

**CORRELATION BETWEEN NUTRITIONAL STATUS AND STRESS RESPONSE
AMONG ADOLESCENT GIRLS IN KOLKATA, WEST-BENGAL**

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Adolescent is the period of rapid physical and psychological changes and considered to be the most vulnerable segment of the population in relation to nutritional, physical and behavioral aspects. The changing life style pattern, dietary habits, peer pressure to achieve educational success and limited finances create a stress on them.

The reciprocal interaction between stress and reproductive axis is manifested by ovulatory abnormalities and infertility in female adolescent girls. The main objective of this study is to find out whether the adolescent girls are facing any kind of stress-related hazards in reference to their diet, academic pressure and modern life-style pattern which can impair their health status.

50 adolescent girls (12-19 years) were surveyed using pre-tested questionnaires about nutritional status, general health, menstrual cycle and source of stress. Height, weight, BMI, BMR and body fat content (by Bioimpedance analyser), blood pressure, heart rate and O₂ saturation was measured.

The adolescent girls were stunned which indicates chronic malnutrition and lack of physical growth. Majority of them had a lower BMI (younger) and higher dysmenorrhea (older). Academic workload was found to be the most stressful event followed by, exercising, inadequate sleep, unhealthy dietary habits, and socio-economical status.

Adolescent is a person between 10 to 19 years of age and constitute one fifth of the total population of the world (WHO, 2006). In India population of adolescent is 1.2 billion which is about 21% of the total population of the world (WHO, 2006). Adolescent is a period of magnificent and rapid change and is vulnerable to a number of nutrition and health related problems (Chrousos *et al.*, 1998; Spear, 2000; Adam, 2006; Matchock *et al.*, 2007). Due to enhanced growth with rapid physical and psychological changes during this period, requirements of some specific nutritional substances and healthy diet is of paramount importance. Simultaneously changes in life style pattern, peer pressure to achieve educational success, limited finances create a stress on them. Adolescence is a critical period in the development of life long patterns of responding to stress. Stanley Hall characterize the adolescent period as 'storm and stress' (Hall, 1904). Anna Freud described a rapid oscillation between excess and asceticism during adolescence (Freud, 1959). The three most serious and common effects of stress are adrenal fatigue, neurotransmitter imbalances and hormonal and immunological disorders. Each of these conditions leads to another long list of debilitating symptoms which ultimately hampered the cognitive abilities of adolescents. appropriate activation of physiological stress responses are necessary for survival, repeated exaggerated

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or prolonged physiological reactivity to stressors may result in persistent dysregulation of stress system (e.g. HPA- Hypothalamic- pituitary-adrenal axis, ANS- Autonomic nervous system) leading to a variety of physical and psychiatric disorders ((Charmandari *et al.*, 2005; McEwen, 1998). Numerous studies have been done on stress response by HPA/ANS systems and results demonstrate that a reciprocal interaction between the two systems and the activity of hypothalamic pituitary gonadal (HPG) axis, highlighting the possibility of pubertal influence on stress response system (Chrousos, 1998 Spear, 2000). Stress causes various diseases, including infertility and ovarian dysfunction in female. Chronic stress can have a deleterious effect on the reproductive axis of females, as manifested in reduced pulsatile gonadotropin secretion and increased incidence of ovulatory abnormalities and infertility (Kalantaridou *et al.*, 2010).

MATERIALS AND METHODS

Survey Schedule: 50 adolescent girls (12-19 years) of a slum area in Kolkata were surveyed . Consent of individuals were taken prior to conducting the study.

(i) Nutritional Survey: Food consumption of the subjects was assessed using a 24-hour recall method for three consecutive days (Swaminathan, 2002). The average daily nutrient intake was calculated with the help of the food composition tables of Gopalan *et al.*, (2002). The daily nutrient intake was calculated in terms of energy, protein, fat, ascorbic acid, iron, retinol, folic acid, and calcium and compared against recommended dietary allowances for Indians (ICMR, 2000).

(ii) Anthropometric surveys: Nutritional status of all the adolescents was assessed by measuring body heights (cm), and weights (kg). The individuals were kept under basal condition with minimum clothings and without shoes (WHO, 1993). Body weight, BMI, BMR and body fat content were measured by Bioimpedance analyser(Model-OMRON-HBF-375). Pulse rate and O₂ saturation was measured by Pulse-Oxymeter and blood pressure by Sphygmomanometer.

(iii) Survey of Menstrual history: Subjects are asked about the menstrual history in terms of menarche, dysmenorrhea, irregular menstruation and other problems if any by pretested Questionnaires guided by WHO (2007).

(iv) Survey of stress status: Stress status was assessed by pretested questionnaires along with initial questions designed to gather demographic data on the adolescents including academic year (Britg *et al.*, 2010). In the first phase of stress survey to rank the stress level of certain factors such as- socioeconomical status, academic workload, exercise, adequate sleep, and unhealthy dietary habits on a scale of 1 to 6, with 6 being the highest (Britg *et al.*, 2010). The second phase Questionnaires was designed to know how the adolescent girls thought they respond to stress. It inquired about the participant's degree of involvement in a variety of healthy and unhealthy behaviours.

(v) Anthropometric assessment for Nutritional status: Nutritional status was assessed from anthropometric indices as per recommendation of World Health Organisation for pubertal growth by using height for age (stunning),weight for age and body mass index (BMI) for age using National center for Health Statistics (NCHS standards) (WHO, 1993).

RESULTS AND DISCUSSION

Most of the girls are not aware of the functions of the foods, balanced diet and about healthy dietary habits. Dietary pattern shows (Table 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6) that there was a mean deficit of daily energy intake in all age group from 12 to 19 years. However the energy deficiency was most severe ($p < 0.01$) in adolescents of 14 to 18 years (Table 1.2, 1.3, 1.4, and 1.5.). Intake of protein, calcium, retinol and vitamin C were comparatively less than the recommended dietary allowances (RDA) of the respective age groups as per ICMR guideline (ICMR, 2000).

Overall adolescents were stunted (Fig-1) which indicates chronic malnutrition (stunting was high in younger adolescents of age group 12 to 14 years, where 63% were stunted at $< 3SD$ level). Average height for age (Fig.-1) was lower than standard WHO median height (WHO, 1995). The mean weight in all age group (Fig.-1) was significantly ($p < 0.05$) lesser in $<$ median 2SD level (NCHS standard) except 12% cases in older adolescents. Present study in slum area observed that no one was obese or severe thin. Result of the present study is similar to the previous reports where 51.43% and 35.5% of the adolescent girls were found to be malnourished (Singh and Mishra, 2001; Kapoor and Aneja, 1992). Hence there is a distinct difference between the health status of the girls from different socioeconomic background. These are lower intake of healthy food and nutrients than recommended and intake of unhealthy food and less consumption of leafy vegetables and fruits. These inadequate intake of nutrients compounded by financial constraints results nutritional deficiency disorders like stunting and undernutrition.

72.4% of girls have achieved menarche from 12 to 14 years, which is slightly higher than the previous observation by Prajapati *et. al.* (2011) but quite similar to Khanna *et. al.*, (2005). Dysmenorrhea as a menstrual problem is experienced by 57% of the older (15-19 years) adolescent girls.

Regarding stress status academic workload was ranked by the most adolescent girls to be the most stressful factor (Fig-2.1). Study also found that the older one (16 to 19 years) thought adequate sleep and regular exercise as a stressful event. Academics was found to be cause stress (Fig-2.2) in majority of the adolescent girls (47%) followed by, exercise (21%), inadequate sleep (14%), unhealthy dietary habits (10%), and socio-economical status (8%). According to Robert Sapolsky (1998) we are turned on the physiological system for months or end which required to respond in acute physical emergencies on exposure to stress. Britz, J *et. al.* (2010) found the adolescents as the most vulnerable group to develop chronic stress which have long lasting implications on health.

Though the target group of this study are from poor socioeconomic status, they would not thought it to be a significant stressor. This is perhaps due to the contribution of their parents who are quite aware about the basic needs of their wards. But lack of proper knowledge about the healthy habits like dietary pattern, adequate sleep and regular physical exercise their future one are facing various health problems like poor anthropometric indices, undernutrition, menstrual problem and experience somewhat or very high amount of stress which may hamper the physiological, cognitive as well as genetic potential of the adolescent girls.

CORRELATION BETWEEN NUTRITIONAL STATUS AND STRESS RESPONSE AMONG ADOLESCENT GIRLS

Table 1.1
Average Daily Nutrient Intake of 12 to 13 Years of Adolescent Girl

Nutrients	RDA(ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2010	1403.74(\pm 322.098)	S
Protein(g)	40.4	19.88(\pm 10.75)	S
Fat(g)	35	30.2(\pm 2.83)	NS
Calcium(mg)	800	433.76(\pm 193.41)	S**
Iron(mg)	27	15.46(\pm 6.04)	S**
Retinol(μ g)	600	307.0133(\pm 159.17)	S**
Vit C	40	19.4(\pm 10.80)	S*
Dietary Folate(μ g)	140	97.23(\pm 23.77)	NS
S= p <0.05 , S*= p <0.02, S**= p <0.01 , S***= p <0.001, NS=not significant			

Table 1.2
Average Daily Nutrient Intake of 13 to 14 Years of Adolescent Girl

Nutrients	RDA (ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2330	1583.14 \pm 392.104	S**
Protein(g)	51.9	25 \pm 14.005	S*
Fat(g)	40	31.143 \pm 4.673	NS
Calcium(mg)	800	510.2 \pm 152.879	S*
Iron(mg)	27	17.242 \pm 5.191	S*
Retinol(μ g)	600	456.014 \pm 78.97	S
Vit C	40	23.771 \pm 8.522	S
Dietary Folate(μ g)	150	110.971 \pm 21.121	NS
S= p <0.05 , S*= p <0.02, S**= p <0.01 , S***= p <0.001, NS=not significant			

Table 1.3
Average Daily Nutrient Intake of 14 to 15 Years of Adolescent Girl

Nutrients	RDA (ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2330	1723.186 \pm 329.597	S**
Protein(g)	51.9	27.47143 \pm 12.71	S**
Fat(g)	40	32.61429 \pm 3.927	NS
Calcium(mg)	800	577.3429 \pm 122.48	S***
Iron(mg)	27	19.18571 \pm 4.169	S
Retinol(μ g)	600	471.1429 \pm 71.696	S
Vit C	40	21.41429 \pm 9.704	S
Dietary Folate(μ g)	150	119.0571 \pm 16.449	NS
S= p <0.05 , S*= p <0.02, S**= p <0.01 , S***= p <0.001, NS=not significant			

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Table 1.4
Average Daily Nutrient Intake of 15 to 16 Years of Adolescent Girl

Nutrients	RDA (ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2330	1898.743 \pm 23.068	S**
Protein(g)	51.9	31.15714 \pm 10.828	S**
Fat(g)	40	31.25714 \pm 4.698	S
Calcium(mg)	800	620.2143 \pm 96.887	S***
Iron(mg)	27	20.05714 \pm 3.679	S**
Retinol(μ g)	600	497.3 \pm 57.988	S**
Vit C	40	22.65714 \pm 9.155	S*
Dietary Folate(μ g)	150	121.3429 \pm 15.0367	S
S=p<0.05 , S*=p<0.02, S**=p<0.01 , S***=p<0.001, NS=not significant			

Table 1.5
Average Daily Nutrient Intake of 16 to 17 Years of Adolescent Girl

Nutrients	RDA(ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2440	1925.325 \pm 272.384	S**
Protein(g)	55.5	30.55 \pm 12.942	S***
Fat(g)	35	31.05 \pm 2.316	NS
Calcium(mg)	800	617.1 \pm 100.204	S***
Iron(mg)	26	20.11429 \pm 3.15	S**
Retinol(μ g)	600	501.0375 \pm 57.814	S***
Vit C	40	22.5125 \pm 9.11	S
Dietary Folate(μ g)	200	131.875 \pm 35.5048	NS
S=p<0.05 , S*=p<0.02, S**=p<0.01 , S***=p<0.001, NS=not significant			

Table 1.6
Average Daily Nutrient Intake of 17 to 18 Years of Adolescent Girl

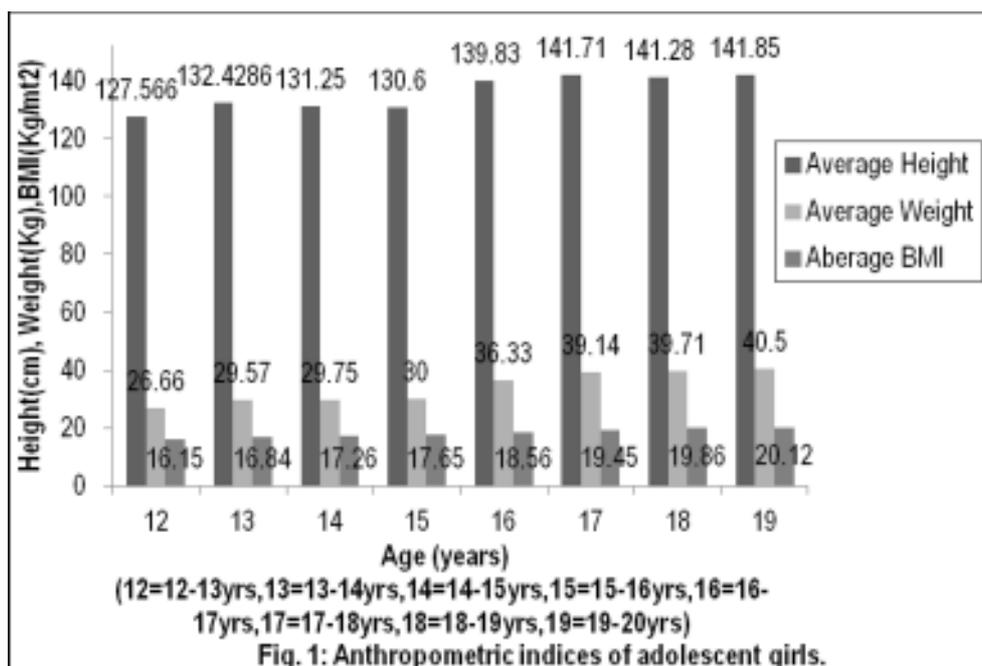
Nutrients	RDA (ICMR)	Observed Mean (\pm SD)	Result
Energy(Kcal)	2440	1968.013 \pm 250.85	S**
Protein(g)	55.5	31.4 \pm 12.54	S***
Fat(g)	35	31.3 \pm 2.31	NS
Calcium(mg)	800	620.35 \pm 100.289	S
Iron(mg)	26	20.68571 \pm 2.97	S***
Retinol(μ g)	600	507.2875 \pm 55.53	NS
Vit C	40	23.075 \pm 8.83	S
Dietary Folate(μ g)	200	133.875 \pm 34.33	NS
S=p<0.05 , S*=p<0.02, S**=p<0.01 , S***=p<0.001, NS=not significant			

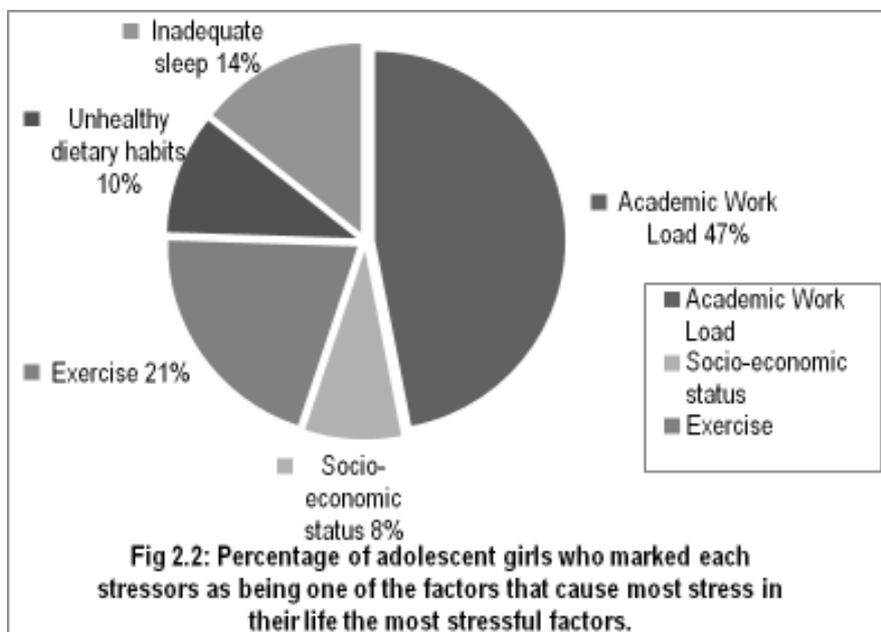
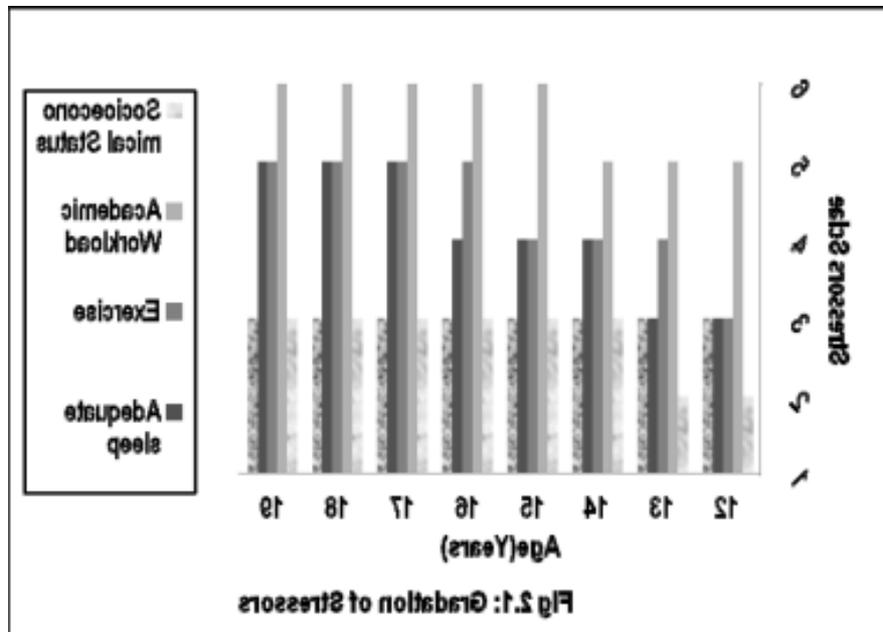
CORRELATION BETWEEN NUTRITIONAL STATUS AND STRESS RESPONSE AMONG ADOLESCENT GIRLS

Table 1.7
Average Daily Nutrient Intake of 18 to 19 Years of Adolescent Girl

Nutrients	RDA(ICMR)	Observed Mean(±SD)	Result
Energy(Kcal)	2230	1912.788±173.61	S
Protein(g)	55	30.225±12.93	S***
Fat(g)	25	18.075±3.71	NS
Calcium(mg)	600	468.425±73.83	S**
Iron(mg)	21	17.6±2.77	S
Retinol(µg)	600	496.1625±62.33	NS
Vit C	40	23.225±8.76	S
Dietary Folate(µg)	200	128.875±37.065	NS

S=p<0.05 , S*=p<0.02, S**=p<0.01 , S***=p<0.001, NS=not significant





REFERENCES

- Adam EK (2006): Transections among adolescent trait and state , emotion and diurnal and momentary cortisol activity in naturalistic settings. *Psychoneuroendocrinology*. **31**(5), 664-679.
- Britz J *et al.*, (2010): Sources and Outlets of Stress among University Students: Correlations between Stress and unhealthy habits. *URJHS*. Vol. **9**.
- Charmandari *et al.*, (2005): Endocrinology of stress response. *Annual Review of Physiology*. **67**, 259-284.
- Chrousos GP *et al.*, (1998): Interactions between the hypothalamic-pituitary adrenal axis and the female reproductive system: clinical implications. *Annals of Internal medicine*. **129**(3), 229-240.
- Freud A. Adolescence (1958): Psychoanalytic Study of the Child. IN: Handbook of Developmental Psychology. Cliffs E (Ed).Princeton Hall: New Jersey.
- Gopalan C, Ramasastri and Balasubramanian S C (2002): Nutritive value of Indian Foods. NIN (ICMR) Hyderabad, 94.
- Hall GS (1904): Adolescence. New York. Appleton.
- Indian Council of Medical Research (2000): Nutrient Requirement and Recommended dietary Allowances for Indians.NIN, Hyderabad, 67-89.
- Kalantaridou S N *et al.*, (2010): Corticotropin-releasing hormone, stress and human reproduction: an update. *Journal of Reproductive Immunology*. **85**. 33-39.
- Kapoor G and Aneja S. (1992). Nutritional disorders in adolescent girls. *Indian Pediatr*. **29**(8), 969-73.
- Khanna A, Goyal RS, Bhaswar R. (2005). Menstrual practices and reproductive problems: a study of adolescent girls in Rajasthan. *J Health Manag*. **7**, 91-107
- Matchock RL *et al.*, (2007): Diurnal and seasonal cortisol, testosterone, and DHEA rhythms in boys and girls during puberty. *Chronobiology International*. **24**(5); 969-990.
- McEwen BS (1998): Protecting and damaging effects of stress mediators. *New England J of Medicine* **338**; 171-179.
- Prajapati M, Bala D V, Tiwari H (2011): A Study of nutritional status and high risk behavior of adolescents n Ahmedabad: A Cross Sectional Study. *Healthline*, ISSN 2229-337X, **2** (1), 21-26.
- Sapolsky R. M. (1998): Why Zebras Don't Get Ulcers. An Updated Guide to Stress, Stress-related Disease, and Coping, New Yourk: Freeman.
- Singh N and Mishra C P (2001): Nutritional status of adolescent girls of a slum community of Varanasi. *Indian J Public Health*. **45**(4), 128-34.
- Spear L P (2000): The adolescent brain and age-related behavioralmanifestations. *Neuroscience and Behavioral Reviews*. **24**(4); 417-463.
- Swaminathan M (2002): Essentials of Food and Nutrition 2nd Edn., Bappco Publication, **2**, 337-338.
- World Health Organisation (1993): Measuring change in Nutritional Status. Guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups.Geneva.
- World Health Organisation (1993): Measuring change in Nutritional Status.Geneva. 1983.
- World Health Organisation, (1995): Physical Status: The use and Interpretation of Anthropometry. Technical Report Series No. 854. Geneva.
- World Health Organization (2006): A Review of the Situation in Selected South-East Asian Countries. Chapter. 3, Pp-5-40.
- World Health Organisation, (2007): Adolescent Job Aid, Prototype2, July. Department of Child and Adolescent Health and Development (CAH).