



ENVIRONMENTAL PRESSURES: STRESS AS A CULPABLE FACTOR INFLUENCING DIETARY CHOICES AMONG ADOLESCENTS

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ABSTRACT Stress in adolescents is a major lifestyle indicator which has a bearing on dietary habits and associated long-term disease risk. The aim of this cross-sectional study was to examine the prevalence of stress and its association with dietary choices among randomly selected adolescents (12-14 years, N= 200). Stress was measured using Cohen's perceived stress scale (PSS-14) and tailored academic stress scale (Sun et al, 2011). Dietary choices assessed using food frequency questionnaire. The results revealed girls reported higher stress (61.6%) compared to boys (53.4%). There was a positive correlation between perceived- academic stress and consumption of bakery-confectionary products ($r=0.146^*$, $p<0.05$), other savory products ($r=0.168^*$, $p<0.05$) and soft drinks ($p<0.05$). The associations among high stress and high fat and sugar foods show stress as a conducive factor upsetting dietary choices. Hence call for a multi-modal approach to tackle stress and unhealthy dietary choices.

KEYWORDS : Stress, food choices, faulty diet, environmental pressure, adolescents, stress and BMI

INTRODUCTION

Nutrition transition has led to a shift towards faulty dietary pattern and reduced energy expenditure across all ages and gender. Adolescent years being the most vulnerable among all ages. This dietary and lifestyle transition also holds significance in the context of understanding dynamics of origins of non-communicable diseases which are carried into adulthood. The changing aspects of environmental exposures and chronic diseases are now recognized beyond the fetal period (Popkin, 2013). Adolescent years are acknowledged to be a major determinant of adult body composition and the risk of chronic diseases (Popkin, 2006). Research studies from low and middle income countries states rapid weight gain from mid childhood worsen the risk of hypertension and impaired fasting glucose in adulthood (Adair, 2009). In India total adolescent population is around 236.5 million which makes up to 20.9 % of total population (Census of India, 2011). WHO defines an adolescent as an individual between 10- 19 years of age. Therefore, adolescents' health and nutritional status holds prominence as it affects the composition and skills as innovators, frontrunners of the nation. There is a growing evidence suggesting environmental pressures such as stress and anxiety alter the health behaviors predominantly dietary choices which subsequently alters appetite and leads to poor health (Pretlow 2011). A cumulative effect of stressors is observed when physiological response and psychological response combine together (Bernstein ,2016). The most indicative stressors are peer competitions, academic assignments, unharmonious relations with teachers and peers and students perception of high expectations of extensive knowledge required and the shortage of time to attain this knowledge (Fairbrother & Warn, 2003, Carveth et al, 1996).

), One such stress related behavior is emotional eating which leads to consumption of high energy density foods (Razolli et al ,2017) .Stress is defined as "the non-specific responses of the body to any factor that overwhelms or threatens to overwhelm the body's ability to maintain homeostasis" (Sherwood, 2001). According to western psychology stress is believed to be a result of environmental happenings, while in Indian psychology expectations from the individual leads to a stressful situation (Palsane et al., 1986). Environmental stressors induce various types of stress acute or chronic, short term or long term during adolescence which alter eating behavior thereby upsetting hormonal balance and appetite (Wardle and Gibson, 2002; Takeda et al., 2004). A study by Jaaskelainen et al. 2014, explained a positive association between stress driven eating elicited by consumption of sausages, chocolates, sweets, burgers and pizzas thereby increasing the risk of obesity among adolescents. Likewise Tajik et al., 2014 stated that adolescents who suffer from stress, affects their health through poor dietary choices and eating behavior.

Furthermore positive associations between reduced cognitive performance at school and western dietary patterns characterized by high intakes of take-away food, red and processed meat, soft drink, fried and refined food have also been observed among adolescents (Nyardi, 2014). As observed, substantial amount of research is done among children on this subject around the world. In the Indian context, limited numbers of studies have been published to understand the link between stress ,food choices made and nutritional status among adolescents. The present study investigates the prevalence of self-reported stress related eating behavior and its association with food selections .

Need for the study

Prevalence of stress amongst adolescents in India is found to be 20% and the prevalence rate of depression in youth is roughly 15% to 20%. (Sahoo & Khess ,2010). Academic issues or academic problems are the most important source of acute or chronic stress for young people in both Western and Asian countries. (Jayanthi et al. 2014).During adolescence dietary patterns are established and these may increase the susceptibility towards non communicable diseases such as obesity. Stress resulted in increased food intake and body weight gain with low physical activity as a coexisting factor leading to obesity among stressed adolescents (Dallman , 2003). Various studies have shown a positive association between high fat and high sugar foods while experiencing moderate to severe stress). (Michaud et al 1990, Oliver et al 2003, Robert et al, 2014 , Jaarveld et al 2009) In the Indian context, limited numbers of research studies are found on this subject in children as well as adolescents. The present study investigates the prevalence of self reported stress related eating behavior and its association with food choices.

Aims and objectives of study:

Aim: To observe stress related food choices among adolescents (12-14 yrs).

Primary Objectives

- To assess the stress levels among adolescents
- To assess the food choices among adolescents
- To find associations between food choices and stress levels among adolescents.

Secondary Objectives

- To assess the nutritional status of adolescents
- To assess the physical activity of adolescents

Methodology:

Approvals and sampling techniques:

Approval obtained from Doctoral Committee and Ethical committee prior to study. Consent of the Principal of coaching classes. Informed consent of parents and assent of participants obtained.

Study Design: Cross sectional ,Observational study

Study Setting: Urban Coeducational coaching classes from Pune

Sample Selection-

Samples for the study were selected by random sampling method. Children from various private institutes were selected for the study by random sampling method. Written individual consent was taken from all students, head of the institutes and teachers and parents. Participation was voluntary and anonymous, and withdrawal from the study was possible at any stage.

Students in the age group of 12-14 years who were willing to participate were included in the study. Students with specific health issues were excluded from the study.

Sample Size: 200(114 = boys and 86 = girls (Charan et al 2013)

Tools and techniques of data collection:

General Information on age, gender, family type, working status of parents was collected using a structured questionnaire.

Assessment of Stress

Perceived stress was assessed using Cohen's Perceived Stress Scale (PSS) of 10 items (Cohen et al, 1983. A global measure of perceived stress).The Perceived Stress Scale (PSS) is the most widely used psychological instrument for measuring the perception of stress. The questions in this, measures how random, uncontrollable, and burdened respondents find their lives. The scale also includes a number of straight inquiries about current levels of experienced stress.

using a 5-point Likert scale response format ('0 = Never', '5 = Very Often').

Academic stress was measured using a structured questionnaire modified from Educational Stress Scale (Sun et al 2011) which included questions pertaining to the pressure related with academic performance in the class, pressure to meet deadlines for assignments , pressures related with teachers and parents expectations..The stress questionnaires were checked for content validation by psychology expert.Academic stress can be defined as a mental distress seen in students; it is a frustration which is linked with academic matters like academic failure, unawareness to the possibility of some failure, competing with other class mates, academic expectations from parents/teachers. (Lal, 2014).

Assessment of Dietary Choices

The dietary choices were assessed using food frequency questionnaire wherein the consumption of Food groups and consumption of processed food products such as bakery items sweets and savory items was assessed.

All questionnaires were pretested on children (n=20) from same age group and later was modified for clarity and language based on the feedback of the children.

Assessment of Physical Activity

Data on daily physical activity, intensity of physical activity, type of physical activity and duration was collected based on WHO physical activity guidelines, 2016.

Assessment of Nutritional Status

Height was measured using Stadiometer (Seca) and Weight using a digital weighing scales (Tanita). The BMI for age was calculated using WHO growth reference, 2007.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 16.0, using descriptive statistics such as frequencies, mean, standard deviation, cross tabulations. Chi square was applied to observe the association between two variables, with 95% confidence limit (p<0.05) or with 99% confidence limit (p<0.01).Pearson's Co relation was applied to determine the association between two variables. To compare mean values of 2

independent variables independent't' test was performed.

Results

Sample Characteristics

The basic features of the sample under study are discussed in table 1.

Table 1 depicting sample characteristics

Variable	Characteristics	Descriptive Statistics
Age	12-14 years	13.2±0.32
Gender	Boys	114 (53%)
	Girls	86 (47%)
Socioeconomic status	Middle income group	96 %
	Higher income group	4%
Family type	Nuclear	68%
	Joint	32%
Working status of parents	Both parents working	60%
	Father working	40%
Anthropometry	Height	152.80 ±8.16
	Weight	49.62± 7.39
	BMI: Underweight	20 %
	Normal	70%
	Overweight Obese grade 1	19.3% 1.8%
Physical Activity		
No	Boys	23.7
	Girls	60.5
Moderate	Boys	16.7
	Girls	18.6
Vigorous	Boys	59.6
	Girls	20.9

Results of perceived stress scores and association with foods

The perceived stress scores for both genders .In males 62 subjects (54.3%) were having moderate stress, following by 30 subjects (26.31 %) with high stress and 22 subjects (19.3 %) having average stress was found. While in females 53 (61.6%) subjects were having moderate stress, following by 19 subjects (22.1%) were having high stress and 14 subjects (16.3%) with average stress. Perceived stress scores were categorized as Average Stress (0-13), Moderate Stress (14-20) , High Stress (above 20).Gender differences were observed in perceived stress .Similar gender difference and suggested that females experiences more perceived stress than males do (Nolen et al 2001)

Table 2 depicting correlation of perceived stress and food groups consumed

	r value pearson correlation	P value significance two tailed
Cereal and products	0.083	0.243
Pulses and legumes	0.106	0.134
Milk and milk products	0.175*	0.013
Meat and meat products	0.016	0.825
Vegetables	-0.029	0.684
Fruits	0.165*	0.020
Bakery products(bread, biscuits and cakes)	0.146*	0.039
Sugars and confectionary	0.142*	0.039
Other savoury items (chips, fried items like samosa, vadapao , burgers, noodles)	0.168*	0.017

The consumption of bakery products (r value=0.146*, p<.05) sweet products (r value=0.142* , p<.05) , other products (r value=0.168* , ere was a positive correlation seen between perceived stress and p<.05) which was statistically significant . There was an negative co relation seen in consumption of fruits and perceived stress (r value=0.165* , p<.05)

Results of academic stress and association with food. Academic stress score in both genders was seen. In males 60 subjects (52.6%) were having moderate stress, following by 49 subjects (43.0%) with high stress and 5 subjects (4.4 %) having low stress was found. While in females 53 (61.6%) subjects were having moderate stress, following by 29 subjects (33.7%) were having high stress and 4 subjects (4.7%)

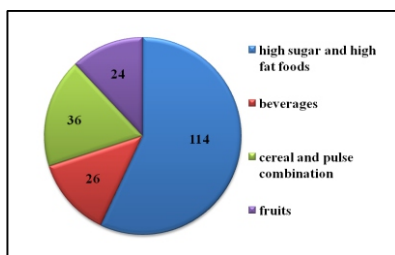
with low stress. The Academic Stress Scores were categorized as Low Stress (0-7), Moderate Stress (8-14), High Stress (15-25). Gender difference was seen for academic stress scores as well. In current study Academic stress was more seen in females (61.6%) than in males (52.6%). Adolescent girls have higher academic stress than boys suggested by Deb et al, 2014.

Table 3 depicting correlation of academic stress and food groups consumed

Food Groups	r value pearson correlation	P value significance two tailed
Cereal and products	0.61	0.392
Pulses and legumes	0.79	0.268
Milk and milk products	-.0047	0.504
Meat and meat products	0.059	0.404
Vegetables	0.062	0.384
Fruits	0.187**	0.008
Bakery products(bread, biscuits and cakes)	0.200**	0.004
Sugars and confectionary	0.170*	0.016
Other savory items (chips, fried items like samosa, vadapao , burgers, noodles)	0.152*	0.032

- There was a positive correlation seen between academic stress and consumption of bakery products (r value= 0.200**, p < .05) fig , sweet products (r value= 0.170*, p < .05) fig , other products (r value= 0.152*, p < .05) fig which was statistically significant . There was a negative co relation seen in consumption of fruits and perceived stress (r value= 0.187**, p < .05). There was a significant association seen between academic stress and high sugar high fat foods preferred under stress with significance of p < .05.

Figure 1 depicting frequency of students and food choices under stress.



In the present study food preferences under stress was observed in the present study, it was found that consumption of high fat and high sugar foods was highest which was around 57% (n=114). Similar results were obtained by study done by Torres and Nowson, 2007 which says that stress induces eating tendency, particularly a desire for high-calorie foods i.e foods with high sugar and high fat.

Association between Physical Activity, gender and BMI

It was observed that 75.40% (n=86) boys were involved in daily physical activity while 39.50% (n=34) girls were involved in daily physical activity. This suggests of sedentary behavior observed more in girls. There was a significant association seen between gender and daily physical activity and intensity of physical activity with significance of (p < .05). Daily physical activity and its intensity was also assessed in the present study. BMI was also significantly associated with daily physical activity with significance of 0.000 (p < .05). BMI is inversely co related with daily physical activity.

Discussion and Conclusion

This study was an attempt to understand stress as a psychological determinant of food choices made. The participants of the study were between 12-14 years of age enrolled in coaching classes after school. As children during early adolescence are undergoing various developmental and pubertal changes and it is important to assess their stress levels so as to understand the magnitude of environmental pressures at early adolescence. The study focused on perceived as well as academic stress. The features of the dietary practices included the consumption of various food groups particularly fruits and vegetables, high fat and high sugar foods. The dietary pattern not just highlighted

the consumption of high fat and high sugar foods but also showed that the consumption of fruits and vegetables was low in individuals experiencing high to moderate stress. Various studies have found the anticipated contraption for stress induced changes in eating and food choices among adolescents are motivational changes such as reduced self-efficacy towards concern about weight control, physiological suggested by low appetite and practical changes in eating opportunities, food accessibility and meal preparation. The sample characteristics revealed that majority of the students belongs to nuclear families in which both the parents were working. Whether the working status of parents is a potential determinant of risky behaviors among adolescents including eating and drinking behavior made by adolescents needs to be researched further (Han et al 2010). However it has been found that students with low social support who are highly anxious exhibit a hyperphagic response (Sproessor et al, 2013) In general, people show an individualist response to stress either by eating less or more.

There is a hormonal interplay in which corticotrophin releasing hormone, non adrenaline suppress the appetite and on the other hand cortisol may stimulate the appetite (Torres et al 2007). This can either lead to hyperphagia or hypophagia (Kandiah et al., 2006; Oliver and Wardle, 1999; Zellner et al., 2006) or sometimes both depending on the duration of stress.

However, the choices made under stress are an important aspect to understand the effect of food selections on nutritional status (Oliver & Wardle 1999). Studies also suggest prolonged or frequent work stress lead to adverse dietary changes which consequently, increase the possibility of weight gain and cardiovascular risk (Wardle et al. 2000). A review on pediatric obesity identified stress to be a determinant in development and maintenance of obesity among children. The stress induced eating tendency was recognized as a factor for high calorie food consumption (Wilson, 2014).

The present study suggested adolescent girls having higher stress perceived as well as academic compared to boys. Similar findings were obtained when stress-related eating behavior was assessed among girls and boys. Girls (43%) showed unhealthy eating as a coping strategy towards stress compared to boys (15%) (Jaaskelainen, 2014). Food preferences under stress were observed in the present study revealed consumption of high fat and high sugar foods to be 57% (n=114). Similar results were obtained by Torres and Nowson, 2007 suggesting stress induces unhealthy eating tendency, particularly a desire for high-calorie foods particularly foods with high sugar and high fat.

Stress or negative emotions leading to increased eating and reduced negative emotions. BMI for age analysis suggested prevalence of underweight, overweight and obesity at 10%, 22% and 3 % respectively.

A strong linkage between stress and obesity has been found through various mechanisms such as increase in appetite leading to consumption of high energy foods on the other hand low energy expenditure or low physical activity along with accumulation of visceral fat (Vriendt et al, 2012)

People dealing with long term stress tend to overeat and perceive this as a coping mechanism under stressful situation (Larissa and Drescher et al; 2014). The present study did not capture the individualistic responses obtained such as pressure of exam or inability to cope up or peer competition as individualistic stressors. However, the study looked at the cross sectional response of stress and dietary choices made. Collectively though the stress levels were found to be high among both boys and girls, the associations between stress and food choices were modest. However the findings suggest stress as an environmental factor which affects the food choices made.

CONCLUSION

The interpretation of the results implies that perceived and academic Stress was associated with food choices made in adolescents among which choice done for unhealthy foods was more.

Foods preferred under stress were of high fat and high sugar foods. Incidence of overweight and sedentary behavior was observed in females. The findings imply that strategies formulated to reduce stress in adolescents could be useful in improving food choices and thereby

reducing the risk for obesity and other problems in adolescents.

RECOMMENDATIONS

- Strategies formulated to reduce stress in adolescents could be useful in improving food choices and thereby reducing the risk for obesity and other problems in adolescents.
- Planning of continuous stress management counseling and nutrition education, stressing the importance of balanced diet should be recommended.
- Special nutrition counseling sessions should be conducted before examinations.
- Parents should be imparted nutrition education stressing the role of diet sleep, stress and physical activity for lifestyle modification.

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REFERENCES

1. Adair LS, Martorell R, Stein AD, et al. Size at birth, weight gain in infancy and childhood, and adult blood pressure in 5 low- and middle-income-country cohorts: when does weight gain matter? *Am J Clin Nutr*.2009;89:1383–1392.
2. Bernstein, C. N. (2016). Psychological stress and depression: Risk factors for IBD Digestive Diseases, 34(1-2), 58-63.
3. Carveth, J.A., Gesse, T., & Moss, N. (1996). Survival strategies for nurse-midwifery students. *Journal of Nurse-Midwifery*, 41(1), 50-54.
4. Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research?. *Indian journal of psychological medicine*, 35(2), 121.
5. Cohen, S; Kamarck T; Mermelstein R (December 1983). "A global measure of perceived stress". *Journal of Health and Social Behavior*. 24 (4): 385–396.
6. De Vriendt T, Clays E, Huybrechts I, De Bourdeaudhuij I, Moreno LA, Patterson E, et al. European adolescents' level of perceived stress is inversely related to their diet quality: the Healthy Lifestyle in Europe by Nutrition in Adolescence study. *Br J Nutr*. 2012;108(2):371–80.
7. Dallman MF, Pecoraro N, Akana SF, et al. Chronic stress and obesity: A new view of "comfort food". *Proceeding of the National Academy of Sciences of the United States of America*. 2003;100(20):11696-11701.
8. Felitti, V. J. (2017). Effects of 12-and 24-Week Multimodal Interventions on Physical Activity, Nutritional Behaviors, and Body Mass Index and Its Psychological Predictors in Severely Obese Adolescents at Risk for Diabetes Fall 2010. *Issues*, 2016.
9. Fairbrother, K., & Warm, J. (2003). Workplace dimensions, stress and job satisfaction. *Journal of Managerial Psychology*, 18, 8-21
10. Han, W. J., Miller, D. P., & Waldfogel, J. (2010). Parental work schedules and adolescent risky behaviors. *Developmental psychology*, 46(5), 1245.
11. Jääskeläinen Anne , Nevanperä Nina Remes Jouko Rahkonen Fanni Järvelin Marjo-Riitta and Laitinen Jaana (2014) Stress-related eating, obesity and associated behavioural traits in adolescents: a prospective population-based cohort study *BMC Public Health*, 321
12. Jayanthi,M.Thirunavakharasu , Rajamanikum ,Rajkumar (2015) Academic Stress and Depression among Adolescents: A Cross-sectional Study *Indian Paediatrics Volume 52-2014*
13. Jaarsveld CHM, Fidler JA, Steptoe A, Boniface D, Wardle J. Perceived Stress and Weight Gain in Adolescence: A Longitudinal Analysis. *Obesity*. 2009;17(12):2155–2161.
14. Krishan Lal, *American International Journal of Research in Humanities, Arts and Social Sciences*, 5(1), December 2013-February 2014, pp. 123-129
15. Kandiah, J., M. Yake, J. Jones and M. Meyer. 2006. Stress influences appetite and comfort food preferences in college women. *Nutrition Research* 26 (3): 118–123. doi:10.1016/j.nutres.2005.11.010
16. Larissa S. Drescher, *Food Choices under Stress: Considering Internet Usage and Social Support*, Technische Universität München, Marketing and Consumer Research, Montréal, Québec, Canada -May 29-30, 2014
17. Michaud C, Kahn JP, Musse N, Bulet C, Nicolas JP, Mejean L. Relationships between a critical life event and eating behaviour in high-school students. *Stress Medicine*. 1990;6(1):57-64
18. Nolen-Hoeksema, S. (2001). Gender differences in depression. *Current directions in psychological science*, 10(5), 173-176.
19. Nyardi Anett, Lijianghong, Hickling Siobhan, Foster Jonathan K Jacques Angela, Ambrosini Gina L and Oddy Wendy H (2015) A Western Dietary Pattern Is Associated with Poor Academic Performance in Australian Adolescents *Nutrients*. Apr; 7(4): 2961–2982.
20. Oliver G, Wardle J, Gibson EL. Stress and Food Choice: A Laboratory Study. *Psychosomatic Medicine*.2000;62(6):853-865.
21. Oliver G, Wardle J. Perceived Effects of Stress on Food Choice. *Physiology & Behavior*. 1999;66(3):511–515.
22. Popkin BM, Conde W, Hou N, Monteiro C. Is there a lag globally in overweight trends for children compared with adults? *Obesity (Silver Spring)* 2006;14:1846–1853.
23. Palsane M N, Bhavasar S N, Goswami RP, and Evans , GW 1993. The concept of stress in Indian Tradition .Pune. University of Poona Press
24. Pretlow RA: Addiction to highly pleasurable food as a cause of the childhood obesity epidemic: a qualitative Internet study. *Eat Disord* 2011, 19:295–307
25. Razzoli, M., Pearson, C., Crow, S., & Bartolomucci, A. (2017). Stress, overeating, and obesity: Insights from human studies and preclinical models. *Neuroscience & Biobehavioral Reviews*.
26. Roberts, C. J., Campbell, I. C., & Troop, N. (2014). Increases in weight during chronic stress are partially associated with a switch in food choice towards increased carbohydrate and saturated fat intake. *European Eating Disorders Review*, 22(1), 77-82.
27. Sproesser, G., Schupp, H. T., & Renner, B. (2014). The bright side of stress induced eating: eating more when stressed but less when pleased. *Psychological science*, 25(1), 58-65.
28. Sherwood, A., Smith, P. J., Hinderliter, A. L., Georgiades, A., & Blumenthal, J. A. (2017). Effects of exercise and stress management training on nighttime blood pressure dipping in patients with coronary heart disease: A randomized, controlled trial. *American Heart Journal*, 183, 85-90.

29. Sahoo S, Khess CR. Prevalence of depression, anxiety, and stress among young male adults in India: a dimensional and categorical diagnosesbased study. *J Nerv Ment Dis* 2010; 198(12): 901-904.
30. Takeda E, Terao J, Nakaya Y, et al. Stress control and human nutrition. *J Med Invest*. 2004;51:139–145 E Tajiki ,Stress, Depression and Obesity among Adolescents: A Narrative Review *Pyrex Journal of Nutrition and Metabolism*, Vol 1 (1) pp. 001-005 April, 2015
31. Torres, S. J., & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition*, 23(11), 887-894. Chicago
32. Wardle J, Gibson EL. Impact of stress on diet: process and implications. In S. Stansfield, M. Marmot(Eds.), *Stress and the heart. Psychosocial pathways to coronary heart disease*, BMJ Publishing Group, London. 2002:124–149.
33. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva: WHO; 2006.
34. Zellner, D. A., Loaiza, S., Gonzalez, J. P., Morales, J., Pita, J., Morales, J., et al. (2006). Food selection changes under stress. *Physiology & Behavior*, 87, 789–793.