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**Dr. Anindita Dey**  
Department of Human  
Development Lecturer,  
Acharya Prafulla Chandra  
College, New Barrackpore,  
Kolkata, West Bengal, India

### A study on the effect of food: Habits, on body mass index (BMI) of adolescents belonging to two economic sub divisions

**Dr. Anindita Dey**

#### Abstract

Environmental risk factors for overweight and obesity are very strong and inter-related. Sub-optimal cognitive stimulation at home and poor socio-economic status predict development of obesity. Parental food choices significantly modify child food preferences, and degree of parental adiposity is a surrogate for children's fat preferences. Children and adolescents of poor socio-economic status tend to consume less quantities of fruits and vegetables and to have a higher intake of total and saturated fat. Early rebound of BMI is linked to glucose intolerance and diabetes in adults. There is evidence stating that individual's eating and physical activity behaviours are heavily influenced by surrounding social and physical environmental contexts both for adults and children. Urbanization related intake behaviours that have been shown to promote obesity include frequent consumption of meals at fast-food outlets, consumption of oversized portions at home and at restaurants, consumption of high calorie foods, such as high-fat, low-fibre foods, and intake of sweetened beverages. These behaviours are cultivated in an environment in which high calorie food is abundant, affordable, available, and easy to consume with minimal preparation as is the case of urban cities throughout the country. Television viewing and other sedentary activities have also been related to childhood obesity. Unfortunately this habit is growing exponentially in developing countries as well. Low levels of physical activity is definitely promoted by an automated and automobile-oriented environment that is conducive to a sedentary lifestyle. The present study emphasises on the effect of economic condition on the Body Mass Index of adolescents. The size of the sample is 100 comprising 50, 15 to 18 year old adolescents and 50, 35 to 38 year old adult, men and women drawn from the population. Stratified random sampling technique was used for sample selection. Percentage, Mean, Standard Deviation and correlation coefficient was calculated for the entire sample and also for the age groups separately. The study tried to find out the effect of economic condition on the Body Mass Index of the subjects.

**Keywords:** Body mass index, economic condition, food habit, correlation coefficient

#### Introduction

Worldwide, disease profiles are transforming at a rapid pace catching the attention of medical professionals and policy makers alike. This is particularly true in low and middle-income countries that form the major chunk of global population. The emerging epidemics of obesity, cardiovascular disease (CVD) and diabetes form the crux of this phenomenal change. Among these entities, obesity has become a colossal epidemic causing serious public health concern and contributes to 2.6 million deaths worldwide every year<sup>1</sup>. Obesity is an independent risk factor for Cardiovascular Diseases. Obesity is associated with an increased risk of morbidity and mortality as well as reduced life expectancy. The last two decades of the previous century have witnessed dramatic increase in health care costs due to obesity and related issues among children and adolescents. Herein comes the effect of food on the healthy lifestyle of the adults and adolescents.

#### Healthy Food Habits

A healthy diet is one that helps to maintain or improve overall health. A healthy diet provides the body with essential nutrition: fluid, adequate essential amino acids from protein, essential fatty acids, vitamins, minerals, and adequate calories. The requirements for a healthy diet can be met from a variety of plant-based and animal-based foods.

**Correspondence**  
**Dr. Anindita Dey**  
Department of Human  
Development Lecturer,  
Acharya Prafulla Chandra  
College, New Barrackpore,  
Kolkata, West Bengal, India

A healthy diet supports energy needs and provides for human nutrition without exposure to toxicity or excessive weight gain from consuming excessive amounts. Where lack of calories is not an issue, a properly balanced diet (in addition to exercise) is also thought to be important for lowering health risks, such as obesity, heart disease, type 2 diabetes, hypertension and cancer.

### **Importance of Food for Adolescence and Adults**

Adolescence is a time of growth for children, for both physical and mental development. A healthy diet is essential for teenagers because of their heightened nutritional needs, but also because the foods they eat as teenagers can impact their health when they reach adulthood. Healthy eating also promotes good food habits to last a lifetime.

### **Calories**

Teenagers need to consume more calories because their bodies are growing rapidly. According to nutritionists, adolescents need more calories each day than at any other point in their lives. In general, teenage boys need to consume 2,800 calories each day and teenage girls need to consume 2,200 calories per day. These caloric needs are even higher for teens who play sports or are otherwise very physically active.

We should eat food in the right proportions. Approximately 50 to 60 percent of the calories should come from carbohydrates, with the majority of these coming from complex carbohydrates. Fat should make up less than 30 percent of a peoples calories. These guidelines will also ensure that teenagers get enough protein, which is notable because teenagers consume, on average, twice as much protein as they

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### **Effect of Underweight in Adolescence and Adulthood**

There are a number of reasons that cause the examination of issues connected with underweight to be particularly important for health professionals. Low muscle mass markedly affects the ability to perform physical exercise. Excessively low content of fat tissue may in turn cause significant health problems and diminish the general physical condition since adipocytes are responsible for secretion of various vital substances. Underweight is frequently associated with malnutrition, and may co-exist with immune system impairment, higher susceptibility to infections and improper functioning of muscular, cardiovascular and alimentary systems. In adolescents, the deficiency of body mass may be linked to various health problems, e.g. asthma, scoliosis, delayed puberty, emotional problems, and negative self-perception of body image. In this study, underweight was observed in 7% of boys and 11.6% of girls. Some authors; however, have claimed a higher prevalence of underweight. In a study of 12 to 17 year-old adolescents (approximately 1000 participants) underweight was observed in 11.1% and 14.4% girls and boys, respectively, while the prevalence of underweight in Indian boys and girls was 12.6% and 19.1%, correspondingly. Results comparable to those of our study were recorded in where out of roughly two thousand participants 5.1% of boys and 6.8% of girls were found to be

underweight. Similarly, underweight was observed in 8.7% of approximately one and a half thousand 15 years-old girls and boys. Therefore, despite decreasing trend in the occurrence of underweight adolescents observed in various countries worldwide, the results of previous studies and our findings suggest that underweight is still not a marginal finding in this age category. It should be noted; however, that differences in percentage of underweight individuals usually corresponded to several percent, and that various criteria were used to determine the frequency.

### **Environmental Risk Factors for Overweight and Obesity**

Environmental risk factors for overweight and obesity are very strong and inter-related. Sub-optimal cognitive stimulation at home and poor socio-economic status predict development of obesity. Parental food choices significantly modify child food preferences, and degree of parental adiposity is a surrogate for children's fat preferences<sup>25</sup>. Children and adolescents of poor socio-economic status tend to consume less quantities of fruits and vegetables and to have a higher intake of total and saturated fat. Early rebound of BMI is linked to glucose intolerance and diabetes in adults. Short sleep duration in children is also associated with an increase in the odds of becoming obese as well as an increase in body fat per cent.

### **Societal Changes, Overweight and Obesity**

Dramatic and rapid societal changes during the last decades have contributed significantly to childhood obesity. There is evidence stating that individual's eating and physical activity behaviours are heavily influenced by surrounding social and physical environmental contexts both for adults and children. Urbanization related intake behaviours that have been shown to promote obesity include frequent consumption of meals at fast-food outlets, consumption of oversized portions at home and at restaurants, consumption of high calorie foods, such as high-fat, low-fibre foods, and intake of sweetened beverages. These behaviours are cultivated in an environment in which high calorie food is abundant, affordable, available, and easy to consume with minimal preparation as is the case of urban cities throughout the country. Television viewing and other sedentary activities have also been related to childhood obesity. Unfortunately this habit is growing exponentially in developing countries as well. Low levels of physical activity is definitely promoted by an automated and automobile-oriented environment that is conducive to a sedentary lifestyle. Community design and infrastructure characteristics are also becoming increasingly important in determining levels of obesity in populations<sup>42</sup>. Such factors include availability of safe walkways, bicycle paths, playgrounds and other avenues for physical activity related recreation.

### **Adverse effects of overweight and obesity in Adolescence and Adulthood**

Worldwide, obesity trends are causing serious public health concern and in many countries threatening the viability of basic health care delivery. It is an independent risk factor for cardiovascular diseases and significantly increases the risk of morbidity and mortality. The last two decades have witnessed an increase in health care costs due to obesity and related issues among children and adolescents. Childhood obesity is a global phenomenon affecting all socio-economic groups, irrespective of age, sex or ethnicity. Aetiopathogenesis of childhood obesity is multi-factorial and includes genetic, neuroendocrine, metabolic, psychological, environmental and

socio-cultural factors. Many co-morbid conditions like metabolic, cardiovascular, psychological, orthopaedic, neurological, hepatic, pulmonary and renal disorders are seen in association with childhood obesity. The treatment of overweight and obesity in children and adolescents requires a multidisciplinary, multi-phase approach, which includes dietary management, physical activity enhancement, restriction of sedentary behaviour, pharmacotherapy and bariatric surgery. A holistic approach to tackle the childhood obesity epidemic needs a collection of activities including influencing policy makers and legislation, mobilizing communities, restructuring organizational practices, establishing coalitions and networks, empowering providers, imparting community education as well as enriching and reinforcing individual awareness and skills. The implications of this global phenomenon on future generations will be serious unless appropriate action is taken. There are critical phases in the evolution of obesity. Intrauterine growth patterns play a significant role in the evolution of obesity by modifying fat and lean body mass, neuroendocrine appetite control mechanisms, and pancreatic functional capacities. Longitudinal studies have identified a strong relationship between birth weight and BMI attained in later life. Increasing birth weight was independently and linearly associated with increasing prevalence of childhood obesity. In addition, low birth weight babies show a dramatic transition to central adiposity and insulin resistance very early in life. These two factors are known to increase cardiovascular risk manifold. Catch up growth and early adiposity rebound increase the odds of children as well as adults becoming obese significantly. The combination of lower birth weight and higher attained BMI is most dangerous as it is associated with extreme Cardiovascular Disease risk in later life. The nature and duration of breastfeeding have been found to be negatively associated with risk of obesity in later childhood. A systematic review of nine studies has concluded that breastfeeding seems to have a small but consistent protective effect against obesity in children. The normal pattern of insulin resistance during early puberty may be a natural cofactor for unnecessary weight gain as well as various comorbidities of obesity. Early menarche is clearly associated with extent of obesity, with an increase in rate of early menarche associated with BMI greater than the 85th percentile. The risk of obesity persisting into adulthood is higher among obese adolescents than among younger children. Observations suggest that up to 80 per cent of overweight adolescents will become obese adults.

### Prevention of Obesity

The ideal preventive strategy for obesity is to prevent children with a normal, desirable BMI from becoming overweight or obese. Preventive strategies should start as early as newborn period. The strategies may be attempted at the individual, community or physician's level. Those at the individual level backed by consistent evidence include limiting sugar sweetened beverages, reducing daily screen time to less than two hours, removing television and computers from primary sleeping areas, eating breakfast regularly, limiting eating out especially at fast food outlets, encouraging family meals and limiting portion sizes<sup>88</sup>. Encouraging diets with recommended quantities of fruits and vegetables have been supported by mixed evidence. Healthy behaviours derived from this evidence include consuming a balanced diet rich in calcium and fiber, initiating and maintaining breastfeeding, accumulating 60 min or more of moderate to vigorous

physical activity per day and limiting consumption of energy dense foods.

Community level interventions include advocacy to increase physical activity at schools and at home through the creation of environments that support physical activity. These efforts could include creation and maintenance of parks, inclusion of child friendly walking and bicycle paths as well as creating awareness about locally available physical activity options. At the physician's level it is essential to engage families with parental obesity or diabetes, because these children are at increased risk for developing obesity later in life. It is also essential to encourage an authoritarian parenting style and to discourage a restrictive one. Physicians should encourage parents to be role models when it comes to healthy diets, portion sizes, physical activity and screen time. Regular enquiries regarding diet and physical activity on routine visits will enhance awareness about the need for positive modifications.

### Definition of Body Mass Index

The body mass index (BMI) or Quetelet index is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of  $\text{kg}/\text{m}^2$ , resulting from mass in kilograms and height in metres.

### The range of Body Mass Index

Category	Bmi ( $\text{Kg}/\text{M}^2$ )	
	From	To
Very Severely Underweight	0	15
Severely Underweight	15	16
Under Weight	16	18.5
Normal (Healthy Weight )	18.5	25
Overweight	25	30
Obese Class 1 (Moderately Underweight)	30	35
Obese Class 2 (Severely Obese)	35	40
Obese Class 3 (Very Severely Obese)	40	Above

### Dietary Management

Dietary management should aim at weight maintenance or weight loss without compromising appropriate calorie intake and normal nutrition. Due emphasis should be given to initiate and maintain healthy eating patterns. A standard protocol is to recommend a fat intake of 30 to 40 per cent kcal in children 1 to 3 yr old, with a reduction to 25 to 35 per cent in children 4 to 18 yr old; a carbohydrate intake of 45 to 65 per cent kcal in all children and adults; and protein intakes of 5 to 20 per cent kcal in children 1 to 3 yr old with gradual increase to 10 to 30 per cent kcal in children 4 to 18 yr old<sup>72</sup>.

In obese children 8 yr or older, the Dietary Intervention Study in Children (DISC) intervention diet can be introduced without compromising growth, development and pubertal maturity<sup>73</sup>. This diet distributes 58 per cent of total calorie intake to carbohydrates, 28 per cent to fats and 14 per cent to protein. Of the 28 per cent calories from fats, 11 per cent should be from monounsaturates, 9 per cent from polyunsaturates and less than 8 per cent from saturates. Cholesterol intake should be less than 75 mg/1000 kilocalories, not to exceed 150 mg per day. Age-appropriate serving sizes including 5 or more servings of fruit and vegetables, 3 or more servings of low fat milk or dairy products, and 6 or more servings of whole-grain and grain products per day as well as adequate amounts of dietary fiber (age in yr + 5 g/d) should also be encouraged<sup>22</sup>.

Due emphasis should be given to reduction of eat outs,

planning for healthy snacks, balanced diet, adequate intake of fruits and vegetables, fiber content of diet and avoidance of high calorie/high fat foods. The benefits of salt reduction, restriction of sugar rich beverages and avoidance of trans fatty acids from the diet are supported with strong evidence<sup>74-76</sup>.

Definition of Healthy diet:-

- A healthy diet is one that helps to maintain or improve overall health.
- A healthy diet provides the body with essential nutrition:
- A healthy diet supports energy needs and provides for human nutrition without exposure to toxicity or excessive weight gain from consuming excessive amounts.

**Physical Activity Enhancement**

Moderate intensity regular physical activity is essential for the prevention of overweight and obesity as well as for treatment of the same. Children and adolescents should engage in not less than 60 min of moderate to vigorous physical activity per day to achieve optimum cardiovascular health. Overweight and obese children should target higher levels to achieve similar results. Longer periods of moderate intensity exercises like brisk walking burn more fat as calories and are excellent for reducing body fat. Children should be prescribed physical activity that is safe, developmentally appropriate, interesting, practical and has a social element. Involving other members of the family in the exercise programme and supervising the activity on a regular basis will improve compliance. In addition to weight reduction, exercise training is associated with beneficial changes in fat and lean body mass, cardiovascular fitness, muscular strength, endothelial function and glucose metabolism, all of which significantly reduce the morbidity associated with excess weight.

**Method**

**Objectives**

To find out whether the Body Mass Index is effected by the economic conditions of adults and adolescents

**Hypothesis**

Body Mass Index is positively and significantly correlated with the economic conditions of adolescents and adults

**Sample**

1. The size of the sample is 100 comprising 50, 15 to 18 year olds and 35 to 38 year old girls and boys drawn from the population.
2. Stratified random sampling technique was used for sample selection. So the sample is a stratified one comprising of 2 age based strata i.e., i) 14 years 12 months to 18 years 11 months ( 15 to 18 years), ii) 34 years 12 months to 38 years 11 months (35 to 38 years).
3. The sample comprised of equal numbers of girls and boys.
4. The subjects belong to below poverty line and above poverty line category (considering their parents' occupations )families.

**Variables**

Independent Variables	Dependent Variable
1. Age	1. Body Mass Index
2. Gender	2. Economic Condition

**Tools Used**

An Investigator made questionnaire to understand the food habit of the individual, including their weight and height to

calculate the Body Mass index was used.

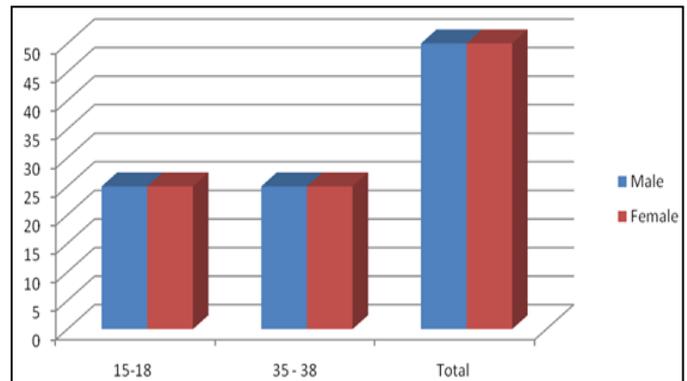
**Method of Statistical Analysis**

At the outset the percentages were calculated according to the response of the subjects. Mean and standard deviation was calculated and correlation coefficient between Body Mass Index and economic condition was calculated.

**Result and Discussion**

**Table 1:** Age and gender wise segregation of the sample

Age	Male	Female
15-18	25(50%)	25(50%)
35 - 38	25(50%)	25(50%)
Total	50(100%)	50(100%)

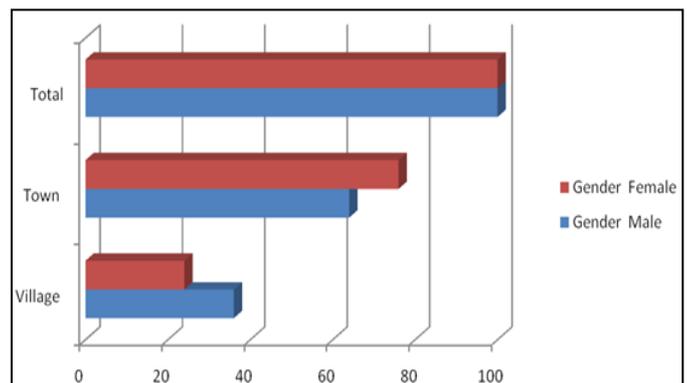


**Fig 1**

Table 1 and Figure 1 shows that there are equal number of boys and girls in the present sample for both the age groups.

**Table 2:** Place of Residence

Place of Residence	Gender	
	Male	Female
Village	18(36%)	12(24%)
Town	32(64%)	38(76%)
Total	50(100%)	50(100%)



**Fig 2**

The table and the figure revealed that most of the subjects were from urban area and only 30 of them resided at the villages.

**Table 3:** Economic subdivision

Economic subdivision	Gender	
	Male	Female
APL	25(50%)	25(50%)
BPL	25(50%)	25(50%)
Total	50(100%)	50(100%)

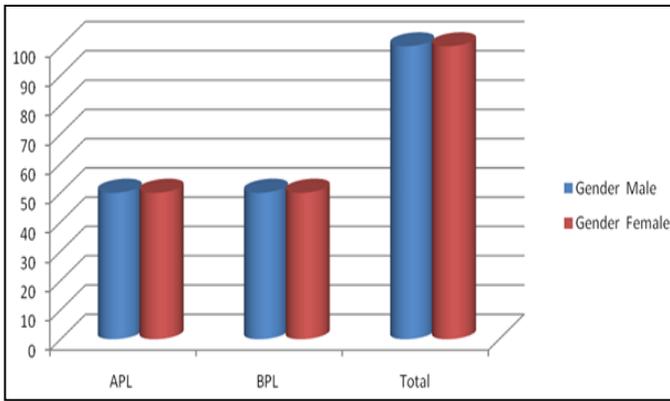


Fig 3

Table 3 and figure 3 revealed that 50% of the population were from below poverty line and 50 percent were from above poverty line category.

**Food habit**

Normal food habit refers to the one having a breakfast, midmorning, lunch, evening and dinner  
 Breakfast – Cereal, milk, fruit  
 Midmorning – Fruits or Vegetables as salads  
 Lunch – Cereal, Pulse, Vegetables, Proteins, Dessert  
 Evening – Milk, Cereal  
 Dinner – Cereal, Pulse, Vegetables, Proteins, Dessert  
 Not normal food habit is anything that violates the above dietary routine.

Table 4

Food habit	Gender	
	Male	Female
Normal	15(30%)	9(18%)
Not Normal	35(70%)	41(82%)

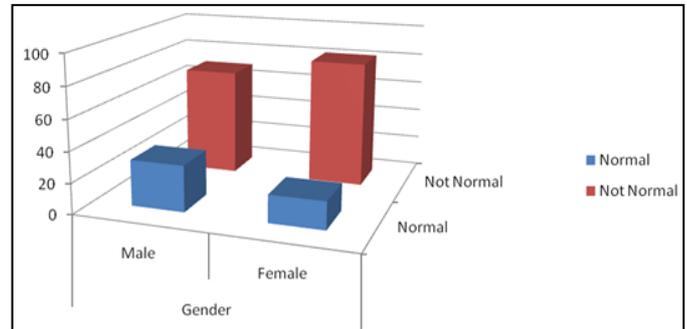


Fig 4

The figure and the graph shows that most of the subjects irrespective of their age do not have a normal diet.

Table 5: Body Mass Index of the subjects

BMI	Gender		Total
	Male	Female	
Very Severely Underweight	3	2	5(5%)
Severely Underweight	7	9	16(16%)
Under Weight	21	25	46(46%)
Normal	12	8	20(20%)
Overweight	7	6	13(13%)
Total	50	50	100 (100%)

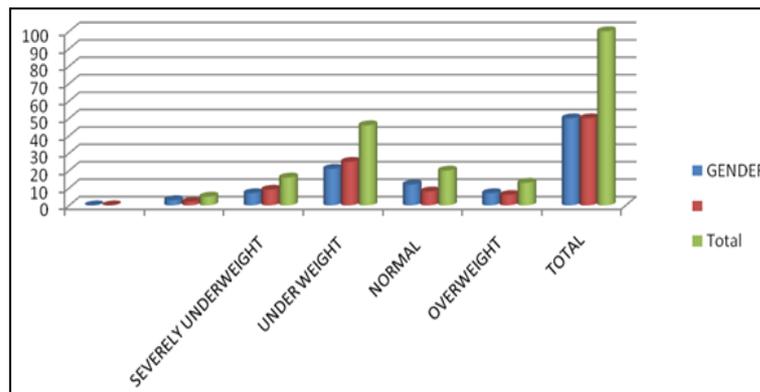


Fig 5

The table and the figure shows that most of the subjects were underweight, the effect of a not normal diet in this respect.

Table 6: BMI range and Economic Condition

Conditions Of The Subject	BMI Range	Economic Condition	
	From To	APL	BPL
Very Severely Underweight	0 15	0	5
Severely Underweight	15 16	0	16
Under Weight	16 18.5	0	45
Normal (Healthy Weight )	18.5 25	20	0
Overweight	25 30	13	0
Obes Class 1(Moderatly Underweight)	30 35	0	0
Obese Class 2(Severely Obese)	35 40	0	0
Obese Class 3(Very Severely Obese)	40 Above	0	0

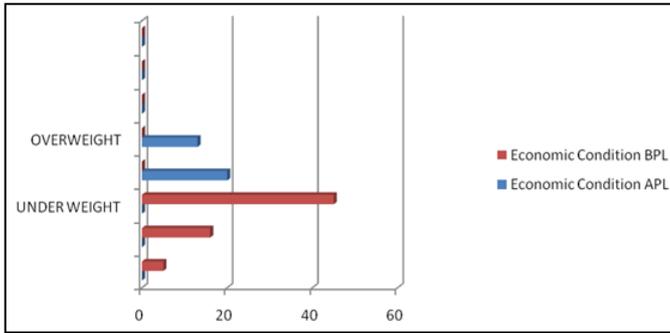


Fig 6

The Table and the Figure represents that most of the population are underweight irrespective of whether they belong to the above poverty line or below poverty line category. The overweight and the normal subjects are mostly from the above poverty line population.

Table 7: Means and Standard Deviations

Gender	Mean	Standard Deviation
Male	19.36	4.25
Female	18.66	3.99
Total	18.98	4.12

From observation of Table 6, it is clear that the BMI scores is more or less same on the average for the subjects. The standard deviation values reported in the Table are moderate indicating that the scores of the entire sample (N = 100) and the gender – groups are more or less homogeneous.

Table 8: Correlations among Body Mass Index and Economic Status of Adolescents and Adults

Age Group	Gender	Correlation Coefficients
15 - 18 years	Male	-0.82**
	Female	-0.83**
	Total	-0.82**
35 - 38 years	Male	-0.79**
	Female	-0.81**
	Total	-0.81**
15 - 18 years and 35 - 38 years	Male	-0.84**
	Female	-0.83**
	Total	-0.86**

\*\* p<.01

The Table shows that the correlation between the Body Mass Index and Economic Status of the subjects belonging to different age groups are negatively correlated. Same is true for the two age groups separately as well as the entire population. Therefore the null hypothesis is rejected.

**Conclusion**

The effect of food habit on adolescents and adults has given rise to outcomes such as underweight, overweight and obesity. These conditions have made significant impact globally with serious public health consequences. In addition to cardiovascular, emotional and social issues, it poses a serious hazard to the basic health care delivery system. With this backdrop in mind the present study has tried to find out the relation between one of the influencing factors of improper food habit, that is economic condition. It is very clear from the present investigation that economic condition for the present sample do not have a significant impact on the Body Mass index of the subjects. This was true for both the age groups (adolescents and adults).The reason behind the problem being diet quality and physical activity. Some times low economic status is associated with higher BMI in girls

rather than boys. Childhood poverty may be associated with overweight and obesity among adolescent girls. Health policies to encourage proper diet consumption and discourage skipping of meals might be effective for countering the association between poverty and overweight. In certain cases media measures seem to have a positive impact on BMI rather than economic conditions, use of computer also is not related to BMI. The problems of underweight, overweight and obesity is an epidemic for our society. Unless this epidemic is contained at a war footing, the implications of this global phenomenon on future generations will be serious. The reversibility of this disease with suitable intervention strategies should be seen as an opportunity and efforts pursued with vigour.

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