Section: General Medicine

Original Research Article

FAMILY-BASED STUDY OF OBESITY AND METABOLIC SYNDROME: CORRELATION BETWEEN OVERWEIGHT PARENTS AND THEIR CHILDREN

Narava Suvarna Kumari[2], G. Vishal[2]

[1]*Assistant Professor, Department of General Medicine, Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana, India.*
[2]*Associate Professor, Department of Pediatrics, Maheshwara Medical College and Hospital, Isnapur, Patancheru, Sangareddy, Telangana, India.*

Received *: 16/06/2025*
Received in revised form *: 08/08/2025*
Accepted *: 30/08/2025*

Corresponding Author:
Dr. Narava Suvarna Kumari,
Assistant Professor, Department of General Medicine, Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana, India.

DOI: 10.70034/ijmedph.2025.3.372

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 2012-2016

ABSTRACT

Background: Obesity and metabolic syndrome (MetS) have become major public health challenges globally, with rising prevalence across all age groups. Family-based clustering of overweight suggests a significant influence of both genetic and shared environmental factors. This study aimed to evaluate the association between parental overweight and the risk of overweight and metabolic syndrome in their children.

Materials and Methods: This cross-sectional, family-based study was conducted among 200 families (n=600; fathers, mothers, and one child each). Anthropometric, blood pressure, and biochemical parameters were assessed. Overweight was classified using BMI cut-offs, and MetS was defined according to standard criteria. Correlation analysis, logistic regression, and prevalence estimates were used to evaluate intergenerational associations.

Results: Mean BMI was 27.0 ± 3.5 kg/m² in fathers, 25.2 ± 3.2 kg/m² in mothers, and 21.8 ± 3.1 kg/m² in children. Overweight prevalence was 59.0% in fathers, 52.0% in mothers, and 31.0% in children, with MetS observed in 32.5%, 27.0%, and 12.0%, respectively. Significant positive correlations were found between parental BMI and child BMI (father r=0.29, mother r=0.33, mean parental BMI r=0.37; all p<0.001). Children with two overweight parents had the highest overweight prevalence (54.8%) compared to those with one (21.6%) or no overweight parent (8.3%). Logistic regression confirmed a graded risk: OR 3.14 (95% CI: 1.01–9.8) for one overweight parent, and OR 12.2 (95% CI: 4.1–36.2) for two overweight parents.

Conclusion: Parental overweight strongly predicts child overweight and metabolic risk, emphasizing the importance of family-centered preventive strategies to mitigate the intergenerational cycle of obesity.

Keywords: Obesity, metabolic syndrome, family-based study, parental overweight, childhood obesity.

INTRODUCTION

Obesity is one of the most significant public health challenges of the 21st century. According to the World Health Organization (WHO), more than 1.9 billion adults worldwide were overweight in 2016, including over 650 million who were obese.[1] Parallel to this trend, childhood overweight and obesity have reached alarming levels, with over 340 million children and adolescents aged 5–19 years affected globally.[2] This is particularly concerning, as obesity during childhood and adolescence is strongly associated with metabolic syndrome (MetS), type 2 diabetes, cardiovascular disease, and premature mortality.[3,4]

The determinants of obesity are multifactorial, involving interactions between genetic predisposition, environmental exposures, and behavioral patterns. Among these, family context is especially important, as parents exert both genetic and environmental influence on their children's health. Parents shape children's dietary practices, attitudes toward physical activity, and lifestyle habits, which in turn affect body weight

trajectories.[5] Numerous studies have demonstrated significant parent–child correlations in body mass index (BMI), suggesting strong intergenerational transmission of overweight risk.[6]

Parental obesity not only increases the likelihood of childhood overweight but also contributes to the clustering of metabolic risk factors in children. Metabolic syndrome, characterized by abdominal obesity, hypertension, dyslipidemia, and hyperglycemia, has been linked to parental overweight in several cohorts.[7] Furthermore, evidence indicates a dose–response relationship: the risk of obesity in children rises progressively when one parent is overweight and is highest when both parents are overweight.[8] These findings highlight the synergistic effects of genetic inheritance and shared family environments.

India is experiencing a rapid nutrition transition, marked by increasing consumption of calorie-dense diets, reduced physical activity, and rising rates of obesity across age groups. Recent data from the National Family Health Survey (NFHS-5) report that nearly one in four Indian adults is overweight or obese, with rising prevalence also noted among adolescents and children.[9] Despite this, few family-based studies in India have comprehensively examined the association between parental overweight and childhood obesity or metabolic syndrome.

In this context, the present study was designed to investigate the relationship between parental overweight and obesity and the risk of overweight in children in a family-based cohort. By analyzing correlations between parental BMI and child BMI, and quantifying the impact of parental overweight status on child overweight risk, this study seeks to provide evidence relevant to intergenerational obesity transmission in Indian families.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of General Medicine, Apollo Institute of Medical Sciences and Research, Hyderabad, in association with Department of Paediatrics, Maheshwara Medical College and Hospital, Patancheru from December 2024 to June 2025. A total of 200 families (n=200 fathers, n=200 mothers, and n=200 children aged 10-17 years; one child per family).

Inclusion Criteria: Families with at least one biological child aged 10–17 years, both biological parents available for BMI assessment, children free from chronic illnesses like type-1 diabetes, congenital genetic disorders that could affect weight or metabolism and families willing to participate were included.

Exclusion Criteria: Families with incomplete anthropometric data, children on long-term medications such as steroids, antiseizure medication, children with genetic abnormalities, parents with missing BMI values and families not willing to participate wee excluded.

Written informed consent was obtained from all family members or head of the family. The study protocol was reviewed and approved by the institutional ethics committee. The demographic information of the family, anthropometric parameters of family members were recorded.

Anthropometric measurements: Height, weight, waist circumference, and BMI were recorded using standardized procedures.

Blood pressure: Measured in a seated position using a digital sphygmomanometer (mean of two readings).

Biochemical analysis: Fasting blood samples were collected to estimate fasting glucose, triglycerides, and HDL cholesterol using standard enzymatic methods.

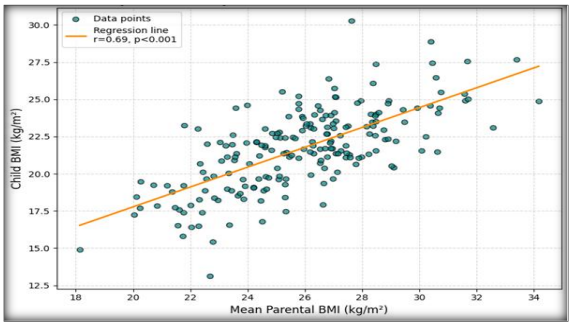
Definitions

a) Overweight (Adults): BMI ≥ 25 kg/m².[10]
b) Overweight (Children): ≥85th percentile for age and sex using WHO growth charts.[11]
c) Metabolic syndrome (Adults): Defined by IDF criteria.[12]
d) Metabolic syndrome (Children): Pediatric proxy definition (≥3 of the following: high waist circumference, high BP, high TG, low HDL-C, high fasting glucose).[13]

The collected data was analysed by using SPSS v26.0. Descriptive statistics was used to analyse continuous variables and represented in Mean and SD and categorical variables in frequency and percentages. Pearson's correlation was used to correlate mean parental BMI and child BMI. Comparison of overweight categories was done by chi-square test.

RESULTS

The mean father BMI was 27.0 ± 3.5 kg/m², mother BMI 25.2 ± 3.2 kg/m², and child BMI 21.8 ± 3.1 kg/m². Average waist circumference was 94.5 ± 8.2 cm in fathers, 84.3 ± 7.6 cm in mothers, and 70.4 ± 8.0 cm in children. Fasting glucose and lipid values fell within expected population ranges (Table 1). The Prevalence of overweight and metabolic syndrome in fathers was 118/200 (59.0%) and 32.5%., in mothers 104/200 (52.0%) and 27.0% and in children 62/200 (31.0%) and 12.0% respectively (Table 2).



Graph 1: Scatterplot of mean parental BMI vs child BMI

Pearson correlation analysis demonstrated significant positive associations between parental BMI and child BMI. Father BMI correlated with child BMI ($r = 0.29$, $p < 0.001$), mother BMI showed a slightly stronger correlation ($r = 0.33$, $p < 0.001$), and the strongest correlation was observed with mean parental BMI ($r = 0.37$, $p < 0.001$) (Graph 1).

Children with two overweight parents had the highest prevalence of overweight (54.8%), compared with 21.6% for children with one overweight parent, and only 8.3% for those with neither parent overweight (Table 3). This gradient demonstrates a clear dose–response relationship between parental overweight status and child overweight prevalence.

Logistic regression confirmed a graded increase in child overweight risk based on parental overweight. Compared with children with no overweight parent, those with one overweight parent had 3.14 times higher odds (95% CI: 1.01–9.8, $p = 0.048$), and those with two overweight parents had 12.2 times higher odds (95% CI: 4.1–36.2, $p < 0.001$) of being overweight (Table 4). This emphasizes the strong influence of parental weight status on childhood overweight.

Table 1: Baseline anthropometric and metabolic characteristics of participant families

Parameter	Fathers (n=200) Mean ± SD	Mothers (n=200) Mean ± SD	Children (n=200) Mean ± SD
Age (In years)	45.2 ± 5.9	42.6 ± 5.4	13.8 ± 2.1
Height (cm)	171.5 ± 6.3	158.2 ± 5.8	156.0 ± 7.2
BMI (kg/m²)	27.0 ± 3.5	25.2 ± 3.2	21.8 ± 3.1
Waist circumference (cm)	94.5 ± 8.2	84.3 ± 7.6	70.4 ± 8.0
Systolic BP (mmHg)	132.6 ± 12.8	127.1 ± 11.2	116.4 ± 10.3
Diastolic BP (mmHg)	84.7 ± 8.4	82.5 ± 7.8	75.3 ± 6.5
Triglycerides (mg/dL)	162.8 ± 42.7	154.1 ± 38.9	132.5 ± 34.2
HDL-C (mg/dL)	41.5 ± 8.1	47.2 ± 9.0	49.8 ± 8.5
Fasting Glucose (mg/dL)	103.4 ± 12.5	96.8 ± 11.2	90.2 ± 9.4

Table 2: Prevalence of overweight and metabolic syndrome

Group	Overweight Number (%)	MetS Number (%)
Fathers	118 (59.0%)	65 (32.5%)
Mothers	104 (52.0%)	54 (27.0%)
Children	62 (31.0%)	24 (12.0%)

Table 3: Status of child overweight by parental overweight

Number of Overweight Parents	Families (n)	Child Overweight n (%)
0	48	4 (8.3%)
1	79	17 (21.6%)
2	73	40 (54.8%)

Table 4: Logistic regression of child overweight on parental overweight

Predictor	OR (95% CI)	p-value
One parent overweight	3.14 (1.01-9.8)	0.048
Two parents' overweight	12.2 (4.1-36.2)	<0.001

DISCUSSION

The present study corroborates prior research that underscores the notable correlation between parental overweight and the heightened risk of overweight in their offspring. A comprehensive review and meta-analysis revealed that children with overweight or obese parents are almost twice as likely to experience overweight or obesity themselves when compared to children whose parents maintain a healthy weight.[14] The transmission across generations underscores the necessity of considering parental weight status within the framework of obesity prevention strategies. Kodagoda H et al. documented prevalence rates of child overweight, encompassing obesity, at 15.1% for 3-year-olds, 29.1% for expectant mothers, and 53.5% for their partners. The influence of both parents' overweight and obesity on children's BMI is substantial, with the most pronounced correlation identified in mothers. The likelihood of a child being classified as OWOB was 2.88 (1.83-4.43) when both parents exhibited obesity, in contrast to situations where neither parent was obese.[15] A systematic review and meta-analysis revealed that parental engagement in childhood obesity interventions has a notable impact on BMI z-scores, levels of physical activity, screen time, and dietary self-efficacy, though it did not influence the percentage of body fat.[16] Mikkelsen Mari et al. identified a significant correlation between the body mass index and the obesity status of parents and their children. The probability of obesity in offspring escalated when the mother was obese (OR=3.44), when the father was obese (OR=3.74), and when both parents were obese (OR=6.01), in contrast to instances where both parents maintained a normal weight.[17] A comprehensive review and meta-analysis conducted by Lee JS et al. indicated that parental weight status significantly impacts the risk of childhood obesity, implying that parents may be pivotal in the

prevention of obesity among children.[18] A study grounded in empirical evidence conducted by Mei H et al. revealed that maternal weight status exerted a negligible impact on both fetal and child growth postnatally, whereas a notable yet modest effect from fathers was observed solely after birth.[19]

In addition to genetic determinants, the weight status of parents significantly impacts the health behaviors of their children. Offspring of parents with excess weight tend to display a propensity for inactive lifestyles and suboptimal eating practices, which can lead to the onset of obesity. A research investigation carried out in China revealed that offspring with both parents classified as overweight or obese exhibited increased probabilities of developing general, abdominal, and compound obesity, with odds ratios ascending to 4.04.[20] In a similar vein, studies conducted in Iran have indicated a heightened prevalence of childhood overweight in instances where one or both parents are classified as overweight.[21] The results underscore the necessity for strategies aimed at addressing familial behaviors to reduce the risk of childhood obesity. The significant occurrence of overweight individuals and metabolic syndrome identified in our research underscores the pressing necessity for public health initiatives aimed at the prevention and management of obesity. The significant correlation between the overweight status of parents and their children underscores the importance of interventions that focus on the family unit. Initiatives that involve both parents and children in the adoption of healthy lifestyle habits, such as a balanced diet, consistent physical activity, and the encouragement of a positive body image, tend to be more successful in the prevention and management of obesity.[22]

Furthermore, it is imperative to consider societal elements such as the influence of food marketing, urban design that fosters physical activity, and the implementation of policies that enhance access to nutritious foods, as these are critical facets of a holistic approach to addressing the obesity crisis.[23] Although our study offers significant insights, it is cross-sectional in nature, which constrains our capacity to determine causality. Longitudinal studies are essential for a deeper comprehension of the temporal dynamics between parental and child overweight status, as well as for pinpointing crucial periods for intervention. Moreover, subsequent investigations ought to examine the influence of socioeconomic variables, cultural dynamics, and psychological dimensions in the intergenerational transfer of obesity.[24] Grasping these intricate influences can facilitate the customization of interventions to suit particular populations and contexts.

CONCLUSION

This family-based study demonstrates a strong intergenerational association between parental and child overweight, with risk rising substantially when both parents are overweight. The prevalence of obesity and metabolic syndrome in children closely paralleled parental trends, highlighting the combined influence of genetic predisposition and shared lifestyle behaviors. Correlation and regression analyses confirmed that parental BMI is a significant predictor of child BMI and overweight status. These findings underscore the urgent need for preventive strategies targeting entire families, rather than individuals, to break the cycle of obesity and reduce the future burden of metabolic syndrome and related chronic diseases.

REFERENCES

1. World Health Organization. Obesity and overweight. WHO Fact Sheet. 2021.
2. WHO. Childhood overweight and obesity. 7th May 2025.
3. Freedman DS, Mei Z, Srinivasan SR, Berenson GS, Dietz WH. Cardiovascular risk factors and excess adiposity among overweight children and adolescents: the Bogalusa Heart Study. J Pediatr. 2007;150(1):12-17.e2.
4. Weiss R, Dziura J, Burgert TS, et al. Obesity and the metabolic syndrome in children and adolescents. N Engl J Med. 2004;350(23):2362-2374.
5. Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, Agostoni C. Factors influencing children's eating behaviours. Nutrients. 2018;10(6):706.
6. Whitaker KL, Jarvis MJ, Beeken RJ, Boniface D, Wardle J. Comparing maternal and paternal intergenerational transmission of obesity risk. Am J Clin Nutr. 2010;91(6):1560–1567.
7. Reilly JJ, Kelly J. Long-term impact of childhood overweight and obesity on morbidity and mortality: systematic review. Int J Obes. 2011;35(7):891–898.
8. Sommer A, Twig G. The impact of childhood and adolescent obesity on adult cardiovascular risk: a systematic review. Curr Diab Rep. 2018;18(10):91.
9. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), India, 2019–21. Mumbai: IIPS; 2021.
10. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications. Lancet. 2004;363:157–163.
11. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85:660–667.
12. Alberti KG, Zimmet P, Shaw J. The metabolic syndrome—a new worldwide definition. Lancet. 2005;366:1059–1062.
13. Zimmet P, Alberti G, Kaufman F, et al. The metabolic syndrome in children and adolescents. Lancet. 2007;369(9579):2059–2061.
14. Wang Y, Min J, Khuri J, Li M. A systematic examination of the association between parental and child obesity across countries. Adv Nutr. 2017;8(3):436–448.
15. Kodagoda H, Lindkvist M, Ivarsson A, Silfverdal SA, Vaezghasemi M. Intergenerational Transmission of Overweight and Obesity among Preschool Children in Sweden. European Journal of Public Health. 2024;34(3):ae144.114.
16. Aleid AM, Sabi NM, Alharbi GS, Alharthi AA, Alshuqayfi SM, Alnefiae NS, Ismail GM, Allhybi AK, Alrasheeday AM, Alshammari B, Alabbasi Y, Al Mutair A. The Impact of Parental Involvement in the Prevention and Management of Obesity in Children: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Children (Basel). 2024 Jun 17;11(6):739.
17. Mikkelsen Mari, Wilsgaard Tom, Grimsgaard Sameline, Jacobsen Bjarne, Hopstock Laila. The intergenerational transmission of obesity from parents to offspring: Insights

from The Tromsø Study 1994-2016. Norsk tidsskrift for ernæring. 2024;22(5):22.
18. Lee JS, Jin MH, Lee HJ. Global relationship between parent and child obesity: a systematic review and meta-analysis. Clin Exp Pediatr. 2022;65(1):35-46.
19. Mei H, Guo S, Lu H, et al. Impact of parental weight status on children's body mass index in early life: evidence from a Chinese cohort. BMJ Open. 2018;8(6):e018755.
20. Zhang P, Wu H, Zhou X, Lu Y, Yuan Z, Moore JB, Maddock JE. The Association between Family and Parental Factors and Obesity among Children in Nanchang, China. Front Public Health. 2016 Aug 12;4:162.
21. Kelishadi R, Ardalan G, Gheiratmand R, et al. Thinness, overweight and obesity in a national sample of Iranian children and adolescents: CASPIAN Study. Child Care Health Dev. 2008;34(1):44-54.
22. Whitaker KL, Jarvis MJ, Beeken RJ, Boniface D, Wardle J. Comparing maternal and paternal intergenerational transmission of obesity risk in a large population-based sample. Am J Clin Nutr. 2010;91(6):1560-1567.
23. Birch LL, Ventura AK. Preventing childhood obesity: what works?. Int J Obes (Lond). 2009;33 Suppl 1:S74-S81.
24. Biro FM, Wien M. Childhood obesity and adult morbidities. Am J Clin Nutr. 2010;91(5):1499S-1505S.