the rate of increase in the cases of obesity suggests that the lifestyle and environmental factors governed largely by personal choices, rather than genetic factors seem to be major reasons behind this growing epidemic (7).

A mother's well being and behavior during pregnancy and after the child's birth have been identified as important determinants of the risk of child obesity. For example, pre-pregnancy obesity, gestational diabetes, feeding patterns of the child in infancy, physical exercise, socio-economic status have been associated with greater risks of childhood obesity or the child growing up into an obese adult. There is a growing body of literature exploring the involvement of the different maternal factors, but no such study on the Indian population has been reported thus far. Since variations in the different factors leading to obesity have been observed in populations of different ethnic origin, this study was undertaken to investigate the role of maternal factors in obesity among children in the Delhi and NCR region.

## METHODOLOGY

The study comprised a random sample of 529 mothers of children in the age bracket of 0-10 years across Delhi NCR. A pilot study comprising 110 mothers was conducted initially, and the final questionnaire was adapted based on the responses received. The questionnaire was self administered to the mothers. Children in the age group of 5-10 years were categorized as obese, overweight, normal or underweight by calculating the body mass index (BMI) and plotting on sex-specific BMI charts available from IAP. For children under 5 years of age, obesity was defined by the sex-specific growth charts available from IAP. Mothers were defined as obese ( $BMI \geq 30$ ), overweight ( $BMI \geq 25$ ), normal ( $BMI 18.5-24.9$ ) and underweight ( $BMI < 18.5$ ) in accordance with the current WHO BMI standards.

## RESULTS

A number of maternal factors which could possibly predispose children to obesity were assessed using the questionnaire. Of the various factors, mode of delivery, duration and type of feed during infancy, gestational weight gain using pregnancy, and pre-pregnancy weight gain of the mother during pregnancy appeared to be linked to obesity/overweight in children (Figure I). A greater percentage of children found obese/overweight (54%) were borne by caesarian delivery. In 46% cases, the obese/overweight children were delivered normally.

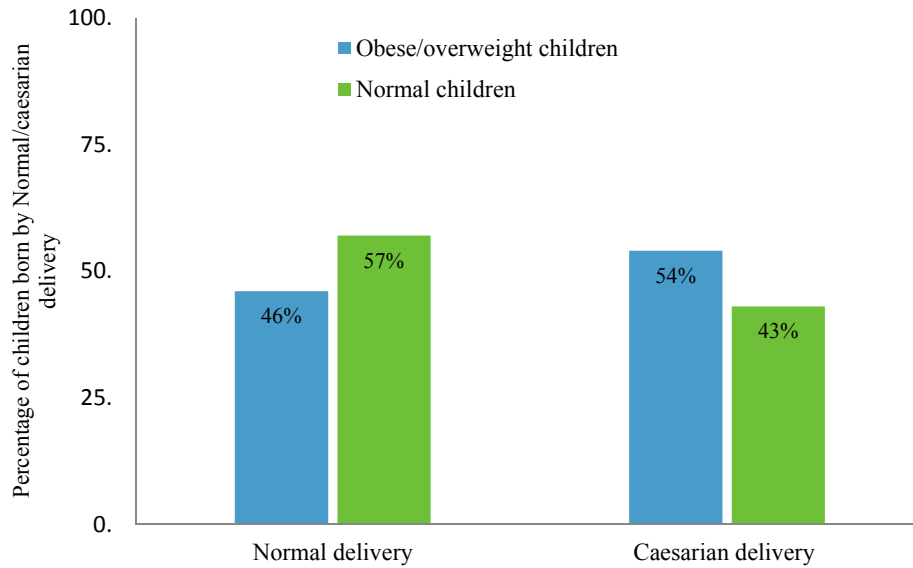


Figure I: Mode of delivery in obese/overweight children and normal children

When the feeding pattern of the obese/ overweight children was compared with the normal children (Figure II), it was found that the percentage of obese children who were breast fed exclusively for 6 months was lower than that of the normal children. The proportion of children who were exclusively on formula feed since beginning was overall less, but the percentage was higher in the obese/overweight cases.

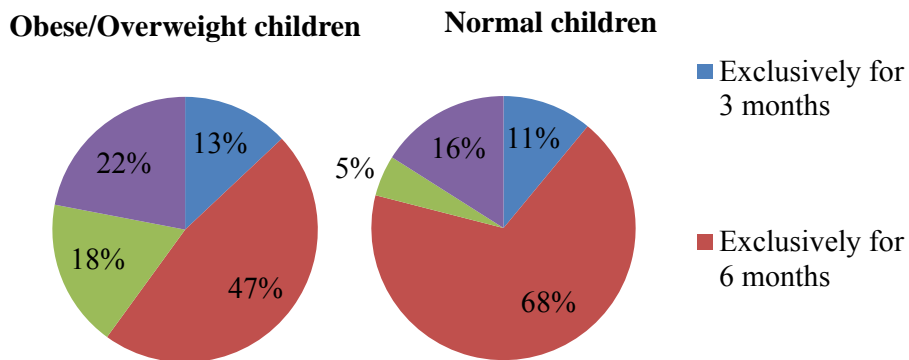


Figure II: Duration and type of feed during infancy in obese/overweight children and normal children

Pre-pregnancy weight status of the mother was also found to possibly affect the weight status of the child (Figure III). A greater percentage of the obese/ overweight children (41%) were borne to obese mothers or overweight mothers and the percentage of normal children borne to obese weight mothers was only 23%. Gestational weight gain in the mothers was also excessive in greater proportion of obese/overweight children than the mothers of normal children (Figure IV).

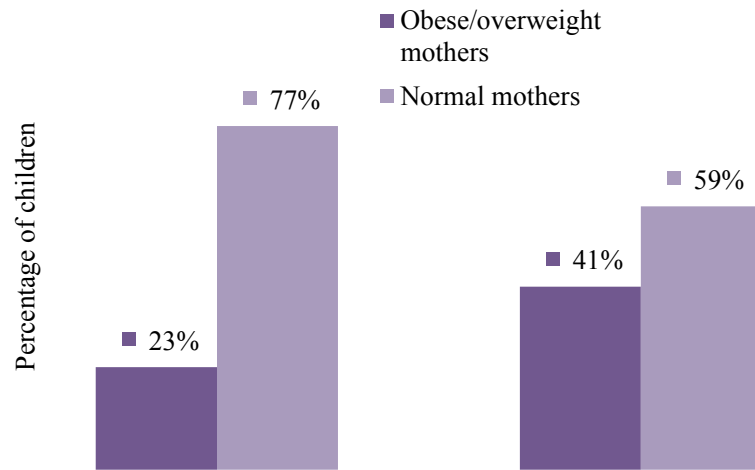


Figure III: Pre-pregnancy weight status of the mother in obese/overweight and normal children.

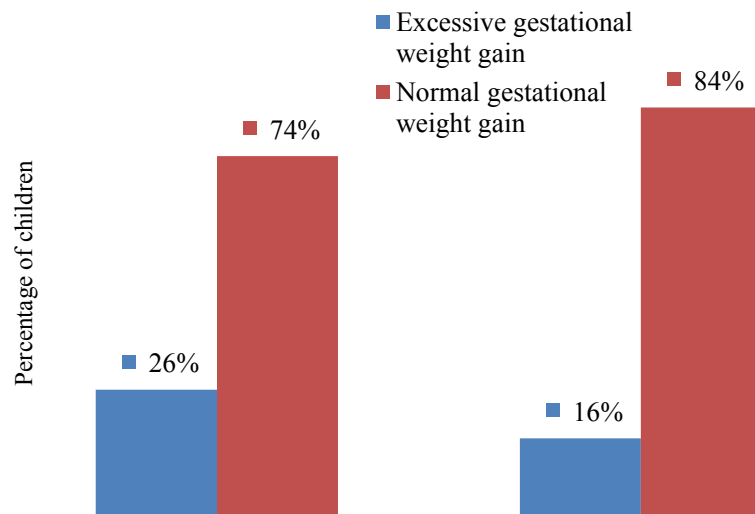


Figure IV: Gestational weight gain in mothers of obese/overweight Vs mothers of normal children

## DISCUSSION

Obesity is indeed becoming a very worrisome health issue, and is linked to a number of other non-communicable diseases also. A number of factors have been investigated and there appear to be a very complex interplay of several genetic, lifestyle and environmental factors. In the present study we have explored the involvement of maternal factors in childhood obesity and have found some of them to be apparently linked to obesity.

The mode of delivery seems to be associated with childhood obesity. Amongst the obese children, a greater number were born by caesarian section than vaginal delivery compared to the normal counterparts. A similar observation has been made earlier by. An increased risk of children born by caesarian delivery becoming obese was also reported by Goldani et al., 2011 (8) and Portela et al, 2015 (9) in two independent cohort studies conducted on the Brazilian population. They proposed that a lack of contact with the mother's vaginal flora during a Caesarian birth may lead to a delayed attainment of the Bifidobacteria which likely increases their risk of becoming obese. Bifidobacteria are part of the normal gut microflora. There is substantial evidence accumulating in the literature that associates obesity with alterations in the gut microflora. An alteration in the diet pattern/calory intake concomitant with a change in weight status has been found to be associated with changes in gut microflora composition in human beings (10, 11, 12). Interestingly, Gut microbiota transplantation studies in mice have shown an increase in the total body fat mass when germ free mice received microbiota from ob/ob mice. When the lean mice microbiota was used for transplantation, a similar increase was not observed (13). Another such study revealed differences in the the gut microflora composition of overweight and normal weight children (14). The gut microflora is believed to be involved in energy harvest from the diet as well as the manner in which energy is stored and spent (15). Besides being linked to the establishment of gut microflora, a caesarian delivery also reduces the chances of breastfeeding right after birth, which may affect lactation later (16).

WHO recommends that the mother's feed be initiated within an hour after birth and an exclusive breastfeeding for, at least, 6 months. Thereafter additional solid foods are to be provided but with a continued breastfeeding for at least 2 years. Mother's milk provides optimal nutrition for the health and development of an infant besides helping the babies fight infection because of the maternal antibodies that are passed to the baby through the milk. In the present study, we found that a greater proportion of the children who had been formula fed exclusively from beginning or those who had been given a mix of mothers and formula feed were obese. There are studies that not only show the protective effect of infant breastfeeding on obesity (17, 18, 19, 20, 21), but also an increase in protection with an increase in duration and exclusivity of breastfeeding (22). In another report, the protective effect of initial exclusive breastfeeding against obesity has been shown to be restricted till 4 years (23). In the 6 year old obese children, there appeared to be little correlation with breastfeeding probably because of predomination of other lifestyle factors. Since we selected children upto 10 years of age, the mean age being 7 years, it is difficult to draw further inference. Nevertheless, our results do reinforce the importance of breastfeeding and its association with reduced odds of obesity.

Maternal obesity pre-pregnancy has also been linked to interim effects on the mother and the fetus (24) as well as long standing consequences for the mother and the child (25). A higher BMI of the mother pre-pregnancy has also been associated with risks of a child growing obese (26).

The magnitude of weight gain between conception and delivery can be categorized as excessive or not depending on the pre-pregnancy weight status of the mother. An excessive gestational weight gain has previously been shown to be linked to the weight of the infant and the chances of the infant growing obese. In case of obese women, excess weight gain during pregnancy may be associated with adverse fetal outcomes like low birth weight of the child, neonatal ICU admissions, and preterm deliveries, and preeclampsia and caesarian deliveries for the mother (27). In the present sample, a larger no. of mother's of obese

children had excessive gestational weight gain during pregnancy compared to the mothers of normal children.

#### CONCLUSIONS

Obesity is a preventable disease and every effort should be made to prevent this disease. It is imperative that the young women be counseled about the effect of their own BMI status on the to-be child and thus the importance of maintaining a healthy weight before planning pregnancy. Also, in line with the WHO recommendations, the child should be breast fed exclusively for atleast six months. A routine screening of infants and children for identifying overweight and obese children should be done so as to timely intervene and prevent the disease. The importance of healthy lifestyle including regular recommended physical exercise, consumption of a healthy and balanced diet must be made realized in all sections of the society.

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