

# Prevalence of overweight and obesity among school children of Bhaktapur and Kathmandu

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## Abstract

**Background:** World Health Organization defines childhood obesity as “one of the most serious public health challenges”. Low income countries like Nepal experience a burden of infectious diseases as well as rising incidence of non-communicable diseases frequently associated with obesity. There is paucity of information on childhood obesity in Nepal.

**Objectives:** This study aims to determine the prevalence of childhood obesity and overweight in school going children and find its association with blood pressure.

**Methodology:** A school based cross-sectional analytical study was conducted on 509 children aged between 10-16 years, studying in grade 5-10 of private schools in Kathmandu and Bhaktapur. Simple random sampling technique was used for data collection. Anthropometric measurements and blood pressure were taken using standard protocol. Obesity was assessed using Body Mass Index criteria.

**Results:** The overall prevalence of obesity and overweight in children were found to be 1.6% and 6.1% respectively. This study also showed that prevalence of obesity in children from Kathmandu is comparatively more, which was statistically significant ( $p < 0.001$ ). A highly significant relationship was observed for diastolic blood pressure and Body Mass Index ( $p < 0.001$ ) between the two groups.

**Conclusion:** This study concludes that obesity though small in percentage, was found in rising trend when compared with previous data. Also, there was strong association with blood pressure, so timely identification and control of obesity is required for prevention of development of other cardiovascular comorbidities.

**Key words:** Blood pressure; Childhood obesity; Overweight; Prevalence.

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## INTRODUCTION

According to World Health Organization (WHO) childhood obesity is “one of the most serious public health challenges of the 21<sup>st</sup> century”<sup>1</sup>. Obesity gives rise to major risk factors for non-communicable diseases (NCD) such as diabetes mellitus, metabolic syndrome, cardiovascular disease and hypertension. Higher socioeconomic status, watching television for long intervals of time, and consuming less fruits are major risk factors for overweight among adolescents in Nepal<sup>2</sup>. With the ongoing transformation of Nepalese society

towards rapid urbanization, it can be expected that the burden of the disease may be mounting in Nepal<sup>3,4</sup>.

Worldwide 42 million school children aged less than five years are overweight and close to 35 million of that population is living in developing countries<sup>5</sup>. The magnitude and seriousness of this problem, has largely been underestimated in Nepal as no national data is available. We must therefore be particular in addressing this problem before it turns epidemic. This study aims to determine the prevalence of childhood obesity and overweight in school going children and find its association with blood pressure.

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## METHODOLOGY

**Case Selection:** A school based cross-sectional analytical study was conducted from August to December 2017.

In this study all the school going children aged 10 to 16 years were included. The study population was 509 school children aged 10-16 years studying in grade 5-10 of two different private English medium schools from each district which was randomly selected. Age was verified from school records and rounded off to completed years.

Population proportion simple random sampling technique was used based on their roll numbers so that each student had equal chance of being included. Informed written consent was obtained prior to data collection both from the school authorities and from the parents of the children after explaining the objectives and the method of study. Confidentiality of information was assured and ensured throughout the study. Children with any chronic illness like hypothyroidism, heart disease, kidney disease and those children on any steroid treatment were excluded from the study.

### Measurement methods

Anthropometric measurements were done utilizing the standard equipment and methodology. Height and weight of each child was recorded. Height was measured by using stadiometer (Hardik Medi-tech, India) to the nearest 0.1 cm with child standing upright barefoot on ground with heels, buttocks touching wall and head in the Frankfurt plane. A calibrated and standardized electronic weighing scale (Dr Trust, USA) to nearest 100 grams was used to measure weight. Weight was measured in three recordings and mean was taken to minimize measurement errors. Body Mass Index (BMI) was calculated using the formula  $BMI = \text{weight in kg} / (\text{height in meters})^2$  and plotted in Center for Disease Control (CDC) BMI percentile chart for age and sex for classification. A child was classified according to National Center for Health Statistics (NCHS) guidelines as overweight with BMI for age between 85<sup>th</sup> and 95<sup>th</sup> percentiles and as obese with BMI for age at or above the 95<sup>th</sup> percentile. Blood pressure was measured by auscultatory method using a mercury sphygmomanometer and appropriately sized cuff (bladder width of approximately 40% of arm circumference midway between olecranon and acromion; inflatable bladder covering at least two thirds of upper arm length and 80-100% of its circumference). We measured BP after 5-10 minutes of quiet rest with the subjects seated and the right arm positioned at the level of the heart. To avoid the effects of white coat hypertension, blood pressure was measured thrice on each occasion at an interval of 5 minutes between each measurement and a mean of the three measurements was taken as blood pressure value. The first and fifth Korotkoff sounds were recorded as the systolic blood

pressure (SBP) and diastolic blood pressure (DBP). For information needed from the parents of the school children, a small questionnaire was handed over to the children, which was subsequently given to their respective parents.

### Data Collection Tools used

Sphygmomanometer, Stadiometer, Digital weighing machine, CDC BMI percentile chart for age and sex.

### Data analysis

Prevalence rates of obesity and overweight were calculated and presented as percentage. Pearson's chi-square test was used to estimate the p-value for the difference in prevalence of obesity in different demographic variable. The Student t-test was done to test statistical significance of the difference in the mean values continuous variables like systolic and diastolic blood pressure in obese and overweight groups. Values were expressed as mean  $\pm$  standard deviation. P-values  $<0.05$  indicated statistical significance. Statistical Package for the Social Sciences (SPSS) version 20 software was used for this purpose.

Ethical approval was provided by the Institutional Review Committee of Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal.

## RESULTS

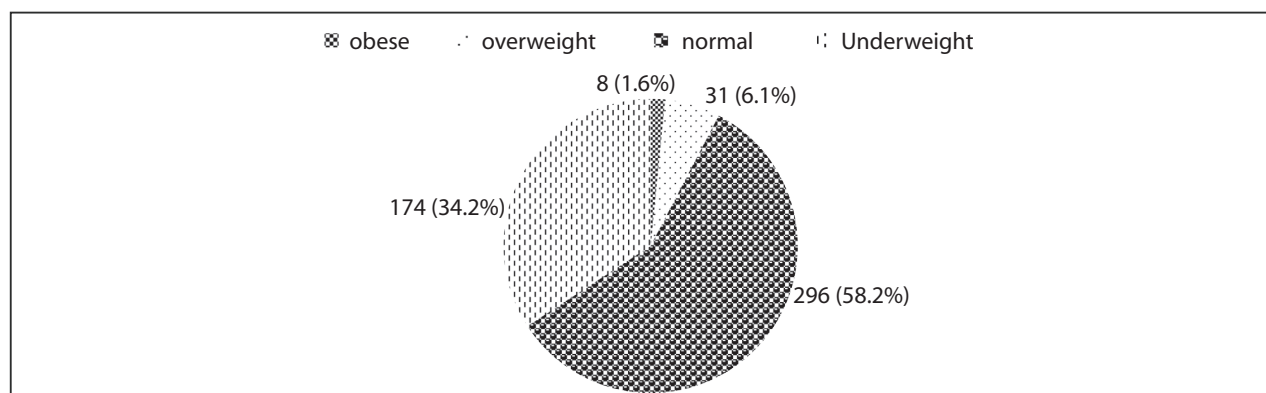
A total of 509 (256 boys and 253 girls) school children were included in this study. Among them eight children were found to be obese, (two males, six females) and 31 children were overweight (14 males, 17 females). The overall prevalence of obesity and overweight in children was found to be 1.6% and 6.1% respectively (Figure 1). Prevalence of obesity as well as overweight in girls were higher (2.4% and 6.7% respectively) as compared to boys (0.8% and 5.5%) (Table 1). Highest prevalence rates of obesity and overweight were seen in the age group 16 years (Table 2).

The presence of obesity and overweight at 16 years of age is higher i.e 4.68% and 9.37% compared to other age group children. No case of obesity was observed at age 10, 11 and 15 years but overweight was observed in all age groups. To compare variables with BMI Category, children above 85<sup>th</sup> percentile BMI for age and sex were considered obese and overweight, and below 85<sup>th</sup> percentile BMI for age and sex were considered non obese.

This study also showed that prevalence of obesity and overweight in children from Kathmandu is comparatively

more than children from Bhaktapur which is statistically significant. However, no statistically significant association of BMI category was seen with age and sex (Table 3).

A highly significant relationship was observed for DBP and BMI ( $p < 0.001$ ) between the two groups, however, in case of SBP no such relationship was found (Table 4).



**Figure 1:** Overall prevalence of overweight and obesity in children

**Table 1:** Prevalence of obesity/overweight according to gender

Gender	Obesity	Overweight
Girls	6 (2.4%)	17 (6.7%)
Boys	2 (0.8%)	14 (5.5%)

**Table 2:** Prevalence of obesity and overweight in different age groups

Age in years	Prevalence			
	Obese	Overweight	Normal	Underweight
10	0 (0%)	2 (3.27%)	35 (57.3%)	24 (39.3%)
11	0 (0%)	5 (6.3%)	36 (45.5%)	38 (48.1%)
12	3 (4.3%)	2 (2.8%)	41 (59.4%)	23 (33.3%)
13	1 (1.29%)	5 (6.49%)	45 (58.4%)	26 (33.76%)
14	1 (0.9%)	8 (7.5%)	63 (59.4%)	34 (32.07%)
15	0 (0%)	3 (5.66%)	36 (67.9%)	14 (26.4%)
16	3 (4.68%)	6 (9.37%)	40 (62.5%)	15 (23.4%)

**Table 3:** Comparison of BMI categories with different demographic variables

Variables		Obese/overweight	Non-obese	p-value
Age	10-13	18 (6.3%)	268 (93.7%)	0.126
	14-16	21 (9.4%)	202 (90.6%)	
Sex	Male	16 (6.2%)	240 (93.8%)	0.150
	Female	23 (9.1%)	230 (90.9%)	
Area	Kathmandu	31 (12.7%)	214 (87.3%)	<0.001
	Bhaktapur	8 (03.0%)	256 (97.0%)	

**Table 4:** Comparison of mean systolic and diastolic blood pressure with obese/overweight and non-obese children

Blood pressure	Obese/overweight		Non-obese		Test of significance	
	Mean	Standard Deviation	Mean	Standard Deviation	t-test	p-value
Systolic	107.7	9.25	95.02	42.1	1.8529	0.869
Diastolic	73.18	10.24	61.85	7.09	9.111	<0.001

## DISCUSSION

Obesity is becoming a global nutritional concern. In the present study, the proportion of overweight children was higher compared to obese children. The prevalence of obesity is high in developed countries and similar trends are found in recent years among children from developing countries. A study in 2014 by Raut et al among children in different locations of Kathmandu valley showed that 3.1% were overweight, 0.6% were obese, 64.8% were underweight and 31.5% were of normal BMI<sup>3</sup>. Another school-based study from eastern Nepal showed 1.8% prevalence of obesity, 2.9% overweight, 19.9% underweight and normal BMI in 75.3% children<sup>6</sup>. Our observation showed that 1.6% of children were obese, 6.1 % were overweight, 34.2% were underweight and 58.2% were normal BMI children, which corroborates with the prior mentioned studies. According to various studies, the current prevalence of overweight children in India could range from 4% to 22%<sup>7-10</sup>. Though the prevalence of obesity in Nepalese children is lower than in India, comparison between previous and our study shows a gradually increasing trend in childhood obesity. This may be because certain areas in Nepal are urbanizing at a fast pace, its urban population increasing to 17% of the total population in 2011 from 13.9% in 2001<sup>11</sup>.

Piryani et al showed that 12.2% of adolescent students in Nepal were overweight<sup>2</sup>. A study assessing the knowledge and prevalence of obesity in adolescent children of Kaski district showed that all children with obesity were between 14 to 16 years age group<sup>14</sup>. Our study is comparable with previous studies as the highest prevalence rates of obesity/overweight were seen in the age group of 16 (4.7% and 9.4%). In similar studies from India, highest prevalence rates of obesity were seen between 9 to 12 years age<sup>3,5</sup>. It is observed that the prevalence rates of obesity among older children and adolescents have been rising alarmingly in many developing countries like Thailand, Brazil, China and India<sup>13</sup>. This may be because adolescence is a critical phase where various biological, psychological, social and environmental changes are occurring. However, in our study, the various age groups did not show any statistically significant difference in the prevalence of obesity.

In the study by Raut et al 3.5% male children were overweight and 1.2% were obese; whereas only 2.6%

females were overweight, and none were obese<sup>3</sup>. But in some studies a higher prevalence was reported in males as well<sup>2,3,7,14</sup>. Our study also showed a higher prevalence in girls, but the difference was not statistically significant. The gender difference in BMI category could be due to sedentary lifestyle of girls and also the pubertal changes.

The difference in prevalence of overweight/obesity in Bhaktapur and Kathmandu were statistically significant with obesity being more common in the school of Kathmandu. The difference may be because of changes in lifestyle, cultural differences, food habits and different rate of urbanization in the two areas. Studies from India, Bangladesh and China also show similar pattern of higher prevalence of overweight or obese children in urban areas and private schools<sup>3,12,15</sup>. However, in the present study all the schools belonged to private management. But it is particularly seen in those studies, that obesity is prevalent in areas that have gone through rapid economic growth, urbanization, cultural transition and variation of food systems.

On comparing the mean SBP and DBP values between obese and non-obese groups, a highly significant relationship was observed for DBP with obesity but not with SBP. Some studies however, do show relationship of SBP with obesity in children<sup>8</sup>. SBP and DBP were also found to be higher in children with high BMI (>85<sup>th</sup> percentile) in a study by Dwivedi et al<sup>16</sup>. A study by Shah et al<sup>6</sup> in eastern Nepal as well as other various studies from Brazil, Spain, Thailand and China showed that childhood obesity was significantly associated with blood pressure<sup>2,17,18,19,20</sup>. Multiple data including this seems to point out that obesity and overweight may lead to early onset of chronic disease like hypertension leading to multiple cardiovascular comorbidities later in adulthood.

## CONCLUSION

The present study shows overweight and obesity in children is in increasing trend whereas underweight still remains a major concern. This suggests the need for a balanced and judicious approach to effectively control this double burden paradox in Nepal. A strong association of overweight with blood pressure was also observed suggesting need of timely identification and control of overweight and obesity for prevention of development of other cardiovascular comorbidities later in life.

## REFERENCES

1. World Health Organization. Childhood overweight and obesity on the rise: Global Strategy on Diet, Physical Activity and Health. 2004. Available from: <http://www.who.int/dietphysicalactivity/childhood/en/>
2. Piryani S, Baral K, Pradhan B, Poudyal A, Piryani R. Overweight and its associated risk factors among urban school adolescents in Nepal: a cross-sectional study. *BMJ Open*. 2016;6(5):e010335.[FullText | DOI]
3. Raut B, Jha M, Baidya D, Shrestha H, Sapkota S, Aryal M et al. Determination of Risk Factors Associated with Childhood Obesity and the Correlation with Adult Obesity- A Random Cross Sectional Study from Nepal. *American Journal of Health Research*. 2014;2(4):134. [FullText | DOI]
4. Aryal M. Childhood Obesity, Unrecognized Public Health Challenge in Nepal. *KUMJ*. 2012;8(4):358-9. [FullText | DOI]
5. Siddiqui NI, Bose S. Prevalence and trends of obesity in Indian school children of different socioeconomic class. *Indian Journal of Basic & Applied Medical Research*. 2012;2(5):393-8. [FullText | DOI]
6. Sah V, Giri A, Acharya R. Prevalence of overweight, obesity and its associated risk factors among school children aged 6-16 years of Biratnagar. *Journal of Nobel Medical College*. 2016;5(2):22-5. [FullText | DOI]
7. Nayak BS, Bhat HV. Prevalence of Overweight / Obesity among School Children In Karnataka, South India. *International Journal of Public Health Research*. 2011:180-4.[Full Text | DOI]
8. Vohra R, Bhardwaj P, Srivastava JP, Srivastava S, Vohra A. Overweight and obesity among school-going children of Lucknow city. *J Family Community Med*. 2011;18:59-62. [Full Text]
9. Gupta DK, Shah P, Misra A, Bharadwaj S, Gulati S, Gupta N, et al. Secular trends in prevalence of overweight and obesity from 2006 to 2009 in urban Asian Indian adolescents aged 14-17 years. *PLoS One*. 2011;6:e17221.[DOI]
10. Fernandes N, Khubchandani J, Seabert D, Nimkar S. Overweight Status in Indian Children: Prevalence and Psychosocial Correlates. *Indian pediatrics*. 2015 April;52(1): 131-4. [DOI]
11. Central Bureau of Statistics. Preliminary result of census 2011. Kathmandu: National Planning Commission, 2011. [FullText]
12. Rahman S, Islam MD, Alam DS. Obesity and overweight in Bangladeshi children and adolescents: a scoping review. *BMC Public Health* 2014, 14:70. [FullText | DOI]
13. Gupta N, Goel K, Shah P, Misra A. Childhood Obesity in Developing Countries: Epidemiology, Determinants, and Prevention. *Endocr Rev*. 2012 Feb;33(1):48-70. [FullText | DOI]
14. Pandey A, Sapkota S. Prevalence and Knowledge on Obesity Among School Going Adolescents of Kaski, Nepal. *J Nepal Paediatr Soc*. 2018;38(2):63-8.
15. Zhao Y, Wang L, Xue B, Wang Y. Associations between general and central obesity and hypertension among children: The Childhood Obesity Study in China Mega-Cities. *Scientific Reports*. 2017;7(1). [FullText | DOI]
16. Dwivedi G, Sethi S, Singh R, Singh S. Association of blood pressure with body mass index and waist circumference in adolescents. *International Journal of Contemporary Pediatrics*. 2016;971-6. [FullText | DOI]
17. Rosaneli CF, Baena CP, Auler F, Nakashima AT, Netto-Oliveira ER, Oliveira AB, et al. Elevated Blood Pressure and Obesity in Childhood: A Cross-Sectional Evaluation of 4,609 Schoolchildren. *Arq Bras Cardiol*. 2014; 103(3):238-44. [FullText | DOI]
18. EspinosaNM, Fernandez A, Sanchez-Lopez M, RiveroMerino I, LucasDeLaC, SoleraMartinez M, et al. Prevalence of high blood pressure and association with obesity in Spanish schoolchildren aged 4-6 years old. *PLoS ONE*. 2017;12(1):e0170926. [FullText | DOI]
19. Sukhonthachit P, Aekplakorn W, Hudthagosol C, Sirikulchayanonta C. The association between obesity and blood pressure in Thai public school children. *BMC Public Health*. 2014;14(1). [FullText | DOI]
20. Dong B, Ma J, Wang HJ, Wang ZQ. The Association of Overweight and Obesity with Blood Pressure among Chinese Children and Adolescents. *Biomed Environ Sci*, 2013; 26(6): 437-44. [FullText | DOI]