

Original Article

Adolescents' Level of Perceived Stress and its Relationship with Body Mass Index in a Bangladeshi Population

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Abstract

Background: Several behavioral factors, specially stress, eating behavior, and physical activity have been linked with adolescent obesity. In our country, mental health of adolescents is often neglected. So, we designed this study to describe the current perception of stress in Bangladeshi adolescent students. **Objective:** Aim of this study was to assess association between stress and body mass index of adolescents while controlling for physical activity and examining stress associated eating behavior. **Materials and Methods:** This cross-sectional study was carried out among 278 adolescent students during the period from January to December 2013. Data were collected through self-administered questionnaire which included physical activity questions, Dutch Eating Behavior Questionnaire (DEBQ), Adolescent stress questionnaire (ASQ) and standard anthropometric measurements and were analyzed statistically using SPSS version 21.0. **Results:** In this study majority of the respondents were males. Among the female respondents, about 12.23% were overweight and obese compared to their male peers (4.1%). The normal and high BMI adolescents in the study showed significantly different proportions regarding gender ($p < 0.001$), father's education ($p = 0.036$) and smoking status ($p = 0.22$). Findings in this study reveals negative correlation between physical activity score and body mass index ($\rho = -0.15$, $p < 0.05$). Body mass index was found significantly correlated with all three DEBQ eating subscales the restraint score, emotional eating score ($\rho = 0.58$ $p < 0.001$), and external eating score ($\rho = 0.55$, $p < 0.001$). Based on sample data, the mean stress scores were due to home life (3.40 ± 0.54), school performance (3.31 ± 0.63), school attendance (2.42 ± 0.87), romantic relationship (3.02 ± 0.92), peer pressure (2.85 ± 0.72), due to teacher interaction (2.89 ± 0.56), future uncertainty (3.83 ± 0.90), school/leisure conflict (3.55 ± 0.68), financial pressure (2.99 ± 0.79) and emerging adult responsibility (3.11 ± 0.76). Majority of the respondents (86.7%) were highly stressed. The study identified gender (OR, 19 with 95% CI; 4.7, 90.6), Father's education (OR, 16 with 95% CI; 1.6, 16), and stress contributed by school/leisure conflict (OR, 4 with 95% CI; 1.2, 13.8) as significant predictors of adolescents' BMI when adjusted for other factors. **Conclusion:** School/leisure conflict related stress was found associated with body mass index when adjusted for other factors. School is reported to be an important source of adolescent stress and should be the focus of stress management campaigns.

Key words: Adolescent stress; Eating behavior; Physical activity; BMI

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Introduction

Teenagers, like adults, may experience stress in everyday life. Moreover, of all life-stages, adolescence is arguably the one most stressful period marked by rapid and potentially unrestrained transition, including

biological, social, and psychological changes.¹ Research has established that overall levels of stress tend to increase from preadolescence to adolescence.² Chronic stress is hypothesized to be involved in the etiology of obesity.^{3,4} A growing body of research also

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shows psychological stress to be linked with weight gain through a variety of mechanisms, including effects on behavior (e.g., more intake of convenient foods and less time for physical activity)^{5,6} and emotional reactions (“comfort eating”)⁷. Michaud and colleagues found that stress increased food intake in a sample of French high school students and concluded that this behavior could bring about increased body weight and obesity over time.⁸

WHO (2013) considers childhood obesity as “one of the most serious public health challenges of 21st century”. By 2020, it is estimated that the global prevalence of childhood obesity will reach approximately 60 million.^{9,10} As obesity accounts for a wide range of psychosocial and medical consequences and health issues in adolescence is more likely to follow through into adulthood, it is important to investigate the developmental mechanisms of obesity during this early stage of life.

Epidemiological research describing the current experience of stress in adolescents and investigating the relationship between stress and obesity in adolescents is rather scarce but essential in this context.⁴ Considering adolescents as children in our country, their mental health is often neglected. Studies done in Bangladesh that relate to adolescent health and well-being are less explored in mental health arena; especially adolescent stress has not been addressed as an important health issue. This current study was set up to describe the current perception of stress in a set of Bangladeshi adolescent students and to examine the association between perceived stresses with body mass index levels in adolescents.

Materials and Methods

This cross-sectional analytic study was conducted to assess the relationship between stress and body mass index in urban adolescents. Assuming 95% confidence and 80% power, and taking stress prevalence among adolescents as 26%¹¹, the sample size was estimated 296 (IBM sample power). A total of 350 students attending higher secondary schools (class 11 and 12) from two colleges in Dhaka city were asked to participate in the study. Of them, 278 gave consent to participate and completed questionnaires with an

overall response rate of 79.4%. Among them 172 (61.9%) were boys and 106 (38.1%) were girls.

Procedures

Permission to carry out the study was obtained from the Ethical Review Committee of National Institute of Preventive and Social Medicine (NIPSOM), with consent granted from both the high schools. Passive consent from the participants was allowed because no identity data were collected. The adolescents and the parents received an information letter that briefly explained the purpose of the study. In all stages of data collection, it was emphasized that participation was voluntary, anonymous, and confidential, and that the participants were free to withdraw from the study. Administration of the questionnaire was completed in whole class groups during September and October of 2013. Research investigator and coinvestigators were present during the data collection process for measuring anthropometric data as well as monitoring and supervising the quality control status.

Measurements

Adolescent stress

Adolescent stress was assessed by the revised Adolescent Stress Questionnaire (ASQ) originally developed by Byrne, Davenport and Mazanov.¹¹ It has a good validity to assess adolescent stressor experience.¹¹ ASQ was originally a 58-item scale with items concerning common adolescent stressors rated on a 5-point Likert scale: 1 (not at all stressful or is irrelevant to me) to 5 (very stressful). Respondents in this sample were classified according to stress level in highly stressed, moderately stressed and low stress level, as measured by the stress questionnaire. Stress level was categorized as follows: Low stress = 58–100, Moderate stress = 101–149, High stress = 150–287. This classification was adopted from a Norwegian study that employed Adolescent Stress Questionnaire as a stress measuring tool among the 16 to 20-year-old. A relative score for each stress component scale was calculated by counting up the scores of the items, belonging to that scale and dividing this score by the number of scale items. An absolute summary score was obtained by adding up the individual scores of all 56 items.

Eating behavior of the respondents

Dutch Eating Behavior Questionnaire (DEBQ)¹² is a 33-item self-report measure for use with the general population, which includes scales on three types of eating style: 13 items on emotional eating, 10 on external eating, and 10 on restrained eating. Participants indicate their response to each item on a 5-point Likert scale (Never, Seldom, Sometimes, Often, Very often). The DEBQ was translated into Bengali. The questionnaire was again back-translated and minor inconsistencies were corrected. Items that proved difficult to comprehend were rewritten. In a survey, these items were individually administered to 20 adolescents, both boys and girls, of about 17-year-old. The students who participated in the test/retest procedure were not included in the final analysis.

Physical activity level of the participants

Physical activity level of the study population was determined by applying six questions adopted from a Italian National Survey on adolescents by Turconi et al.¹³ These questions were previously used by The International Centre for Diarrheal Disease Research, Bangladesh (icddr,b) in a survey on adolescents of Bangladesh in 2013. All responses were structured in different ways according to each question, each score ranging from 0 to 3, with the maximum score assigned to the healthiest habit. The total score of this section was 18. The total score (18) was divided into tertiles, where the lowest one referred to “sedentary physical level”, the medium one referred to “partially moderate physical level” and the highest one referred to “active physical level”.

Measurement of height and weight for BMI calculation

Body weight was measured in kilograms (up to one decimal points) on subjects without shoes by means of Tanita weight machine. A standard measuring instrument (stadiometer) was used to measure height in centimeters (precision ± 1 mm). Body mass index (BMI) was calculated from these measurements (weight in kilograms divided by height in meters squared).

According to the Centers for Disease Control and Prevention (CDC) cut-points, those below the 5th

percentile are underweight, while those at the 85th and below the 95th percentiles are considered at risk for overweight and those at or above the 95th percentile are categorized as overweight. BMI was categorized into normal weight versus at risk for overweight and overweight participants combined.¹⁴ For ease of discussion, the latter group was referred to as the overweight group throughout this paper although this should not indicate that those at risk for overweight should be labeled as overweight.

Statistical analysis

Data were entered into computer with the help of software Statistical Package for Social Sciences (SPSS) for windows versions 21.0. Demographic data and scales were reported with descriptive statistics. Chi-square test was conducted and Yates' continuity corrected value was reported along with crude odds ratio and 95% CI. Spearman rank order correlation was done to determine the relationship between non-normally distributed quantitative variables. All tests were two tailed and $p < 0.05$ was considered to be statistically significant.

In univariate analysis, variables those found statistically and significantly associated with the outcome variable were included in a binary logistic regression model to find out the important predictors adjusting for other factors. The final result was reported with adjusted odds ratio with 95% CI and p value.

Results

Study population

In this study, total study population was 278. Out of them 172 were males and 106 were females. Majority (95.9% [$n=165$]) of the males were of normal weight. Among the female respondents, about 32.1% ($n=34$) were overweight and obese. The normal and high BMI adolescents in the study had significantly different proportions according to their gender ($p < 0.001$); females were almost 11 times more likely to be overweight and obese in this sample. Educational status of both parents ($p=0.036$ and 0.024) and smoking status ($p=0.022$) were also found significant factors affecting body mass index of the respondents (Table I).

Table I: Difference in sociodemographic characteristics between normal weight vs overweight and obese category

| Characteristics | Body Mass Index of respondents | | χ^2 | p value | Crude OR (95% CI) |
|-------------------------------------|--------------------------------|--------------------|----------|---------|-------------------|
| | Normal weight | Overweight & obese | | | |
| | n (%) | n (%) | | | |
| Sex of the respondents | | | | | |
| Male | 165 (95.9) | 7 (4.1) | 38.71 | <0.000 | 11.13 (4.7–26.6) |
| Female | 72 (67.9) | 34 (32.1) | | | |
| Religion | | | | | |
| Muslim | 199 (86.1) | 32 (13.9) | 0.501 | 0.479 | |
| Non muslim | 38 (80.9) | 9 (19.9) | | | |
| Educational status of father | | | | | |
| HSC and below | 47 (95.9) | 2 (4.1) | 4.04 | 0.036 | 4.48 (1.12–5.42) |
| Graduate and above | 190 (83) | 39 (17) | | | |
| Educational status of mother | | | | | |
| HSC and below | 150 (83.9) | 18 (10.7) | 8.89 | 0.024 | 2.7 (1.12–5.46) |
| Graduate and above | 87 (79.1) | 23 (20.09) | | | |
| Occupation of fathers | | | | | |
| Service holder | 142 (85.5) | 24 (14.5) | 0.028 | 0.868 | |
| Businessman | 95 (84.8) | 17 (15.2) | | | |
| Occupation of mothers | | | | | |
| Service holder | 51 (89.5) | 6 (10.5) | 0.638 | 0.424 | |
| House wife | 186 (84.2) | 35 (15.8) | | | |
| Smoking status of respondent | | | | | |
| Smoker | 147 (81.7) | 33 (18.3) | 2.2 | 0.022 | 4.3 (1.1–4.3) |
| Non smoker | 90 (91.8) | 8 (8.2) | | | |

Physical activity and BMI of respondents

Two-fifths (n=112, 40%) of the respondents were in ‘sedentary’ category; rest were more or less equally distributed in moderately active (n=81, 29%) and active (n=85, 30%) groups (not shown in table). Spearman’s Rank Order correlation showed a weak, negative correlation between physical activity and body mass index, which was statistically significant ($\rho=-0.15$, $p<0.05$). (ρ =Spearman’s rank correlation coefficient). Increase in physical activity was significantly correlated with decrease in body mass index in this study sample and found more obvious in female samples when sex stratification was done (Fig 1).

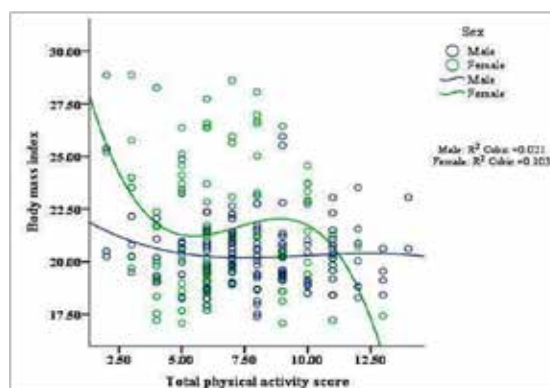


Fig 1. Relationship of physical activity score with BMI by sex

Adolescent stress

Adolescents reported highest levels of stress from future uncertainty, school/leisure conflict and stress from home life whereas lowest levels of stress from school attendance (Table II). It was also found that,

Body mass index was also statistically significantly correlated with all the three DEBQ eating scales. DEBQ restraint score and emotional eating score $\rho=0.58$ ($p<0.001$), and external eating $\rho=0.55$, ($p<0.001$) (Fig 2).

Table II: Descriptive statistics of ASQ scale (N=278)

| ASQ Scale | Number of items | Mean (SD) | Minimum-Maximum | Range |
|-------------------------------|-----------------|-------------|-----------------|-------|
| Home life | 12 | 3.40 (0.54) | 1.58–4.67 | 3.08 |
| School performance | 7 | 3.31 (0.63) | 1.43–4.57 | 3.14 |
| School attendance | 3 | 2.42 (0.87) | 1.00–4.67 | 3.67 |
| Romantic relationship | 5 | 3.02 (0.92) | 1.00–5.00 | 4.00 |
| Peer pressure | 7 | 2.85 (0.72) | 1.00–4.57 | 3.57 |
| Teacher interaction | 7 | 2.89 (0.56) | 1.49–4.49 | 3.00 |
| Future uncertainty | 3 | 3.83 (0.90) | 1.00–5.00 | 4.00 |
| School/leisure conflict | 5 | 3.55 (0.68) | 1.40–5.00 | 3.60 |
| Financial pressure | 4 | 2.99 (0.79) | 1.00–4.75 | 3.75 |
| Emerging adult responsibility | 3 | 3.11 (0.76) | 1.00–5.00 | 4.00 |

majority (86%) of the respondents were highly stressed and the rest were moderately stressed. None in the study scored to be in low stress category.

Spearman’s Rank Order correlation between variables of interest and BMI

Spearman’s Rank Order correlation coefficients (ρ) and significance levels are reported in Table III. Eight out of the ten domains of adolescents, stress subscales except stress contributed by financial pressure and interaction with teacher showed significant positive correlation with body mass index; any increase in the reported significant variables is likely to result in a positive increase in BMI (all significant at $p<0.01$ and <0.05 level).

Table III: Spearman correlation of stress and body mass index

| Measure | ρ | p values |
|-------------------------|--------|----------|
| Home life | 0.27 | <0.001 |
| School performance | 0.36 | <0.001 |
| School attendance | 0.17 | <0.001 |
| Peer pressure | 0.15 | <0.05 |
| Romantic relation | 0.23 | <0.001 |
| Teacher interaction | 0.70 | 0.352 |
| Adult responsibility | 0.18 | <0.001 |
| Financial pressure | 0.34 | 0.542 |
| Future uncertainty | 0.16 | <0.001 |
| School/leisure conflict | 0.35 | <0.001 |

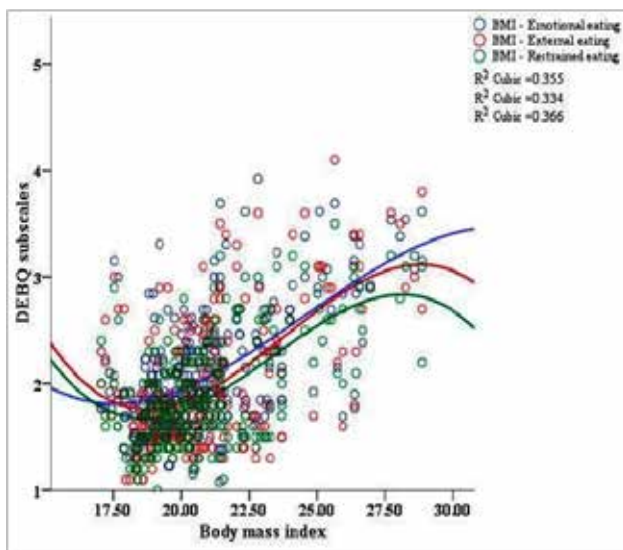


Fig 2. Relationship of BMI with eating behavior subscales of DEBQ

Stress and BMI in adolescents

Multivariate analysis showed sex, education level of father, school/leisure conflict and restraint eating statistically significantly associated with BMI when adjusted for other factors (Table IV).

Among the respondents, females had about 19-fold higher risk of developing overweight and obesity in comparison to males (OR with CI; 19.2, 4.70–90.65). Participants having fathers who were educated up to graduation or further had 16 times higher chance

of being overweight or obese than their peers who had fathers with lower levels of education (OR with CI; 16.2, 1.6–164.94). Results also showed that respondents who had experienced stress due to school/leisure conflict had 4 times higher risk of gaining weight and becoming overweight and obese (OR with CI; 4.18, 1.26–13.8). Respondents who had restraint eating behavior were 45 times more likely to be overweight and obese, controlling for other factors (OR with CI; 45.83, 3.14–236.2).

Discussion

The present study was conducted to find out the coherence of stress and body mass index of adolescent students of Bangladesh. In the sample, females were found to be higher at risk of being overweight and obese as compared to males. A study done by Vidal et al¹⁵ on Portuguese adolescents showed higher mean BMI in females than males. During adolescence, it is a common scenario in our country that females become more homebound compared to the boys and hormones (Estrogen and progesterone) are also likely to play positive role in weight gain in female teens. The data demonstrated that having a highly educated father increased the likelihood of a child to be overweight or obese. Parental educational level was reported associated with overweight in children previously.¹⁶ Wilkosz et al¹⁷ showed parents’ lower educational level was related to overweight status in adolescents. In context of Bangladesh, parents attaining high levels

Table IV: Predictors for adolescent BMI adjusted for other factors (N=278)

| Characteristics | Coefficient (β) | SE | χ ² | p values | Adjusted OR | 95% CI |
|---|-----------------|-------|----------------|----------|-------------|------------|
| <i>Sex of the respondent</i> | | | | | | |
| Male | | | | | | |
| Female | 2.95 | 0.79 | 13.4 | <0.001 | 19.2 | 4.70–90.65 |
| <i>Educational status of the father</i> | | | | | | |
| HSC and below | | | | | | |
| Graduate and above | 2.79 | 1.18 | 4.6 | 0.018 | 16.2 | 1.6–164.94 |
| <i>Stress due to school/leisure conflict</i> | | | | | | |
| | 1.43 | 0.609 | 2.73 | 0.019 | 4.18 | 1.26–13.8 |
| <i>Eating behavior of the respondents</i> | | | | | | |
| Emotional eating | -0.456 | 1.08 | | 0.52 | | |
| External eating | -1.05 | 1.06 | | 0.40 | | |
| Restraint eating | 3.82 | 1.23 | 9.02 | <0.00 | 45.83 | 3.14–236.2 |

of education are expected to be more affluent due to higher job and income security and their children are more likely to be overweight and obese due to more availability of food, modern life facilities (eg, increasing purchasing power, availability of car for transport, internet facilities etc,) which tend to make an adolescent overweight and obese.

Among the participants, majority were nonsmokers including all the female respondents. Rest of the participants had some experiences in smoking (occasional or regular). As data were collected from older adolescent groups (age 16–19 years) and late adolescence is usually a starting time for smoking, this finding is not unusual.

Nonsmokers were found less likely to be of normal weight than smokers. Many literatures supported similar type of association between smoking and body mass index which indicated that mean BMI tended to be lower among smokers than among nonsmokers in many populations. One would expect that, because of the metabolic and possibly anorexic effects of smoking, those who initiate smoking during the study (called “smoking initiators”) would gain less body weight over time than would nonsmokers.¹⁸ But, smoking showed no relationship with higher body mass index after stratified analysis. This finding was due to the fact that all the females were included in our nonsmoker group, who in context of our country’s social and cultural norms are usually nonsmokers, thus sex might confound the effect of smoking.

Physical activity plays an important role to prevent obesity.¹⁹ As far as physical activity and lifestyle are concerned, though most adolescents have moderate physical levels, about one-third of the students led a sedentary lifestyle. This result represents a typical adolescent habit in spending many hours in sedentary activities (watching television, using computer, listening to music, reading a book etc). Most of the respondents chose the option of watching television in their leisure time. Watching television has been linked with an unhealthy diet, high cholesterol levels and overweight and obesity.²⁰ This may be influenced by unhealthy nutrition messages in commercials, eating junk foods and decreased physical activity. Correlation analysis suggested physical activity as a protective factor against weight gain in teens. Studies have shown that daily physical activity benefits

health and protect against varieties of physical and psychological conditions.^{21,22} Research has indicated that consistent exercise participation is crucial for weight maintenance across time in adults and it is probable that this relationship also holds in youth.²³ Sue et al²⁴ stated that ‘preventing the steep decline in physical activity during adolescence is an important method to prevent obesity’.

When considering the relationship between eating behavior and body mass index, disordered eating behavior seemed to influence weight gain in teens. Respondents who had restraint eating behavior were at much higher risk of gaining higher BMI as revealed in our study. These findings are consistent with those found in other studies conducted in adolescents and obese children, which showed higher scores for emotional, external and restrained eating behavior. Vidal et al¹⁵ reported that, in Portuguese adolescents, overweight/obese subjects had higher restraint scores in both genders. One study supported a positive cross-sectional association between restrained eating and BMI²⁵, whereas others found no significant relation²⁶ or inverse relations²⁷. However, an excessive restriction may have a counterproductive effect and may eventually be followed by weight gain. Indeed, the intent to diet may be disrupted by certain events such as stress²⁸ or enjoyed foods²⁹. Successions of restrained eating and disinhibition may lead to a vulnerable weight cycle.³⁰

In the present study, adolescents reported to experience highest levels of stress from home stress followed by their school performance related stress. Lowest levels of stress were experienced from other dimensions such as romantic relationships, peer pressure, financial pressure or emerging adult responsibility. Several domains of adolescent stress scale demonstrated positive association with body mass index; but financial pressure related stress and stress due to relationship with teacher showed no association with BMI. Compared to their western counterparts, the adolescents in our country take financial responsibility at a later stage, generally during their adulthood. In our society, adolescents are considered as children and their financial needs are met by their families, which might be a reason why this domain showed insignificant statistical association with body mass index.

In the sample, after controlling for other factors, school/leisure conflict related stress seemed to have positive influence on the body mass index of the participants. Adolescents were likely to be overweight or obese if they had experienced this category of stress. When compared with the previous literature, similar positive associations of personal stress with general and central adiposity measures in adolescents were found by Yin et al.³¹ School-related stress has previously been as the main source of stress in urban African-American and high-risk American adolescents, indicating that the school environment is a non-negligible source of adolescent stress.³² Additionally, school-related stress was demonstrated to be associated with more compromising health behaviors, health complaints and psychological complaints.³³ It is important that, school administration and teachers are aware of this and that they are involved in developing strategies to turn down the experience of stress in adolescents and to ameliorate their coping capacities. Recently, Kraag et al³⁴ documented that school programs, targeting stress management or coping skills, are effective in reducing stress symptoms and enhancing coping skills in school-aged children and adolescents, and that these kinds of primary preventions should be promoted in schools. Moreover, Wells et al³⁵ reported that the most effective approach to promote mental health in schools is the ‘whole-school approach’, including key elements such as changing the school environment, developing personal skills in class, involving parents and the community and actively involving the school.

Majority of the high school students were highly stressed. The data demonstrated that several risk factors such as female gender, having father with high educational status, restraint eating behavior and stress contributed by school/leisure conflict were associated with being overweight and obesity whereas high physical activity level seemed to be protective against obesity among a sample of urban students. Future research is recommended to investigate long-term effects of stress on adolescence adiposity and to explore a country specific school based approach of stress prevention and management programs.

Limitations

The study was conducted in two higher secondary schools in Dhaka city. So, the risk factors that the study identified may not be representative of all adolescents in Bangladesh.

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