PREVALENCE AND DETERMINANT OF OBESITY AMONGST SCHOOL GOING ADOLESCENT OF ASSAM

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ABSTRACT

BACKGROUND

The risk factors of cardiovascular diseases (CVD) in India are increasing at an alarming rate for the last few decades. Obesity is one major risk factor of CVD which start very early in life, hence there is a need to determine prevalence and risk factor of obesity among younger age group so as to plan preventive strategies.

MATERIALS AND METHODS

A cluster sample with cluster size of 50 was taken from 16 schools to cover sample size of 800 with consideration of design effect. Socio-demographic, environmental, dietary, and anthropometric and laboratory risk factors were assessed in the studied population.

RESULTS

Obesity was prevalent in 5%, while overweight in 10%. Overweight and obesity was found to be more amongst students having educated parents ($p<0.05$). Strong association was seen amongst tobacco product users with overweight ($p=0.000$) and obesity ($p=0.001$), secondhand smoke exposures and depression ($p<0.05$), alcohol consumption, less fruit intake (weekly) ($p<0.05$), frequent animal food product consumer with both overweight ($p=0.007$) and obesity ($p=0.008$). Maximum obese (2.0%) students were daily consumer of sweet snacks ($p=0.030$). Overweight and obesity were strongly associated with number of meals served per day ($p<0.05$). Significant mean difference of systolic blood pressure, diastolic blood pressure and waist circumference between overweight and non-overweight and obese and non obese was seen. Second hand smoke exposure was associated with a statistically significant risk of overweight (OR=3.30, 95% CI = 1.754-6.210, $p<0.05$). Also hypertension was significantly associated with overweight and obesity with (OR=.30, 95% CI = 0.175-0.522, $p<0.05$) and (OR=0.25, 95% CI = 0.126-0.513, $p<0.05$) respectively.

CONCLUSION

There is a need to reduce the risk factor prevalence of CVD to address the future epidemic of non communicable disease amongst this group of population. Different health promotional activities can be implemented with implementation research for better evidence generation beginning at an early age. Since students spend most of their time in the school environment, so schools should promote positive health behaviour.

KEYWORDS

Obesity, Overweight, Anthropometry, CVD Risk Factor, Assam.

HOW TO CITE THIS ARTICLE: Mahanta TG, Mahanta BN, Baruah SD, et al. Prevalence and determinant of obesity amongst school going adolescent of Assam. J. Evid. Based Med. Healthc. 2017; 4(63), 3790-3796. DOI: 10.18410/jebmh/2017/757

BACKGROUND

Obesity doubled in children and tripled in adolescents over past 30 years.[1] This weight gain tracks forward and worsens in young adulthood.[2] Heart disease risk increases by 2–4% for each year a young adult is obese.[3] Dietary patterns established early in life carry into adulthood and are strongly associated with CHD risk.[4] The transition from adolescence to young adulthood is considered a high-risk period because of declines in diet quality and increases in body weight.[5-7] Risk factors for CVD include traditional (smoking, family history of CVD, dyslipidemia, and hypertension), and novel (physical inactivity, second-hand smoke exposure, increased inflammatory markers or general inflammation, and obesity). Both traditional and recently discovered risk factors have been found to be associated with endothelial dysfunction in children and adults. The increasing prevalence of obesity in childhood and adolescence poses an ever-widening problem.[8] Obese children tend to become obese adults.[9] Some obese children and adolescents go on

Financial or Other, Competing Interest: ICMR.
Submission 19-07-2017, Peer Review 22-07-2017,
Acceptance 03-08-2017, Published 07-08-2017.
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DOI: 10.18410/jebmh/2017/757

to display a characteristic profile of hypertension, low HDL-cholesterol concentrations, high LDL-cholesterol and triacylglycerol concentrations, and insulin resistance (metabolic syndrome).[10,11] Such a metabolic, or atherogenic, profile may create favorable conditions for atherogenic cardiovascular disease (CVD), as shown by greater intima-media thickness in affected obese children.[12] Hence, there is a need to assess the prevalence of obesity and overweight and its risk factors in children in order to decrease the burden of CVDs in future.

MATERIALS AND METHODS

A cluster sample design was adopted. The cluster size was taken as 50. The sample size for cluster sample is calculated taking 95% confidence coefficient and 5% precision, considering a design effect of two where 800 schools going adolescent were enrolled from 16 clusters.

Study Design- A school based survey was conducted including student of class VIII, IX and X standard. Two stage cluster sampling design was used to get a representative sample of Assam. Four districts was selected out of 27 Districts of Assam using computerized random numbers. From each District from all enlisted schools 16 schools was selected using computerized random numbers assigned for each school. From each school selected 17 students was enrolled using random number table with the help of attendance register.

Step	Description	Purpose	Number
1	Gathering social and demographic information by questionnaire.	To obtain core data on: • socio-demographic information	All participants n~800
2	Physical measurements in the school.	To build on the core data in Step 1 and determine: • Smoking, tobacco, and alcohol use • diet, fat and salt consumption • Physical activity. • key anthropometric measures • Systolic and diastolic blood pressure.	All participants n~800
3	Taking blood samples.	To measure prevalence of diabetes, lipid profile, serum insulin level.	Blood sugar for all participants n~800 Other test for n~272

Measurement Tool- Predesigned, pretested schedule was used for socio-demographic information. Clinical examination was done maintaining privacy and participants were allowed to select the degree of privacy. Blood pressure measurement was done using OMRON (Digital Automatic Blood Pressure Monitor) after 15 mins of sitting, three measurements were taken and lowest reading is recorded. Height and weight were measured using SECCA scale and body mass index was calculated. Waist and hip circumferences were measured to the nearest 0.1 cm.

Ethical Consideration- Institutional ethical clearance was obtained. All information obtained as well as all related medical records stored in the strictest confidence. Information to participant was given that they will not be identified in any manner in the study records or their identity will not be disclosed in any reports or publications. Written informed consent was taken from each participant.

Statistical Analysis- Pearson's chi-square test is used to see if there is any association between categorical variables. Backward Wald Logistic regression was used to estimate the odds ratio (OR) and the 95% confidence intervals. Student's t-test for independent samples was used to compare mean score. Box plot was used to displaying variation in a set of data. Statistical analysis was performed with IBM SPSS Statistics version 21 Software. p-value less than or equal to 0.05 was considered as statistical significance.

RESULTS

The prevalence of obesity in the studied population was 5.0% and the prevalence of overweight was 10.0%. Significant mean difference of age was seen between overweight and non overweight participants as well as same mean age difference was found in obese and non-obese adolescents. Overweight and obese were more commonly seen among those whose mothers and fathers had more than tenth standard of schooling ($p<0.05$ for both) as well as in those with middle socioeconomic status (class II & III). Out of 800 adolescents only 1.0% obese student's had the history of family members died due to a heart disease/ diabetes. Gender and family history of heart disease was not found to be associated to overweight and obesity (Table 1).

Variables	All Total	Overweight	p value*	Obese	p value*
N	800	80 (10.0%)		40 (5.0%)	
Age, mean ± sd	14.63 ± 1.03	14.15 ± 1.11	0.000**	14.20 ± 1.09	0.007*
Sex Male Female	 313 (39.1%) 487 (60.9%)	 27 (3.4%) 53 (6.6%)	0.299	 13 (1.6%) 27 (3.4%)	0.387
Socio Economic Status Middle (class II & III) Lower (class IV & V)	 586 (73.3%) 214 (26.7%)	 73 (9.1%) 7 (0.9%)	0.000*	 36 (4.5%) 4 (0.5%)	0.014*

Father's education Illiterate Up to 10th standard More than 10th standard	56 (7.6%) 437 (59.6%) 240 (32.7%)	3 (0.4%) 23 (3.1%) 48 (6.5%)	0.000*	1 (0.1%) 11 (1.5%) 28 (3.8%)	0.000*
Mother's education Illiterate Up to 10th standard More than 10th standard	108 (14.2%) 451 (59.5%) 199 (26.3%)	4 (0.5%) 21 (2.8%) 52 (6.9%)	0.000*	1 (0.1%) 14 (1.8%) 25 (3.3%)	0.000*
Any family members suffers from any heart disease(HTN/DM/Angina/MI/Stroke/Others) Yes No	204 (25.5%) 596 (74.5%)	14 (1.8%) 66 (8.3%)	0.084	7 (0.9%) 33 (4.1%)	0.234
Any family member die due to a heart disease/diabetes Yes No	80 (10.0%) 720 (90.0%)	8 (1.0%) 72 (9.0%)	1.000	8 (1.0%) 32 (4.0%)	0.031*

Table 1. Distribution of Overweight and Obesity Prevalence According to Social, Demographic Factors and Past History

*p-value for Pearson's chi-square test; **p-value for Student's t-test.

History of tobacco product users was strongly associated with overweight and obese. 1.5% overweight (p=0.000) and 0.6% obese (p=0.001) students were current users of tobacco products. Second hand smoke exposures and depression was significantly associated with overweight participants (p<0.05). Alcohol consumption had a significant association with overweight and obesity. Among 800 participants 0.5% overweight and 0.3% obese students had the habit of alcohol consumption in past 12 months. However, higher prevalence of physical activity (more than one hour per week) at school was seen among those with higher overweight and obese (p<0.05). Smoking was not found to be associated to overweight and obesity. Not any significant association was also seen between sitting activity, leisure time spent and psychological factors except depression with overweight and obesity (Table 2).

Variables	All total	Overweight	p value*	Obese	p value*
History of Tobacco Used Never use tobacco product Formerly used tobacco product Currently uses tobacco product	460 (57.5%) 75 (9.4%) 265 (33.1%)	62 (7.8%) 6 (0.8%) 12 (1.5%)	0.000*	34 (4.3%) 1 (0.1%) 5 (0.6%)	0.001*
Smoking habit Yes No	92 (11.5%) 708 (88.5%)	6 (0.8%) 74 (9.3%)	0.263	1 (0.1%) 39 (4.9%)	0.072
Second hand Smoke Exposure Yes No	277 (34.6%) 523 (65.4%)	12 (1.5%) 68 (8.5%)	0.000*	9 (1.1%) 31 (3.9%)	0.098
Consumption of alcohol in the past 12 months Yes No	141 (17.6%) 659 (82.4%)	4 (0.5%) 76 (9.5%)	0.002*	2 (0.3%) 38 (4.8%)	0.032*
Physical activity per week Up to 1 hour More than 1 hour	393 (49.1%) 407 (50.9%)	29 (3.6%) 51 (6.4%)	0.015*	11 (1.4%) 29 (3.6%)	0.005*
Sitting activity /day Up to 3 hours More than 3 hours	593 (74.1%) 207 (25.9%)	53 (6.6%) 27 (3.4%)	0.090	33 (4.1%) 7 (0.9%)	0.215
Leisure time activity Mainly sedentary Mild exercise Moderate exercise Strenuous exercise	633 (79.1%) 63 (7.9%) 48 (6.0%) 56 (7.0%)	67 (8.4%) 2 (0.3%) 7 (0.9%) 4 (0.5%)	0.163	33 (4.1%) 2 (0.3%) 5 (0.6%) 0 (0.0%)	0.093
Psychosocial factors **Level of stress feel** Little/none Moderate or severe **Feeling of stress in the last year** Never / some periods	 682 (85.3%) 118 (14.8%) 748 (93.5%) 52 (6.5%)	 71 (8.9%) 9 (1.1%) 78 (9.8%) 2 (0.3%)	 0.352 0.126	 34 (4.3%) 6 (0.8%) 38 (4.8%) 2 (0.3%)	 0.964 0.693

Several periods of stress or permanent stress					
Felling of sad, blue, or depressed for 2 weeks or more in a row during the past 12 months					
Yes	214 (26.8%)	14 (1.8%)	0.049*	11 (1.4%)	0.912
No	586 (73.3%)	66 (8.3%)		29 (3.6%)	

Table 2. Distribution of Overweight and Obesity Prevalence according to Psycho behavioral Factors

*p-value for Pearson's chi-square test.

Majority overweight (4.0%) and obese (2.5%) students were weekly takers of fruits (p<0.05). Strong significant association was seen between frequently animal product food item consumer with overweight and obesity. 9.0% overweight (p=0.007<0.05) and 4.4% obese (p=0.008) students frequently consume animal products. Maximum obese (2.0%) students were the daily consumer of sweet snacks (p=0.030). Overweight and obesity were strongly associated with number of meals served per day. 5.0% overweight students had the habit of taking meals ≥ 4 times per day (p<0.05) whereas 2.4% obese students take meals 3 times in a day (p<0.05). Fast food intake, vegetable and snacks takers were not statistically significantly associated with overweight and obesity (Table 3).

Variables	All total	Overweight	p value*	Obese	p value*
Fast food intake					
<3 days/wk.	221 (27.6%)	27 (3.4%)	0.197	12 (1.5%)	0.730
>3 days/wk.	579 (72.4%)	53 (6.6%)		28 (3.5%)	
Fruits taken in a month					
<1 per month - Never	79 (9.9%)	7 (0.9%)	0.007*	3 (0.4%)	0.000*
Monthly	301 (37.6%)	24 (3.0%)		6 (0.8%)	
Weekly	338 (42.3%)	32 (4.0%)		20 (2.5%)	
Daily	82 (10.3%)	17 (2.1%)		11 (1.4%)	
Vegetables taken in a month					
<1 per month - Never	28 (3.5%)	1 (0.1%)	0.175	1(0.1%)	0.152
Monthly	21 (2.6%)	1 (0.1%)		3 (0.4%)	
Weekly	277 (34.6%)	22 (2.8%)		10 (1.3%)	
Daily	474 (59.3%)	56 (7.0%)		26 (3.3%)	
Use of animal product food Frequently					
Yes	766 (95.8%)	72 (9.0%)	0.007*	35 (4.4%)	0.008*
No	34 (4.3%)	8 (1.0%)		5 (0.6%)	
Sweet snacks taken					
<1 per month - Never	157 (19.6%)	21 (2.6%)	0.293	5 (0.6%)	0.030*
Monthly	196 (24.5%)	18 (2.3%)		4 (0.5%)	
Weekly	245 (30.6%)	26 (3.3%)		15 (1.9%)	
Daily	202 (25.3%)	15 (1.9%)		16 (2.0%)	
Snacks taken					
<1 per month - Never	136 (17.0%)	13 (1.6%)	0.693	3 (0.4%)	0.361
Monthly	134 (16.8%)	15 (1.9%)		9 (1.1%)	
Weekly	313 (39.1%)	27 (3.4%)		16 (2.0%)	
Daily	217 (27.1%)	25 (3.1%)		12 (1.5%)	
Number of meals served per day					
2 times	38 (5.7%)	16 (2.4%)	0.000*	9 (1.4%)	0.000*
3 times	217 (32.8%)	31 (4.7%)		16 (2.4%)	
4 times and more	406 (61.4%)	33 (5.0%)		15 (2.3%)	

Table 3. Eating Habits Overweight and Obese Students

*p-value for Pearson's chi-square test.

Significant mean difference of systolic blood pressure, diastolic blood pressure and waist circumference between overweight and non-overweight and obese and non obese was seen (Table 4).

Variables	All Total	Overweight	p value*	Obese	p value*
Systolic blood pressure (mmHg)	117 ± 15	128 ± 14	0.000*	128 ± 17	0.000*
Diastolic blood pressure (mmHg)	73 ± 10	77 ± 10	0.000*	78 ± 10	0.000*
WC (cm)	65 ± 13	79 ± 8	0.000*	87 ± 12	0.000*

Table 4. Characteristics (Mean ± Standard Deviation) of the Study Participants to Obese and Overweight Status

*p-value for Student's t-test.

Second hand smoke exposure was associated with a statistically significant risk of overweight (OR=3.30, 95% CI = 1.754-6.210, p<0.05). Also hypertension was significantly associated with overweight and obese with (OR=.30, 95% CI = 0.175-0.522, p<0.05) and (OR=0.25, 95% CI = 0.126-0.513, p<0.05) respectively. Students who were engaged in physical activity for less than an hour per week was 1.79 and 2.66 times respectively more likely to had the risk of overweight and obesity than engaged in physical activity more than an hour per week (Table 5).

Variables	Overweight		Obese	
	OR (95% CI)	p value*	OR (95% CI)	p value*
Smoking habit Yes no	1.62 (0.688-3.859) 1	0.268	5.17 (0.702-38.11) 1	0.107
Second hand smoke exposure Yes No	3.30 (1.754-6.210) 1	0.000*	1.87 (0.880-3.999) 1	0.103
Family history of CVD Yes No	1.65 (0.959-2.867) 1	0.070	1.22 (0.601-2.492) 1	0.577
Hypertension Yes No	0.30 (0.175-0.522) 1	0.000*	0.25(0.126-0.513) 1	0.000*
Physical activity/week Up to 1 hour More than 1 hour	1.79 (1.114-2.902) 1	0.016*	2.66 (1.312-5.411) 1	0.007*
Fast food intake <3 days/wk >3 days/wk	0.72 (0.443-1.184) 1	0.198	0.88 (0.442-1.773) 1	0.730

Table 5. Odds Ratios (OR) with their respective 95.0% Confidence Intervals (CI) for the Variables Related to Cardiovascular Risk Factors in Adolescents

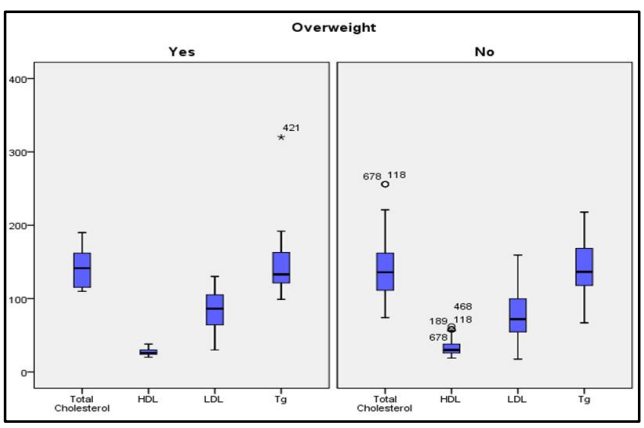

Figure 1 ***Figure 2***

Figure 1. Box Plot is used to Compare the mean Cholesterol, HDL, LDL and Triglyceride of Overweight Students

Figure 2. Box Plot is used to Compare the Mean Cholesterol, HDL, LDL and Triglyceride of Obese Students

From box plot (Figure 1) it is seen that mean cholesterol, LDL and triglyceride of overweight students were more than non-overweight but this result is inverse in case of HDL. Fig 2 indicates that mean total cholesterol and LDL is more for obese students where as mean HDL and Triglyceride is more in non-obese students.

DISCUSSION

Because many CHD risk factors surface in adolescence.[13-15] and track forward to adulthood.[16] the AHA's 2020 Strategic Impact Goals along with the National Heart, Lung, and Blood Institute's (NHLBI's) 2012 Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents.[17] emphasize primordial prevention beginning in childhood and adolescence.[18] This concept of primordial prevention was introduced by Strasser.[19] in 1978 and focuses on preventing the development of risk factors themselves.[18] Dietary modifications are central to this approach.[18] Poor dietary choices negatively affect CHD risk factors in Adolescents. Unhealthy diet choices are a major determinant of CHD risk.[20-22] Recent NHANES data in 4673 adolescents' ages' 12–19 y show an alarmingly high prevalence of adolescents in poor and intermediate CHD risk factor categories.[23] Adherence to the 5 components of the healthy diet score: >4.5 cups (0.001 m3) of fruits and vegetables/d, >2 servings (3.5 oz (99.2 g)) of fish/wk, >3 servings (1 oz (28.4 g)) of fiber-rich whole grains (>1.1 g of fiber per 10 g of carbohydrate)/d, <1500 mg of sodium/d, and <450 kcal (1884.1 kJ) from sugar sweetened beverages/wk. Healthy diet score was the least prevalent component of ideal cardiovascular health.[23] Our study also show association with less fruit intake, more sweet intake and habit of taking more than 4 times meal with overweight and obesity.

Depression, second hand smoke exposure was significantly associated with overweight and obesity. Until primordial prevention strategies are successful in avoiding risk factor development all together, risk factor screening needs to work in tandem with education and management for effective disease prevention. Strategies that focus on

high-risk individuals are effective in reducing CHD events, but population-level strategies are needed to produce wide-scale risk reductions.[18,24] Population-based strategies can be applied to the school setting. Although cafeterias can contribute to an obesogenic environment on school campuses, they also represent an opportunity to influence students' diets for the better by providing nutrition information to guide healthy choices.[25] To motivate students to choose healthier options, schools need to identify healthy choices, provide nutrition information, and use point-of-selection signage.[26] This nutrition information may provide the stimulus for students to reevaluate and change their eating habits.[27] Pyramids that displayed energy and nutrient content of menu offerings at a cafeteria led 71% of patrons to change their lunch selections by choosing meals lower in energy and fat.[28] Peterson et al[29] reported increased awareness of healthy foods as the primary reason for selecting healthier food choices in adjoining hall intervention consisting of signs, table tents, flyers, and benefit-based messages. Similar studies havealso found that point-of-selection nutrition labels in dining halls resulted in better food choices and decreased energy intake at meals.[30,31] In another study, students with the highest nutrition knowledge were 12 times more likely to meet dietary recommendations compared with those with the lowest knowledge.[32] Drawing attention to nutrition and health in a campus dining hall setting has a positive affect on food choices.[29] Targeting school going adolescent may have lifelong change of behavioural risk factors may be critical to prevent disease progression. Increased screening is the first step because young adults at risk must first be identified before treatment approaches can be initiated. School campuses provide an opportunity for population-based screening approaches. School students and health professionals on campus must first be made aware of the need for risk assessment and then risk reduction through lifestyle changes. Future research needs to be done to identify the most effective and efficient ways of screening large numbers of young adults. Screenings embedded into course curricula in health courses, as part of wellness programs are potential avenues to increase screening rates in this age group. Increased screening needs to work in conjunction with education to effectively identify and manage CHD risk.

CONCLUSION

Obesity, overweight, unhealthy diet, tobacco and alcohol use, stress, depression was found to be prevalent NCD risk factors in this population. There is a need to reduce the risk factor prevalence of CVD to address the future epidemic of non communicable disease amongst this group of population. Different health promotional activities can be implemented with implementation research for better evidence generation beginning at an early age. Since students spend most of their time in the school environment, so schools should promote positive health behaviour.

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