Pakistan Journal of Neurological Sciences (PJNS)

Volume 19 | Issue 2 Article 12

6-2024

Evaluation of Body Mass Index (BMI): A Risk Factor for Stroke Among Pakistani Youth

Shafaq Saleem
Aga Khan University, Karachi

Safia Awan
Aga Khan University, Karachi

Ibrar Rafique
Health Research Institute, NIH/Allied Health Professionals Council

Kashif Hafeez
Pulse Consultants, Karachi.

https://doi.org/10.56310/pjns.v19i02.362

EVALUATION OF BODY MASS INDEX (BMI): A RISK FACTOR FOR STROKE AMONG PAKISTANI YOUTH

Shafaq Saleem[1], Safia Awan[2], Ibrar Rafique[3], Kashif Hafeez[4]
[1]. Section of Neurology, Department of Medicine, Aga Khan University
[2]. Department of Medicine, Aga Khan University, Karachi
[3]. Health Research Institute, NIH/Allied Health Professionals Council
[4]. Pulse Consultants, Karachi.

Corresponding author: Shafaq Saleem *Section of Neurology, Department of Medicine, Aga Khan University* ***Email:*** *drshafaqsaleem@gmail.com*

Date of submission: *February 2, 2024* ***Date of revision:*** *May 27, 2024* ***Date of acceptance:*** *June 1, 2024*

ABSTRACT

Background and objective:

Body Mass Index (BMI) has been recognized as a significant risk factor for stroke, especially among younger populations in South Asia. Rising obesity rates contribute to non-communicable diseases, with increased stroke incidences being observed in younger adults. The objective of this study was to assess BMI distribution among Pakistani youth across various educational levels, providing insight into obesity trends and potential health risks.

Methods:

This cross-sectional study was conducted through an online platform, surveying 2,223 respondents across 38 cities in Pakistan. A semi-structured questionnaire was administered, covering 600 educational institutions. Participants were categorized by BMI using WHO standards: underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese (≥30 kg/m^2), and extremely obese (≥35 kg/m^2). Data collected included participant age, gender, educational level, and institution type, ensuring anonymity and statistical analysis.

Results:

Among respondents, 33% were enrolled in Master's programs, 57% were male, and 62% attended public institutions. Notably, 27% of participants had a BMI above 24.9, with a higher prevalence among females. Age analysis revealed an increase in overweight and obesity rates in older groups: 23% in ages 19-24 and 31% in ages 25-28. Educational analysis indicated that obesity rates increased with higher education levels, reaching 30% among postgraduate students.

Conclusion:

This study reveals a concerning trend of high BMI levels among Pakistani youth, especially at higher education levels, highlighting the need for targeted public health interventions to address obesity and related risks of stroke and other diseases.

Keywords: Body Mass Index, Youth, Stroke, Non-communicable diseases

INTRODUCTION

Globally the incidence and prevalence of stroke have skewed towards an earlier age of onset. This is attributed to the regional risk factors and lifestyle advancements taking a toll on the sufferer's life, caregivers, and the healthcare system. Global data from 1990-2019 suggests a significant increase in the age-standardized incidence, death, and DALYs (Disability-adjusted life years) of stroke in young adults, particularly in middle and Southeast Asia. The Body Mass Index (BMI) contributed largely alongside high plasma glucose concentration in age-standardized DALY rates between the rising trend years.[1,2] This was corroborated by similar data indicating rising trends of younger stroke between ages 18-44 years leading to greater hospitalization and dependency on the younger population creating a healthcare burden.[3]

Though the true data in Pakistan lacks about the incidence of stroke, approximately incidence is 37% in

individuals aged 45 years or younger, on average a decade younger when compared with data from Western Countries. This has shown gender differences indicating higher frequency in men.[4,5]

There has been a strong association between high BMI and increased risk of BMI-related health problems, particularly ischemic stroke. It's been indicated that with every rise in a normal BMI of 20, the risk of ischemic stroke rises by 5%.[6,7] Additionally, the relative risk of stroke in obese patients is higher in middle-aged and older patients.[8] Pakistan holds its place between two extremes of having a higher percentage of the population in either the underweight or obese category. An article in 2006, stated that a quarter of the adult Pakistani population is either categorized as overweight or obese, with greater prevalence in women. This also significantly affects the urban population more than the rural population.[9] A recent article emphasizes that more than a quarter of the Pakistani population, particularly those aged 30-59, is overweight, with this trend seen across all education levels.[10]

This study was undertaken to evaluate and assess the frequency and distribution of BMI nationally according to gender, age, and qualification status of youth enrolled in educational institutes. This is needed to create awareness and address the risk factors to primarily target the primary prevention of stroke.

METHODS

This cross-sectional study was conducted using an online web-based platform; 2,223 respondents were interviewed through a semi-structured questionnaire in 38 cities across Pakistan over a period of one over 600 educational institutions were targeted in more than 200 towns nationwide.

BMI was calculated as body weight in kilograms divided by height in meters squared (kg/m^2). Participants were categorized into five groups according to World Health Organization (WHO) cut-off points: $<$18.5 kg/m^2 (underweight), 18.5–24.9 kg/m^2 (normal weight), 25–29.9 kg/m^2 (overweight), $\geq$30 kg/m^2 (obese), and $\geq$35 kg/m^2 (extremely obese). [11]

Participants with education levels above matriculation, adults who are no longer school-going and acquiring higher education in either the public or private sector, were included in the study if they were willing to participate and complete the questionnaire. Those who submitted incomplete responses, who were not Pakistani residents, or who were still attending school were excluded from the study.

The sample size was determined by considering the population distribution across various cultural belts and cities in Pakistan. The study historically covered major cities since 2003, adding more cities progressively to ensure robust representation. In 2023, the coverage was expanded to 26 additional cities, with at least 30 interviews conducted per city based on its population. Eight key cities, constituting nearly 50% of the total urban population of Pakistan, were prioritized for higher sample sizes due to their demographic and educational significance.

Eligible participants, defined as those with education levels above, were interviewed by data collectors from Pulse Consultants. Data collected included participant age, educational qualification, institution type, gender, city of residence, and BMI, all gathered anonymously through an online questionnaire and later sent to the analysis team for statistical review. The analysis calculated BMI frequency distributions across private and public institutions, as well as age and educational status, using SPSS 23.0.

RESULTS

The study included 2,223 respondents from 38 cities across Pakistan. The majority were enrolled in master's programs (33%), followed by intermediate students (27%) (Table 1). Most respondents were male (57%) and from public institutions (62%) (Table 2). The largest number of participants came from major cities, with 238 from Karachi, 219 from Lahore, 113 from Multan, and 112 from Peshawar. Interestingly, despite Pakistan's cultural context, there was no significant gender disparity, as shown in detail in Table 3. Both major and smaller cities, even those with fewer respondents, demonstrated gender equality and similar educational status, reflecting growing awareness and equal access to education among Generation Z (Table 3).

Table 1: Population distribution with education level

Education Level	Percentage (%)	Degrees/Programs
Intermediate	27%	FA, FSc, I Com, DAE
Graduate	26%	B.A, BSc, B Com, BBA, BCS
Postgraduate	33%	MA, MSc, M Com, MBA, MCS
Professional	15%	MBBS, BE, BS, LLB, MPhils

Table 2: Target audience (gender and institution-based distribution)

Category	Group	Percentage (%)
Gender	Males	57%
	Females	43%
Institutes	Public	62%
	Private	38%

Table 3: Data by region, city, and educational levels							
Cultural Belts	**Total Respondents**	**Male**	**Female**	**Intermediate**	**Graduate**	**Post-Graduate**	**Professional**
Overall	2,223	1,257	966	588	569	725	340
Karachi	238	130	108	66	76	68	21
Lower Sindh	128	70	58	36	38	28	24
Upper Sindh	202	115	87	75	39	50	37
South Punjab	241	134	107	27	59	106	43
Central Punjab	516	281	235	120	123	179	81
Northern Punjab	296	193	103	51	63	123	56
KPK	285	180	162	93	118	69	27
Balochistan	201	92	77	51	58	49	11
AJK	32	19	13	10	5	12	5
Gilgit	33	17	16	11	8	8	6

When comparing BMI, 27% of the population had a BMI > 24.9, with a higher prevalence in females (7% vs 1%), particularly in the morbidly obese category, as shown in Figure 1. This highlights the growing risk of non-communicable diseases at a young age, especially in females of reproductive age. Comparing BMI across age groups revealed that individuals aged 15-18 mostly fell within the normal BMI range (18.5-24.9), with only 19% being overweight or obese. Notably, the percentage of overweight and obese individuals increased significantly in the 19-24 age group (23%) and rose further in the 25-28 age group (31%) (Figure 2).

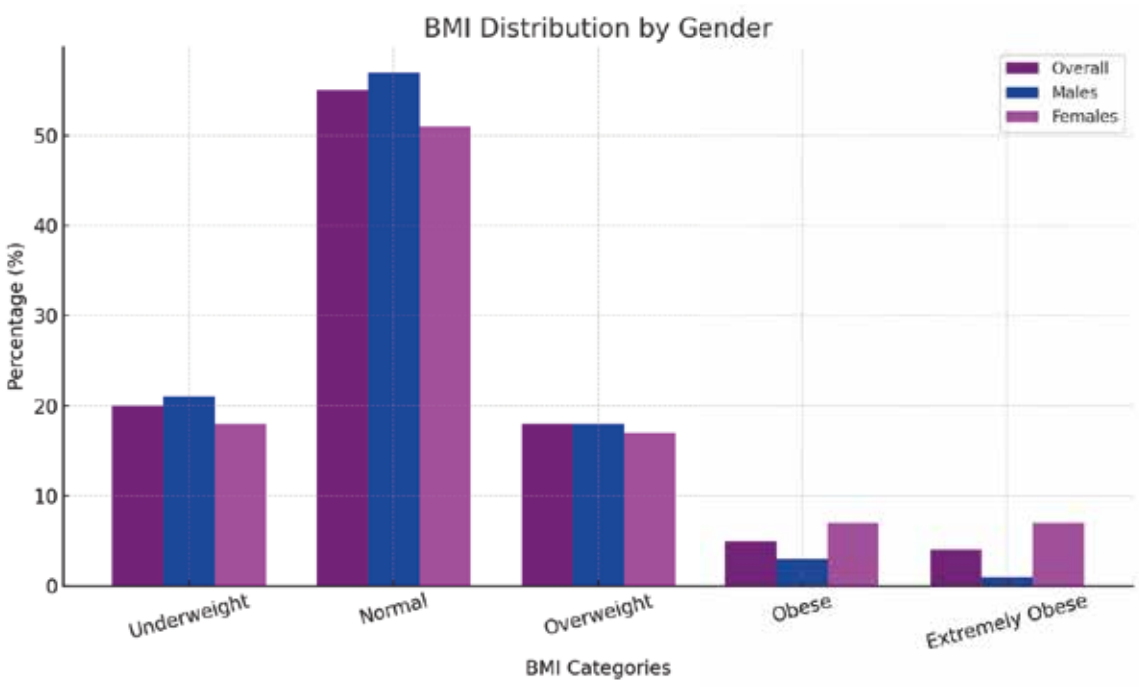

Figure 1: BMI distribution across genders

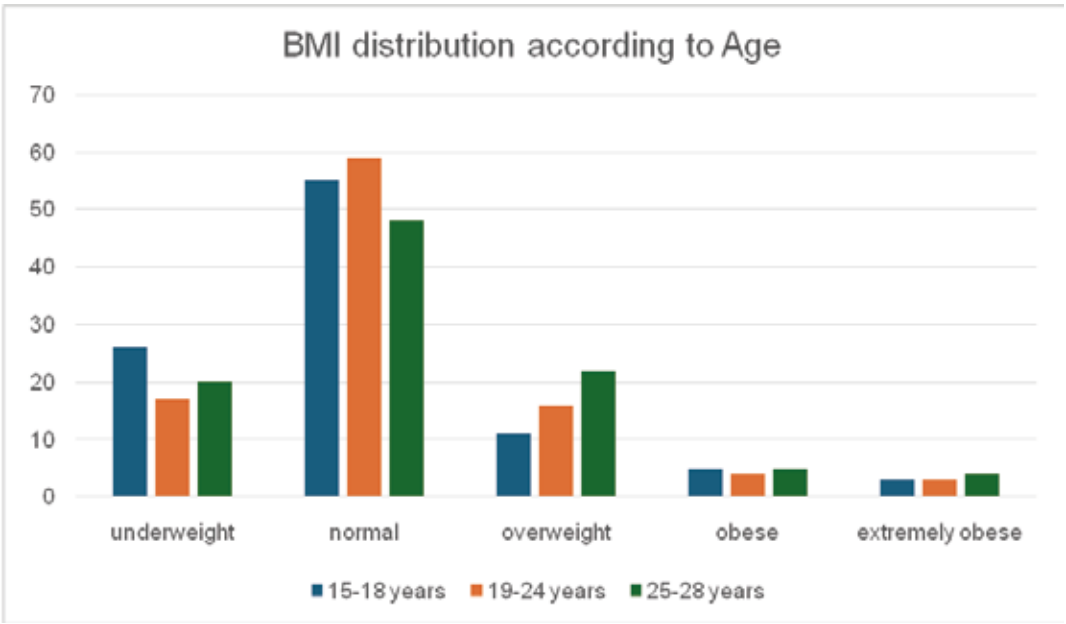

Figure 2: BMI distribution according to age

Although individuals across all education levels, from intermediate to professional, generally fell within the normal BMI range. This proportion reached 29% at the professional level, slightly higher at 30% among postgraduates, and started at 22% in those with an intermediate education level. When comparing BMI across culturally diverse regions of Pakistan, most of the youth in different areas fall within the normal BMI range. However, Balochistan had the highest percentage of underweight individuals (41%) while also recording 21% in the obese category. Notably, 51% of the population in Upper Sindh and 53% in Lower Sindh had BMI values above the normal range. In Punjab, a quarter of the youth fell into the obese category, reflecting regional differences compared to Sindh. Interestingly, the Gilgit/AJK region stood out as having the lowest percentage of obesity among all cultural belts.

DISCUSSION

Obesity is a growing global health issue, contributing to an earlier onset of non-communicable diseases.[12] While Southeast Asian countries like Pakistan are often thought to primarily struggle with malnutrition, Pakistan ranks 8th out of 188 countries, with 38% of its population having a BMI over 25.[13] Projections suggest that by 2030, 5.4 million Pakistani children and adolescents will be obese.[14] A study conducted in 2022 reported an obesity prevalence of 16.7% in the country.[15]

The 2018 national survey of Pakistan revealed an increasing trend in obesity and overweight, particularly among the elite and upper socioeconomic classes. A significant rise was noted in overweight and obese individuals between the ages of 25-44. Interestingly, the prevalence of higher education in this group was like those with primary and secondary education.[16] A notable shift in Pakistan's population health trends is the earlier onset of stroke, with rising BMI at younger ages emerging as a major independent risk factor for conditions like stroke, diabetes, heart disease, sleep apnea, and cancers.

Previous studies in Pakistan have assessed stroke risk factors and prevalence, but these were often limited to specific provinces or targeted a particular socioeconomic class.[17,18] Notably, all these studies emphasized the increasing incidence of stroke among younger populations. A single-center study in Lahore found that elevated BMI, with a mean of 29.9, was the second most common risk factor for stroke in middle-aged individuals.[19] The rise in obesity and overweight rates extends beyond provincial boundaries, with 42% of medical college students categorized as obese, underscoring a global concern for the younger generation.[20] Additionally, a significant association between waist-to-hip ratio and stroke risk has been observed in individuals under 55 years of age.[21] A population survey conducted in one of Pakistan's largest provinces in 2016-2017 reported a stroke prevalence of 1.2% among obese patients, with 38% of the population classified as overweight or obese. Studies have shown a strong dose-dependent relationship between high BMI and stroke risk, with overweight individuals having a 22% higher risk of stroke, and those classified as obese facing a 64% increased risk.[22-25] This risk is consistent across both genders. Additionally, to date, studies have targeted school-going population.[26-29]

It is important to note the regional variations in BMI distribution across Pakistan, influenced by lifestyle, environmental factors, and cultural differences. Our study identifies Sindh as having the highest proportion of individuals categorized as overweight or obese, raising concerns about the increasing burden on the healthcare system if early interventions are not implemented. Similar regional disparities have been reported in previous studies, including among children.[15,30,31]

Our study encompasses the dynamics of Body mass index in youth pursuing higher secondary level and above, providing the first-ever data on correlation with age, institutional, and regional levels. This trend shift is leading to a rise in ischemic and hemorrhagic stroke alongside other non-communicable diseases raising additional burden to the economy and healthcare system. The study enhances our understanding of Pakistan's future health challenges, particularly global health dilemmas. It underscores the necessity of raising awareness, promoting healthy lifestyles as shown by the evidence mentioned in guidelines, and improving the healthcare system, especially concerning the primary prevention of diseases. The healthcare system should be framed to target family-based lifestyle programs addressing dietary problems, increasing physical activity, avoidance of sedentary behavior, promoting the culture of physical activity, and

behavioral strategies to achieve results. The findings highlight critical issues affecting the younger population that require immediate attention.

However, the study has limitations; it does not encompass the entire population within the 12-27 age range and fails to provide a fully representative sample of Generation Z. Furthermore, more than half of the participants were under 50 years old, focusing primarily on educational youth and only including urban residents. The use of a self-administered questionnaire may introduce personal bias, and the study does not identify other potential stroke risk factors prevalent in the younger population.

CONCLUSION

This study reveals a concerning trend of high BMI levels among Pakistani youth, especially at higher education levels, highlighting the need for targeted public health interventions to address obesity and related risks of stroke and other diseases. Given the increasing trend of strokes both globally and nationally, it is essential to address the risk factors affecting the younger demographic, especially within a compromised healthcare system.

REFERENCES

1. Zhang R, Liu H, Pu L, Zhao T, Zhang S, Han K, et al. Global Burden of Ischemic Stroke in Young Adults in 204 Countries and Territories. Neurology. 2023;100(4): e422-e34
2. Amoah D, Schmidt M, Mather C, Prior S, Herath MP, Bird M-L. An international perspective on young stroke incidence and risk factors: a scoping review. BMC Public Health. 2024;24(1):1627
3. Khan SU, Khan MZ, Khan MU, Khan MS, Mamas MA, Rashid M, et al. Clinical and Economic Burden of Stroke Among Young, Midlife, and Older Adults in the United States, 2002-2017. Mayo Clin Proc Innov Qual Outcomes. 2021;5(2):431-41
4. Nomani AZ, Iqbal M, Jamil U, Nabi S, Mughal S, Badshah M, et al. Etiology of stroke in young pakistani adults; results of a single center study. Pak J Neurol Sci. 1015;10 (04) : Article 6
5. Khealani BA, Hameed B, Mapari UU. Stroke in Pakistan. J Pak Med Assoc. 2008 Jul;58(7):400-3. PMID: 18988415
6. Rexrode KM, Hennekens CH, Willett WC, Colditz GA, Stampfer MJ, Rich-Edwards JW, et al. A prospective study of body mass index, weight change, and risk of stroke in women. JAMA. 1997; 277:1539–1545
7. Kurth T, Gaziano JM, Berger K, Kase CS, Rexrode KM, Cook NR, et al. Body mass index and the risk of strokein men. Arch Intern Med. 2002; 162:2557–2562
8. Kernan WN, Inzucchi SE, Sawan C, Macko RF, Furie KL. Obesity. Stroke. 2013;44(1):278-86
9. Ashraf T, Sultana R, Nadeem A, Lashari MN. Obesity from Clinical Evaluation to Management Local Perspective. Pak Heart J. 2023;56(4):248-9
10. Rafique I, Saqib MAN, Munir MA, Qureshi H, Rizwanullah, Khan SA, et al. Prevalence of risk factors for noncommunicable diseases in adults: key findings from the Pakistan STEPS survey. East Mediterr Health J. 2018 Apr 5;24(1):33-41. PMID: 29658619.
11. Appropriate body-mass index for Asian popula tions and its implications for policy and interven tion strategies. The Lancet. 2004;363(9403):157-63.
12. Nathan BM, Moran A. Metabolic complications of obesity in childhood and adolescence: more than just diabetes. Curr Opin Endocrinol Diabetes Obes. 2008; 15: 21-9. doi: 10.1097/MED.0b013e3282f43d19
13. Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany Ec, et al. Global, regional, and national prevalence of overweight and obesity i n children and adults during 384 Risk Factors of Obesity in the Adult Population of Pakistan 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013 [published correction appears in Lancet. 2014; 384: 746. Lancet. 2014; 384: 766-81. doi: 10.1016/S0140-6736(14)60460-8
14. World Obesity Federation. Global Atlas on Childhood Obesity. World Obesity Federation; London, UK: 2019
15. Nomani RMN, Khan A, Shah STA, Naeem A, Liaquat A, Khan MJ. Risk Factors of Obesity in the Adult Population of Pakistan. Life Sci. 2023; 4(4): 379-386. doi: http:// doi.org/10.37185/LnS.1.1.433)
16. Pakistan National Nutrition Survey 2018 [Inter net]. Islamabad: UNICEF Pakistan; 2018 [cited 2024 February 18]. Available from: https://ww w.unicef.org/pakistan/media/2826/file/Nation al%20Nutrition
17. Jafar TH. Blood pressure, diabetes, and increased dietary salt associated with stroke--results from a community-based study in Pakistan. J Human Hypertension. 2006; 20:83–85. doi:10.1038/sj. jhh.1001929
18. Kamal AK, Itrat A, Murtaza M, Khan M, Rasheed A, Ali A, et al. The burden of stroke and transient ischemic attack in Pakistan:a community-based prevalence study. BMC Neurol. 2009;9:58. doi:10.1186/1471-2377-9-58

19. Nasim H, Butt NI, Ashfaq F, Anwar A, Aftab S, Muaaz M. Frequency of Modifiable Risk Factors in Ischemic Stroke Patients at a Tertiary Care Hospital in Lahore Pakistan. Pak J Med Res. 2023;62(2):53-8.
20. Hadaye RS, Manapurath RM, Gadapani BP. Obesity Prevalence and Determinants among Young Adults, with Special Focus on Normal-Weight Obesity; A Cross-Sectional Study in Mumbai. Indian J Community Med. 2020;45(3):358-62.
21. O'Donnell MJ, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE):a case-control study. Lancet. 2016;388(10046):761–775. doi:10.1016/S0140-6736(16)30506-2
22. Kurth T, Gaziano JM, Berger K, Kase CS, Rexrode KM, Cook NR, et al. Body mass index and the risk of stroke in men. Arch Intern Med. 2002;162(22):2557-62.
23. Yatsuya H, Toyoshima H, Yamagishi K, Tamakoshi K, Taguri M, Harada A, et al. Body mass index and risk of stroke and myocardial infarction in a relatively lean population: meta-analysis of 16 Japanese cohorts using individual data. Circ Cardiovasc Qual Outcomes. 2010;3(5):498-505.
24. Shiozawa M, Kaneko H, Itoh H, Morita K, Okada A, Matsuoka S, et al. Association of Body Mass Index with Ischemic and Hemorrhagic Stroke. Nutrients. 2021;13(7).
25. Wang X, Huang Y, Chen Y, Yang T, Su W, Chen X, et al. The relationship between body mass index and stroke: a systemic review and meta-analysis. J Neurol. 2022 Dec;269(12):6279-6289. doi: 10.1007/s00415-022-11318-1.
26. Mushtaq MU, Gull S, Abdullah HM, Shahid U, Shad MA, Akram J. Prevalence and socioeconomic correlates of overweight and obesity among Pakistani primary school children. BMC Public Health. 2011;11:724.
27. Mansoori N, Nisar N, Shahid N, Mubeen SM, Ahsan S. Prevalence of obesity and its risk factors among school children in Karachi, Pakistan. Trop Doct. 2018;48(4):266-9.
28. Ahmed J, Laghari A, Naseer M, Mehraj V. Prevalence of and factors associated with obesity among Pakistani schoolchildren: a school-based, cross-sec tional study. East Mediterr Health J. 2013;19(3):242-7.
29. Khan S, Abbas A, Ali I, Arshad R, Tareen M, Shah MI. Prevalence of overweight and obesity and lifestyle assessment among school–going children of Multan, Pakistan. Isra Med. J. 2019; 11:230–233
30. Amin F, Fatima SS, Islam N, Gilani AH. Prevalence of obesity and overweight, its clinical markers and associated factors in a high-risk South-Asian population. BMC Obes. 2015;2:16. doi: 10.1186/s40608-015-0044-6
31. El Mouzan MI, Al Herbish AS, Al Salloum AA, Al Omar AA, Qurachi MM. Regional variation in prevalence of overweight and obesity in Saudi children and adolescents. Saudi J Gastroenterol. 2012; 18: 129-32. doi: 10.4103/1319-3767.93818

Conflict of interest: Author declares no conflict of interest.
Funding disclosure: Nil

Authors' contribution:
Shafaq Saleem: Concept, Data review, manuscript writing
Safia Awan: Data analysis, manuscript review
Ibrar Rafique; Data Analysis, Manuscript review
Kashif Hafeez; data collection, data analysis, manuscript writing

All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.