



Original Research Article

Study on prevalence of obesity in urban and rural adolescents in Odisha: Implications for public health strategies

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ABSTRACT

Obesity and overweight have become a worldwide public health challenge and there is an urgent need to examine prevalence of obesity among adolescents. The aim of the present research is to determine health status with respect to obesity of urban & rural adolescents. The data were derived from cross-sectional sampling of adolescent boys and girls of urban and rural population. Age, gender and body mass Index was used to define overweight and obesity. The overweight and obesity were considered using an updated body mass index reference based on the revised consensus guidelines for India. It is observed that the average height and weight, physical growth of adolescents of urban area is greater than that of rural area irrespective of their gender. The BMI (Body Mass Index) of urban adolescents are more than their counterparts in rural area, but the mean BMI of rural and urban adolescents are significantly different. On the other hand BMI do not show any variation due to gender, area and gender considered together. Most of the adolescents irrespective of their area of residence, in spite of their long hours of sedentary behavior are falling under normal category.

The result showed physical activities did influence change in BMI, which has a strong independent association with family history of obesity in both rural and urban adolescents. This study analysis showed an increase in prevalence of overweight and obesity in urban adolescents especially with male gender, calling for an urgent need for targeted preventive measures targeting undernutrition and overweight involving public health nutrition interventions for healthy public policies and implementation of equitable nutrition interventions for optimizing public health outcomes for those populations in greater need.

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1. Introduction

Obesity is a serious public health problem, with about 2.8 million people dying each year due to overweight or being obese (WHO).^{1,2} The consequences can range from depression, low self-esteem, and lack of enthusiasm to impaired memory and cognition. Due to the consumption of energy dense food (i.e unhealthy food habits), sedentary life style, lack of health care services and financial support, the developing countries are facing high risk of obesity and their adverse consequences on public health status including non-communicable diseases. The prevalence of obesity in

India varies due to age, gender, geographical environment, socio-economic status etc. Various studies have shown that the prevalence of obesity among women were significantly higher as compared to men.¹

Childhood obesity is a substantial public health problem with burden of ill-health worldwide. Increasing rate of overweight and obesity has reached epidemic proportions in developed countries and is rapidly increasing in many middle-income and less-developed countries.³ In 2016, India had 3.7% obese boys, 2.6% obese girls in the age group of 5 to 9 years. There were 1.8% obese boys and 1.1 obese girls in the age bracket of 10 to 19. Overall obesity rates have doubled between National Health Survey 4 and National Health Survey 5. As per National Family Health

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Survey (NFHS) - 4 (2015-16) Odisha had 32% and 13.2 % obese women in the age group of 15-49 years in urban and rural area respectively. Men in the same age bracket had 32.4% (urban area) and 13.3 % (rural area) were obese. In total 16.5% women and 17.2% men in the same age bracket were obese. From survey it was revealed that 34% of women and 32.4% men (15-49 years) in urban area of Khorda district were obese, whereas it was 17.1% and 8% in rural area of Jajpur district. In total 30.2% of women and 27% of men in the same age bracket of Khorda district were obese against 17.5% of women and 9.4% men in Jajpur district in Odisha. Overweight and obesity are the fifth leading risk of global deaths than underweight, particularly in urban settings. Worldwide obesity has nearly tripled between 1975 and 2016. In 2016 more than 19 billion adults, 18 years and older, were overweight. Of these 650 million were obese. Over 340 million children and adolescents aged 5-19 were overweight or obese. Childhood obesity increases the risk of adult obesity as well as chronic health problems such as type II diabetes, hypertension and cardiovascular disease. In addition, 44% of diabetes burden, 23% of ischemic heart disease burden and 7-41% of certain cancer burdens are attributable to overweight and obesity. Obesity is an abnormal growth of the adipose tissue due to enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both. It is often expressed in terms of body mass index (BMI). Overweight is usually due to obesity but can arise from other causes such as abnormal muscle development or fluid retention. However obese individuals differ not only in the amount of excess fat that they store, but also in the regional distribution of fat within the body.⁴

For industrialized societies, even in those countries, it has been suggested that such increase in body weight have been caused primarily due to sedentary lifestyles and reduced levels of physical activity, rather than by changes in food intake or by other factors. Diet and lifestyle are ostensibly major contributors to weight gain. Overweight and obesity are strongly associated with certain type of diets, such as those include large amounts of fats, animal-based foods and processed foodstuffs.^{1,5,6} Keeping an eye on the global problem, the present study was undertaken to study whether the prevalence of overweight and obesity among adolescents is restricted by their habitat (urban versus rural) or not.

2. Materials and Methods

Primary data was collected through a pre-tested and validated questionnaire distributed to 240 adolescents belonging to the age group of 13 to 18 years by applying random sampling technique. 240 samples comprising of 120 boys and 120 girls from both urban and rural areas were taken for the study. The investigation was undertaken in Bhubaneswar city (urban area) of Khorda district and Dharmasala block of Jajpur district (rural

area) in the state of Odisha. In Bhubaneswar city 3 areas namely Sisupal garh, Palaspalli and New Forest Park and 3 Gram Panchayats namely Kamagarh, Madhupur Garh and Mahisara of Dharmasala block in Jajpur district were selected. Adolescents of various socio-economic backgrounds were selected to make a comparative cross-sectional study.

Information on age, height, weight, was collected from adolescent boys and girls. Weighing machine was used to record the weight in kg. of the respondents without footwear. Height was measured in cm. using a metric stadiometer taking care so that the back of the head, shoulder blades, buttocks and heels touches the stadiometer.^{7,8} Body Mass Index (BMI) was calculated after measuring height and weight. Thereafter adolescents were categorized as normal, overweight and obese using the formula weight/height^2 (kg/ m^2) based on the revised consensus guidelines for India.

The adolescents of both area were enquired about their participation in sports, physical activity, food habit and family history of obesity. The collected data was analyzed with the help of statistical tools such as mean, percentage, standard deviation, F- Test etc.

3. Results and Discussion

Mean values of age, height (cm.) and weight (kg.) of both adolescent boys and girls area wise i.e. urban area & rural area and total area were presented in Table 1. The observation showed that the height and weight were higher in case of boys than girls both in urban and rural area.

The mean height of boys and girls in rural area with \pm SD are 162.53+ 11.304 and 152.18+ 6.365 observed between 137-182 cm. and 137-168 cm. respectively. Similarly the mean height of boys and girls in urban area with \pm SD are 168.73 \pm 8.714 and 157.17 \pm 5.597 observed between 154-189 cm. and 145-171 cm. respectively. Hence it can be inferred that the mean height of both boys and girls of urban area is greater than that of rural area.

The mean weight of boys and girls in rural area with \pm SD are 50.61 \pm 14.135 and 43.57 \pm 11.122 observed between 26-85 and 29-76 kg. respectively. Similarly the mean weight of boys and girls in urban area with \pm SD are 64.2 \pm 15.237 and 51.98 \pm 10.502 observed between 39-120 and 37-83 kg. respectively. From the table it can be concluded that the mean weight of both boys and girls in urban area is greater than that of rural area.

In Table 2, the mean BMI of boys and girls in rural area with \pm SD are 18.82 \pm 3.78 and 18.65 \pm 3.87 observed between 11.57-28.69 and 14.28-31.20 respectively. This shows the mean BMI of both boys and girls of rural area are close enough and may not be treated as different in reference to F-value shown in Table 5 also. In a similar fashion, the mean BMI of boys and girls in urban area with \pm SD are 22.45 \pm 4.87 and 21.16 \pm 4.12 observed between

Table 1: Demographic information of the respondents

Area	Gender	N	Age (Years)	Height (Cm.)	Weight (Kg.)	Sd. Deviation	
						Height	Weight
Rural	Boys	60	15.27	162.53	50.61	11.304	14.135
	Girls	60	15.33	152.18	43.57	6.365	11.122
	Total	120	15.30	157.36	47.09	10.509	13.150
Urban	Boys	60	15.75	168.73	64.20	8.714	15.237
	Girls	60	15.32	157.17	51.98	5.597	10.502
	Total	120	15.53	162.95	58.09	9.322	14.402
Total	Boys	120	15.51	165.63	57.41	10.521	16.146
	Girls	120	15.33	154.68	47.78	6.471	11.570
	Total	240	15.42	160.15	52.59	10.301	14.824

14.50-37.04 and 14.27-33.33 respectively. This shows the mean BMI of both boys and girls of urban area are close enough and may not be treated as different in reference to F-value shown in Table 5 also. But the mean BMI of rural and urban area are 18.73 and 21.81 are significantly different in reference to F-value (Table 3). Accordingly, the BMI of urban area students are better than that of rural area. For further study, the data has been classified as normal, over weight and obese where BMI is ≤ 24 , 25-29 and ≥ 30 respectively based on the revised consensus guidelines for India.

From Table 3, it is observed that the calculated F-value shown against area (32.425) is significant where as those against gender (1.838) and pooled area & gender (1.077) is not significant at 5% level. Hence, the variation in BMI due to area i.e. between urban & rural is acceptable and in other two cases the variation in BMI due to gender and pooled over area & gender (area - gender interaction) may not be acceptable.

Table 4 shows the cross tabulation of obesity category (normal, over weight and obese) with area of residence (rural, urban). The calculated Chi-square value 10.299 found to be not significant at 5% level shows the association between obesity category and residence is acceptable. Although more students are found to be normal in both rural (92.5%) and urban (77.5%) area, overweight (17.5%) and obese (5.0%) students are more from urban area in comparisons to rural area. Hence, the students of urban area are found to be more obese than those of rural area.

Figures in parentheses indicate percentage.

The overall prevalence of overweight and obese and its relationship with participation in sports, physical exercise, food habit and family history of obesity are presented in Table 5. It is also found that overweight and obese of rural and urban adolescents participation in sports, do physical exercise less often than normal weight participants. The result revealed that physical activities did influence changes in BMI. The result with regards to vegetarian or non-vegetarian (mixed diet) food habit did not have any significant effect on prevalence of normal, overweight

and obesity among adolescents. The result also revealed that BMI has a strong independent association with family history of obesity both in rural and urban adolescents. Adolescents having family history of obesity were more likely to gain weight easily and to become overweight and obese.

4. Research Findings

It is observed that the average height and weight, physical growth of adolescents of urban area is greater than that of rural area irrespective of their gender. The BMI of urban adolescents are more than their counterparts in rural area, but the mean BMI of rural and urban adolescents are significantly different. Hence it can be inferred that as area changes from rural to urban, the BMI varies significantly. On the other hand BMI do not show any variation due to gender, area and gender considered together.

When the rural and urban adolescents were distributed on the basis of obesity category, it is revealed that there is association between obesity category and area of residence. But it is satisfactory to note most of the adolescents irrespective of their area of residence, in spite of their long hours of sedentary behavior are falling under normal category, indicating their health consciousness attitude at the same time. More overweight and obese are from urban area in comparison to rural area. The result showed that overweight and obese of rural and urban adolescents participation in sports, do physical exercise less often than normal weight participants. The result showed physical activities did influence changes in BMI. Food habit did not have any significant effect on prevalence of normal, overweight and obese adolescents. BMI has a strong independent association with family history of obesity in both rural and urban adolescents. This indicates that adolescents having family history of obesity are more prone to become obese or overweight. Awareness programs at all level for the consequences of obesity and its prevention need to be initiated. This will also help to prevent diabetes burden, burden of heart disease and certain cancer burdens to a considerable extent. As a result the economic growth of

Table 2: Mean BMI of adolescents of rural and urban area

Area	Gender	N	Mean	Std. Dev.	Minimum	Maximum
Rural	Boys	60	18.82	3.78	11.57	28.69
	Girls	60	18.65	3.87	14.28	31.20
	Total	120	18.73	3.81	11.57	31.20
Urban	Boys	60	22.45	4.87	14.50	37.04
	Girls	60	21.16	4.12	14.27	33.33
	Total	120	21.81	4.54	14.27	37.04
Total	Boys	120	20.64	4.71	11.57	37.04
	Girls	120	19.90	4.18	14.27	33.33
	Total	240	20.27	4.46	11.57	37.04

Table 3: Analysis of variance on BMI of adolescents of rural and urban area

Source of Variation	Sum of Squares	Degrees of freedom	Mean Square	F
Area	567.116	1	567.116	32.425*
Gender	32.154	1	32.154	1.838 ^{NS}
Pooled over Area & Gender	18.821	1	18.831	1.077 ^{NS}
Error	4127.640	236	17.490	
Total	4745.740	239		

B:- * - Significant at 5% level (P<0.05)

Table 4: Chi-square test between BMI of adolescents and area of residence

Obesity Category		Area		Total
		Rural	Urban	
Normal	N	111	93	204
	%	92.5%	77.5%	85.0%
Overweight	N	8	21	29
	%	6.7%	17.5%	12.1%
Obese	N	1	6	7
	%	0.8%	5.0%	2.9%
Total	N	120	120	240

B:- Chi Square = 10.987 Significant at 5% level for DF = 2 (P<0.05)

Table 5: Prevalence of overweight and obese and its relationships with participation in sports, physical exercise, food habit and family history

Characteristics	Rural			Urban		
	Normal 111	Overweight 08	Obese 01	Normal 93	Overweight 21	Obese 06
Participation in sports						
Yes	59 (53.15)	04 (50.00)	0 (0.00)	55 (59.14)	09 (42.86)	02 (33.34)
No	52 (46.85)	04 (50.00)	01(100.00)	38 (40.86)	12 (57.14)	04 (66.66)
Physical exercise						
Yes	58 (52.25)	03 (37.50)	0 (0.00)	35 (37.63)	08 (38.10)	01 (16.67)
No	53 (47.75)	05 (62.50)	01(100.00)	58 (62.37)	13 (61.90)	05 (83.33)
Food habit						
Vegetarian	04 (3.60)	04 (50.00)	01(100.00)	05 (5.37)	02 (9.52)	01 (16.67)
Non.Veg (Mixed diet)	107(96.40)	04 (50.00)	0 (0.00)	88 (94.63)	19 (90.48)	05 (83.33)
Family history of diabetes						
Yes	29 (26.13)	03(37.50)	01(100.00)	21 (22.58)	07 (33.34)	03 (50.00)
No	82 (73.87)	05 (62.50)	0 (0.00)	72(77.42)	14 (66.66)	03 (50.00)

the nation having healthy citizens will also be accelerated for healthy public policies in the state under study and also in India.^{9–14}

5. Conclusion

Of the reproductive age, one in two women is anemic, one in three children under five years of age is stunted, and one in five children under five years is wasted in India. Inequalities are evident for stunting with its prevalence being 10.1% higher in rural vs urban areas. Rates of overweight or obesity is 20.7% in adult women and 18.9% in adult men in India. With coexistence of undernutrition and overweight or obesity, India faces the double burden of malnutrition (WHO).⁶

Optimizing the collection, quality, availability and accessibility of population-level nutrition and overweight data and integrating into health information systems would be a major improvement and an invaluable asset for public health responses. It is important to invest in the comprehensive integration of nutrition strategies especially the coexistence of undernutrition and overweight or obesity, comprehensive health and nutrition information systems are a complex, but essentially feasible and will have multiple benefits for public health concerning overweight and obesity.

Nutrition care, preventive and curative strategies, targeting undernutrition and overweight must be fully integrated into national health responses, supported by a strengthened multisectoral approach. Essential nutrition services should be part of the standard package of universally available healthcare services. Front-line workers involved in public health nutrition service delivery should have the required pre- and in-service training, means and motivation to perform their assigned roles. Nutrition products, such as ready-to-use therapeutic foods, should be readily available and affordable concerning targeting undernutrition and overweight. Innovative technological solutions, such as remote counselling and web applications, can enhance access to quality nutrition care, particularly for those in the areas of harder to reach. Public health nutrition services should be regularly monitored and evaluated to address inequities in delivery, coverage and access. The collection, analysis and dissemination of high-quality disaggregated nutrition data should be mainstreamed in public health information systems, to underpin the design and implementation of equitable nutrition interventions for optimizing public health outcomes for those populations in greater need. This public health problem of obesity can be preventable by spreading public awareness about obesity and its health consequences. Governmental agencies should promote the benefits of public health nutrition interventions, healthy life style, food habits and physical activity for addressing overweight and obesity.

6. Source of Funding

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7. Conflict of Interest

The authors declare that there is no conflict of interest.

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