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*Keywords: intake, health care, sanitation.*

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*Strictly as per the compliance and regulations of:*

# A Study of Prevalence and Household Socio-Economic Determinants of Malnutrition among School Children in Mumbai Metropolitan Region

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*Keywords:* *intake, health care, sanitation.*

## I. Introduction

The malnutrition, especially that affecting young children, is one of the principal public health problem in developing countries. Growing children in particular are most vulnerable to its consequences (Hasan, I.Mohd Zulkifle 2010). Children are the most important segments for a nation for the optimal physical, mental, emotional development of its future worthy citizens. A nation's health depends on the healthy citizen. A healthy adult emerges from a healthy child. Good nutrition is the fundamental right of children for the maintenance of positive health.

A proper diet is essential from early stage of life. The children below age of five year constitute over twenty percent population and also form a most vulnerable group. The foundation of good health and sound mind are laid during this period of life. The level of food insecurity within the household determines the nutritional status of children and is the immediate cause of malnutrition. The caregivers and parents make most food choices for meals consumed at home. These choices are based on culture, beliefs, cost, time restraints and availability. The nutritional status of a child, as with any individual, is assessed through dietary, anthropometric, biochemical and physical observation for signs of malnutrition (Kaur Herbaksh et.al 2014). The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence.

Malnutrition during growth spurt is moreover associated with one or the other micronutrient deficiencies. In such a situation, iron and iodine deficiencies may play an obstructive role. Preschool age is considered as one of the most critical stage of human life where different nutritional deficiencies may occur. Hence, various ongoing programs on prevention mode during early childhood are run in the country. At the juncture of age five, they are considered more or less safe from nutritional disorders and little attention is paid to the quality of life. School children are not considered as "at risk" population, but physiologically this period demands unique interventions in the life cycle. Growth spurt in children are observed in their school going day (Joshi Kejal and Sirimavo Nair 2011). Most of the studies

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in India have estimated the prevalence of malnutrition in children attending government schools. In India, government has taken steps to combat malnutrition among school children, by providing them one nutritious meal at school called 'mid day meal'. But mid day meal is provided in government schools but not in private schools. There is dearth of studies focusing on the nutritional status of children in private schools and also those trying to assess the relationship between malnutrition and scholastic performance (Rashmi1 et.al 2015). In urban area, the school children's are ignored from nutritional policy. Improving the quality of life through good nutrition may directly influence effective learning and the future of productivity of a particular economy. When children are hobbled by poor nutrition and ill health, their weakened condition reduces their learning capacity and forces them to end their school carrier prematurely. Moreover the ill health of this population for lack of good nutrition is also a source of infectious diseases which affect the growth of the children. The long run effect latter falls on the wider society which bears burdens workforce and impaired adults.

The Mumbai Metropolitan Region is most developed region in India. The people migrate from the rural and semi urban areas. They search different employment opportunities in formal and informal sector in region. The informal sector does not require skills and work experience. Most of less educated and informal sector workers live in slums. They are depending on daily earning for their livelihood. Some household members are engaged in construction activities and self employment. The persons with regular jobs are very low. The income earned from the daily basis is very low. Most of the households do not earn enough income to fulfill their basic needs. Low per capita income and big household size forcing the family to have gender discrimination of food. The female are discriminated in house. They are offered less food and health care. Therefore they become more malnourished as compare to male. If the family has more preference to the son then they wait for boy, in such situation, the number of girls exceeds in the family. Due to more girls and less family income, the girls become more malnourished. Family neglect girls and they do not invest in their health and education. At lower age, girls are more malnourished because they do not show any preference for food and care. As the age of the girls' increases, the deficit of nutrition also increases and they become more malnourished.

Most of the slums in region do not get the water supply from Municipal Corporations. They are either on government or private land. They are treated as illegal squatters. Municipal Corporations in region are reluctant to supply the basic infrastructural facilities to slums. It includes water supply, sewage, solid waste, roads, street lights and housing. The drinking water supply is not available in slums. The women children struggle to get few liters of required drinking water. The male and female children carry drinking water from longer distance in slums. The drinking water is available at common tabs within slums. There is long queue for water supply at common tabs in slums. But the family members have no choice but to carry drinking water from longer distance. Carrying drinking water required time and energy. If all members spend more time and energy to carry drinking water then family has enough water. The economic condition does not allow family to buy water from private water venders. If it is bought then it is only used for drinking purposes. The water used for other purpose is of wells, pond, stored and rain water etc. Such water leads to water washed diseases. The women and children are the victims of the water borne and washed diseases in slums. They do not take health treatment for various water related diseases. In order to visit health care facilities, the family members has to go early, stand in a long queue, take prescription of doctor, buy medicines etc. They do not have that much time because most of the members are involved in daily wage earnings. They cannot remain absent from work. If they absent for one or two days then they are removed from job. Therefore most of the families either rely on self medication or private medical facilities. The self medication is practiced till the disease is not severely affecting the body of family member. The private health care facilities are expensive but families do not have choice but to spend money for it. The private health care affects on their economic condition. They usually take loan from informal sources to treat family members in private health care. Therefore major illness to any member leads to poverty and destitution. There is no any kind of social security or health insurance to poor households in slums. Due to poverty at home, children are feed in adequately. They required quality food and nutrition for their physical growth and intellectual development. Central and state government has the mid day meal scheme at public school. But the quantity of food given to children is very low. Such food is insufficient to tackle the malnutrition among children. Similarly, there is no space in schools of slums to prepare food. If food is prepared in school, then the hygiene, quantity of food, time to serve food matters to children. The children are of vulnerable section required special diet and adequate nutrition. The present mid day meal scheme required improvement in quantity and quality of food. This study is important because childhood is an important period of rapid physical growth and emotional and cognitive development. It is well known that the wellbeing of this age group is very essential for better health status (Thilakarathne and Wijesinghe 2011). The objective of the study is to find the incidence of malnutrition among school children in region. The second objective is to find the linkages of the socio-economic factors with school children. The

first part of paper deals with incidence of malnutrition among children in region. The second part of paper deals with regression result. The last part of paper deals with conclusion and policy implication.

## II. Economic Model

We have developed the economic model of malnutrition among school children in Mumbai Metropolitan Region. It is presented as follows.

$$TM_{SC}=(C, A, E) \quad (1)$$

Total incidence of malnutrition is observed among children, adults and elderly in region. But it is different for different age groups.

$$TMC=(C, E, W, T) \quad (2)$$

Total malnutrition among school children is observed in central, western and eastern part of Mumbai city. The Thane city and some parts of Thane district have also observed as malnutrition among school children.

$$Cm=A \quad (3)$$

Child malnutrition is related to age of the children. The age of the school children is important because at lower age more incidence of malnutrition is observed.

$$Cm=PE \quad (4)$$

The child malnutrition is related to education of parents.

$$PE= (M, F) \quad (5)$$

Education of mother and father is linked to the malnutrition among children.

$$E_{mf}= (P, S, HS, C) \quad (5a)$$

Education of mother and father is classified as illiterate, primary, secondary, high school and college.

$$A= (P, E) \quad (6)$$

Assets are classified as physical and electronic assets in house. The physical assets are classified as follows.

$$P=(C, S, T) \quad (7)$$

The physical assets in household are categorized as chair, sofa and table in house.

$$E= (T, R, C, B) \quad (8)$$

The electronic assets are classified as television, radio, car and bike.

The food eaten by the family is classified as the vegetarian and non vegetarian food.

$$F= (Vg, Nvg) \quad (9)$$

We have categorized the vegetarian and non vegetarian food as follows.

$$Vf=(M,C,P,B,V,F,) \quad (9a)$$

The vegetarian food eaten at home is classified as milk, curd, pulses, beans, vegetables, fruits etc. The non vegetarian food consists as.

$$Nov= (E, C, M, F) \quad (9b)$$

The non vegetarian food is classified as eggs, chicken, meat, fish etc.

$$Cm= (Y) \quad (10)$$

Child malnutrition is depending on income. Such income is classified as the mothers, fathers and other source of income.

$$Y= (M, F, O) \quad (10a)$$

Such income sources are differs from household to household.

## III. Data

For this study, we have collected primary data of slum households in Mumbai Metropolitan Region. We have collected 767 households data from eight slums such as Mankhurd East and West, Govandi East and West, Kalwa, Koparkhairne, Rabale, Turbhe, Vashi and Ghatkopar. The household heads and women are interviewed during survey. The questionnaire comprises as different questions related to household members, income and expenditure, fertility behavior, household assets, media exposure and illness. We have given special emphasis of health of the school children. The primary data was collected in May-June 2014. We have analyzed data in SPSS@20 and STATA@12 software.

## IV. Methodology

Child malnutrition is a major public health issue in developing countries. Malnutrition among children is a leading cause of high morbidity and mortality. Various studies have highlighted the socio-economic and demographic factors related to child malnutrition. BMI is a very useful indicator to calculate the nutritional status of school children.

$$BMI=\frac{\text{Weight}}{\text{Height}^2(\text{m})}$$

Body mass index is used to assess underweight, overweight and risk for overweight. Children's body fatness changes over the years as they grow. This is why BMI for children, also referred to as BMI-for-age. The BMI figure shows protein and fat reserves and it reflects functional reserves including ability to survive nutritional deficiencies and diseases.

The BMI is thought to be a more accurate indicator of body fat content than the CDC height-weight tables that have been in use for over 30 years. The weight-for-stature curve does not show age-related changes while the BMI-for-age chart does show age related changes are more useful. BMI is a very useful approximation to what one should weigh depending on height in children and teens (Babar Fazal et.al. 2010). We have used BMI indicator to classify school children's nutritional status in metropolitan region.

*a) Incidence of malnutrition among children*

The nutritional status of the school children is studied by many researchers. The age of 5 to 15 years is a period of transition between childhood and adulthood which occupies a crucial position in the life of human beings. This period is characterized by an exceptionally rapid rate of growth. School provides the most effective and efficient way to reach large portion of the school age population (Bhoite, Rachana, Uma Iyer 2011). Therefore we have considered six to sixteen age groups for this study. We have used the body mass index to classify the incidence of malnutrition among children. Such incidence is classified according to the suburbs and type of malnutrition.

*Table 1 :* Malnutrition among children in suburbs of region (Percent)

| | Sever | | Moderate | | Mild | |
|---|---|---|---|---|---|---|
| Suburb | M | F | M | F | M | F |
| Mankhurd(E) | 67.65 | 48.72 | 8.82 | 10.26 | 8.82 | 7.69 |
| Mankhurd(W) | 50.00 | 55.00 | 2.78 | 0.00 | 5.56 | 5.00 |
| Govandi(E) | 66.67 | 33.33 | 25.00 | 8.33 | 0.00 | 8.33 |
| Govandi (W) | 60.71 | 33.33 | 17.86 | 12.50 | 3.57 | 0.00 |
| Kalwa | 64.52 | 64.71 | 11.83 | 5.88 | 9.68 | 3.92 |
| Koparkhairn | 56.41 | 63.16 | 2.56 | 2.63 | 10.26 | 18.42 |
| Rabale | 47.37 | 25.00 | 5.26 | 8.33 | 21.05 | 16.67 |
| Turbe | 61.54 | 50.00 | 7.69 | 5.88 | 7.69 | 8.82 |
| Vashi | 46.15 | 50.00 | 0.00 | 0.00 | 15.38 | 0.00 |
| Ghatkopar | 75.00 | 14.29 | 0.00 | 0.00 | 0.00 | 28.57 |
| Total | 60.06 | 53.10 | 8.77 | 6.21 | 8.77 | 7.93 |

*Source: Compiled from primary data*

Above table shows that in Ghatkopar 75 percent of male are severely malnourished. It is the highest incidence of malnutrition reported among male in Ghatkopar. In Vashi only 46.15 percent male are severely malnourished. The 64.71 percent female are severely malnourished in Kalwa. The 25 percent male in Govandi (E) are moderate malnourished. The 12.50 percent female in Govandi (E) are moderate malnourished. The 21.05 percent male are mild malnourished in Rabale. The female in mild malnutrition category are 28.57 percent in Ghatkopar. It may be stated that the children frequently suffer from different types of diseases. The health service system was not so well developed at the concerned zone. The major diseases were diarrhea, malaria, jaundice, fever, skin disease and common cold. Parents cannot buy a variety of vegetables. They are habituated to consume rice and locally available vegetables. They do not consume recommended diet. So, the fewer intakes in amount and absence of vegetables are causing deficiency in energy, proteins and vitamins. Again boys of 8 to 12 years of age were regularly being engaged in different types of hard work with their parents. The girls are engaged in household work. As the boys remain outside they can get food only for three times but the girls take some light food one or two time daily in addition to three times of heavy foods. All these are directly related to malnutrition. Less physical labor and extra light food are the causes of less percentage of malnutrition of girls (Kumar P. et.al. 2011)

*Table 2 :* Age wise malnutrition among school children (Percent)

| Malnutrition | age group | 6-8 | 9-11 | 12-15 | Total |
|---|---|---|---|---|---|
| Sever | M | 69.18 | 53.01 | 50.63 | 60.06 |
| | F | 67.26 | 53.85 | 36.36 | 53.10 |
| Moderate | M | 4.79 | 9.64 | 15.19 | 8.77 |
| | F | 3.54 | 7.69 | 8.08 | 6.21 |
| Mild | M | 4.79 | 9.64 | 15.19 | 8.77 |
| | F | 3.54 | 10.26 | 11.11 | 7.93 |

*Source: As per table 1*

There are 69.18 percent of male are severely malnourished in 6-8 age group. The 67.26 percent female in 6-8 age groups are severely malnourished. At lower age we have found more incidence of severe malnutrition among male and female in region. The 15.19 percent male in 12-15 age group are moderate malnourished. The 8.08 percent female in 12-15 age group are moderate malnourished. The 15.19 percent male in 12-15 age group are mild malnourished. The 10.26 percent female are mild malnourished. From severe to mild malnutrition, the incidence declines fast in region. The lack of education, inadequate or inappropriate education breeds illiterate or semi – illiterate individuals who easily succumb to superstitions, taboos and irrational beliefs about some food items. The causes of malnutrition are multi – factorial. Inadequate nutrition results from several biologic, socio-cultural and economic aberrations among which are poverty, inadequate knowledge of nutrition, inadequate and unsafe water supply which predisposes individuals to diarrhea and water borne diseases. Hungry children are less able to concentrate in school and malnutrition expose children to a higher risk of infection, resulting in more frequent illness and absence from school than in the case of well nourished children. Moreover, if malnutrition is allowed to persist for a long time, it may degenerate into Kwashiokor, Marasmus and even Obesity with their attendant consequences. Kwashiokor, for example, may precipitate edema, growth retardation, muscles wasting among others, while obesity is known to predispose individuals to hypertension and other cardiovascular diseases, diabetes, cancer, arthritis, difficulties in pregnancy and child birth later in life (Ayenigbara G.O 2013). We have also considered the parents education and school children health.

*Table 3 :* Parents education and malnutrition among school children (Percent)

| **Mother education** | BMI categories | | |
|---|---|---|---|
| | Sever | Moderate | Mild |
| Illiterate | 52.71 | 5.43 | 10.08 |
| Primary | 44.44 | 7.41 | 7.41 |
| Second | 50.00 | 9.26 | 5.56 |
| Higher secondary | 0.00 | 0.00 | 0.00 |
| College | 0.00 | 0.00 | 0.00 |
| **Father education** | | | |
| Illiterate | 59.23 | 8.46 | 8.46 |
| Primary | 47.37 | 31.58 | 15.79 |
| Secondary | 75.00 | 0.00 | 8.93 |
| Higher secondary | 0.00 | 0.00 | 0.00 |
| College | 0.00 | 0.00 | 0.00 |

*Source: As per table*

The mother's education is playing an important role in health status of children. Literate mothers adopt many improved behaviors related to maternal and child health care, feeding and eating practices which ultimately affect the nutritional status of children (Joshi et.al 2011). The 52.71 percent illiterate female have severe malnourished children. Nearly half of the secondary studied mothers have severe malnourished

children. The 59.23 percent illiterate fathers have severely malnourished female. The 75 percent secondary studied fathers have severely malnourished children. We have not found college studied parents in slums. Father's education and occupation were important factors for chronic malnutrition. Illiterate fathers have an association with children leading to malnutrition. In societies where the women's education level is low, male education gains importance. More emphasis should be given to educate both parents for a better nutrition of their children. There was a significant correlation of father's education level with the nutritional status of the child. A matriculate father was also effective in maintaining the optimum nutritional status of his child. Matriculate or intermediate qualified housewife mothers' input in child-feeding decision making and assistance in upbringing of her child evident in her activities were also positively associated with optimum child nutrition. However, mothers with extremes of educational levels tended to have malnourished, growth retarded, or stunted children. Mothers with education up to graduation who mainly stay at home are more capable of maintaining the nutritional status of their children up to 90 percent and above. Surprisingly, the highly professional and educated mothers have relatively malnourished children which may be due to their pursuit of career, longer time out of home due to duty hours, and chronic tiredness and over fatigued working curriculum (Siddique et.al 2013). Mothers of these children should be educated about the importance of balanced diet. Consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers, sugar and jaggery, fats and oil, milk and milk products, fruits etc., should be promoted. Government should introduce awareness programs through community participation, involvement of NGOs and other sectors regarding affordable but nutritious foods (Shivaprakash et.al 2014). Household assets play an important role in health status of adults and children. Household assets are considered as the standard of living of family. The socio-economic status is calculated on the basis of assets in house. At the same time, the gradient of household socioeconomic status remains as a crucial determinant of level of nutritional achievement among children. Betterment of such condition thus is expected to improve growth of children likely through better nutritional intake and reduced morbidity (Kanjilal et al. 2010). We have asked various electronic and physical assets holding with different households in slums.

*Table 4 :* Malnutrition among children and asset holing (Percent)

| | Sever | | Moderate | | Mild | |
|---|---|---|---|---|---|---|
| Assets | M | F | M | F | M | F |
| Cooker | 66.40 | 51.39 | 10.40 | 8.33 | 5.60 | 2.78 |
| chair/bed | 63.64 | 42.11 | 12.12 | 5.26 | 9.09 | 2.63 |
| Watch | 77.42 | 52.17 | 6.45 | 8.70 | 3.23 | 0.00 |
| Electricity | 64.06 | 50.36 | 9.38 | 7.30 | 7.81 | 4.38 |
| Fan | 64.29 | 49.31 | 9.52 | 8.33 | 7.94 | 5.56 |
| Bicycle | 50.00 | 50.00 | 15.38 | 6.25 | 3.85 | 6.25 |
| Swing machine | 25.00 | 80.00 | 25.00 | 0.00 | 0.00 | 0.00 |
| Radio | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Telephone | 61.40 | 63.83 | 5.26 | 6.38 | 8.77 | 4.26 |
| refrigerator | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 33.33 |
| Television | 69.89 | 53.61 | 7.53 | 9.28 | 7.53 | 4.12 |
| Bike | 55.56 | 75.00 | 11.11 | 0.00 | 0.00 | 0.00 |
| Car | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 64.77 | 51.44 | 9.48 | 7.74 | 6.95 | 4.10 |

*Source: As per table 1*

The 66.40 percent male and 51.39 percent female are severely malnourished but they have cooker in house. The 63.64 percent male and 42.11 percent female are severely malnourished but they have bed in house. Most of the houses do not have bed in house. The 77.42 percent male and 52.17 percent female are severely malnourished but they have watch in house. The 64.06 percent female and 50.36 percent male are malnourished but they have electricity in house. The 64.29 percent male and 49.31 percent female are severely malnourished but they have fan. The half male and female are severely malnourished but they have bicycle. Bicycle is used to carry different things from market. For short distance, bicycle is very useful for

family. The 80 percent severely malnourished female have swing machine at home. The 61.40 percent male and 63.83 percent female are severely malnourished but they have telephone at home. All male have refrigerator but they are mild malnourished. The refrigerator is useful to preserve food and improve nutritional status of children and adults. Total 70 percent male and 53.61 percent female have television at home but they are severely malnourished. Television is useful to watch nutrition related programs. It is providing different type of knowledge to all household members. The 55.56 percent male and 75 percent female are severely malnourished but they have bike at home. Bike at home improves mobility of the family members. They can have access to various facilities in suburb. The car is not owned by any household of malnourished school children. In slums, parents do not have time to observe children's activities. They play games and eat different kinds of food. The nutritional status of the children affect due to the unhygienic food. Sometime parents provide money to the children. They buy gems and biscuits from shops. Finally, it also affects on their health status. Most of the children watch television. They observe the junk food advertisement through a wide range of channels. The children do not aware of nutritional status of such food. The children get influence of food by awareness, preference, loyalty (Story Mary and Simone French 2004). Such food does not provide the nutritional need of the children. We asked the children about the food eaten at home.

*Table 5 :* Malnutrition among children and knowledge of children (Percent)

| nutritional knowledge | Sex | Milk | Curd | Pulses | Beans | Vege | Fruit | Eggs | Chicken | Meat | Fish | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sever | M | 62.11 | 65.66 | 65.74 | 58.54 | 63.29 | 62.31 | 60.38 | 60.12 | 63.70 | 60.87 | 62.17 |
| | F | 51.18 | 56.03 | 53.97 | 54.92 | 53.04 | 53.89 | 52.00 | 51.10 | 52.63 | 52.49 | 52.92 |
| | M | 8.07 | 6.06 | 7.41 | 7.32 | 7.59 | 10.00 | 9.43 | 8.93 | 9.59 | 8.70 | 8.45 |
| Moderate | F | 6.47 | 6.90 | 7.94 | 8.20 | 6.63 | 7.19 | 6.86 | 7.14 | 7.02 | 6.63 | 7.04 |
| | M | 8.07 | 10.10 | 9.26 | 12.20 | 8.23 | 8.46 | 9.43 | 8.33 | 7.53 | 8.07 | 8.75 |
| | F | 7.65 | 8.62 | 6.35 | 6.56 | 7.18 | 5.99 | 7.43 | 6.59 | 5.85 | 6.63 | 6.85 |
| Mild | F | 1.76 | 1.72 | 1.59 | 1.64 | 1.66 | 1.20 | 1.71 | 1.65 | 1.17 | 1.10 | 1.51 |

*Source: As per table 1*

The 60.12 percent male and 51.10 percent female are severely malnourished and eat chicken. Chicken provides good nutrition to children. But it is costly also therefore family cook chicken once or twice in a week. The 10 percent male and 7.19 percent female eat fruits but they are moderate malnourished. Fresh fruits are costly and poor households cannot afford to eat fruits. The 12.20 percent male and 6.56 percent female are mild malnourished but they eat beans. We understand the relationship between per capita income of household and the malnutrition among children in the following table.

*Table 6 :* Per capita income and malnutrition among children (Percent)

| Water Requirement(Liters) | Sex | 0-500 | 600-1000 | 1100-1500 | 1600-2000 | 2100-2500 | 2600-3000 | 3100-3500 | 3600-4000 | 4000> |
|---|---|---|---|---|---|---|---|---|---|---|
| Severe | M | 59.38 | 66.67 | 70.00 | 66.67 | 22.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | F | 49.25 | 62.07 | 44.44 | 25.00 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 |
| | M | 12.50 | 5.88 | 3.33 | 0.00 | 11.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| Moderate | F | 4.48 | 10.34 | 8.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | M | 7.81 | 5.88 | 6.67 | 33.33 | 11.11 | 0.00 | 0.00 | 0.00 | 100.00 |
| Mild | F | 2.99 | 3.45 | 11.11 | 50.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 |

*Source: As per table 1*

Family income is the sole determinant of nutritional status of school children. At lower income, higher incidence of severe malnutrition is observed in sample. The incidence of severe malnutrition among male is 59.38 percent in Rs.0-500.Among Rs.600-1000, the incidence of severe malnutrition among male is 66.67 percent. Among female, it is 62.07 percent. The incidence of severe malnutrition among male in Rs.1600-2000 is 70 percent among male. Among female it is 44.44 percent. The incidence of severe malnutrition among male is 66.67 percent in Rs.2100-2500. Among the female, the incidence of moderate malnutrition is 50 percent. The incidence of severe malnutrition among male is 22.22 percent in Rs.2100-2500. All the female are obese 3 in Rs.2100-2500 income category. All female of Rs.2600-3000 are severely malnourished. All

male are moderately malnourished of above Rs.4000 income category. It means at lower income more male and female are severely malnourished. As the income increases, the incidence of severe malnutrition declines fast. It is very clear in the following figure.

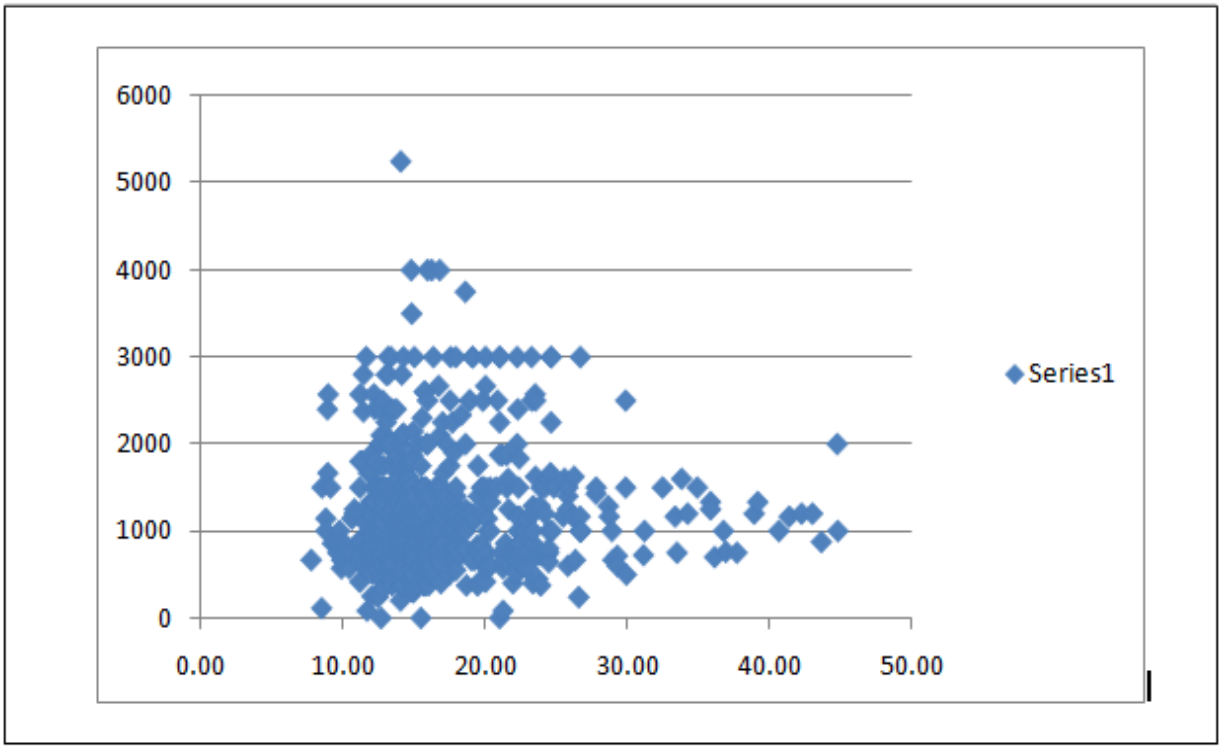


*Figure 1 :* Children's BMI and per capita income

The average per capita income is Rs. 1000 in slums. The maximum cases of malnutrition among children are found in the Rs.1000 to Rs 2000 per capita in slums. The obesity among children is also found in the same per capita income group. As the income increases, the normal BMI among the school children also increases.

## V. Regression Result

We used Logit regression model (Greene W.H. 2003) in order to examine the socio-economic factors behind the school children malnutrition. Such model is used to 6-15 age group children in slums. The children are classified as malnourished if the BMI falls below 18.5 and above 25.

Logit model for school children in slums is as follows

$$\Pr ob(a\ \ given\ \ school\ child\ is\ ma\ln ourished = 1) = \frac{Exp(b`x)}{1+\exp(b`x)}$$

We have used such model for male, female children of MMR slums. The results are presented in the following table.

*Table 7 :* Logit regression for female children

| Variables | Coefficients | Std.error | Z score | 95% Conf. Interval |
|---|---|---|---|---|
| Sex | 5.93* | 0.62 | 9.48 | 4.70-7.15 |
| Age | -0.16** | 0.05 | -3.21 | -0.26--0.06 |
| Per capita income | -0.00** | 0.00 | -2.08 | -0.00--0.00 |
| Per capita liters | -0.00*** | 0.00 | -1.65 | -0.00-0.00 |
| Purify water | 2.15*** | 1.25 | 1.72 | -0.29-0.61 |

| | | | | |
|---|---|---|---|---|
| Bike | -1.36*** | 0.80 | -1.71 | -2.93-0.20 |
| Number of sons | -0.31** | 0.12 | -2.52 | -0.56--0.07 |
| Constant | -2.11** | 0.83 | -2.52 | -3.75-0.47 |
| | LR $chi^2$ = 568.92 Prob > $chi^2$ = 0.0000 | | Log likelihood = -190.6734 Pseudo $R^2$ = 0.6754 | |

**significant at 1 percent **significant at 5 percent ***significant at 10 percent*

The female are more likely to be malnourished as compare to male. The female are more malnourished because of gender discrimination. Female are discriminated in terms of food, medical care etc. Less food intake during physical growth phase make them worse. Boys are given more preference in terms of care and food. The age of female child is negatively co-related to the malnutrition. At lower age female are more malnourished. They are neglected in terms of care. It is negatively affect at the lower age. At older age, female demand food and care at home. At lower age, female are more malnourished. The per capita income is negatively co-related with female malnutrition. The households have lowest income. At lower income, they are not able to buy different inputs required for health. The inputs such as food, care etc. required to children. But poor households cannot buy such inputs. The per capita liter of water is negatively co-related with the female malnutrition. The purified drinking water is positively co-related to the malnourished female. Households use traditional methods for water purification. They do not use water treatment machine for water purification. The ownership of bike is negatively correlated to females. The sons are negatively co-related to the female malnutrition. Female are malnourished because households expects sons. They expect boys and therefore they do not use family planning. More numbers of girl are not given proper care and nutrition and health care.

*Table 8 :* Logit regression for male children

| Variables | Coefficients | Std.error | Z score | 95% Conf.Interval |
|---|---|---|---|---|
| Sex | -4.34* | 0.49 | -8.72 | -5.31--3.366 |
| Household size | -1.11** | 0.59 | -1.86 | -2.29-0.058 |
| Per capita income | -0.00** | 0.00 | -2.29 | -0.00--0.00 |
| Male trips | 0.00** | 0.00 | 2.25 | 0.00-0.00 |
| Bike | 1.67** | 0.86 | 1.94 | -0.14-3.36 |
| Cons | 1.48* | 0.29 | 4.98 | 0.90-2.06 |
| | LR $chi^2$ = 457.62 Prob > $chi^2$ = 0.0000 | | Log likelihood = -184.53727 Pseudo $R^2$ = 0.5536 | |

**significant at 1 percent **significant at 5 percent ***significant at 10 percent*

The male children are less likely to be malnourished as compare to the female. Male are less likely to be malnourished. They affect care and nutrition at home. It is statistically significant and negatively co-related. Household size is negatively co-related to male children. Most of the male children are from nuclear families. Male are not given proper food and care. The working women find the problem of child care in slums. The per capita income is negatively co-related to the male children. The households have lowest income. At lower income, they are not able to buy different inputs required for health. The inputs such as food, care required to children. But poor households cannot buy such inputs. The male trips for carrying water are positively co-related with male children. Most of the male carry drinking water in slums. It is positively co-related and statistically significant. The bike owned is positively co-related to the male children. Malnourished male have bike at home. If the family socio-economic background is good then they can afford to have bike at home. Therefore it is statistically significant and positively correlated.

## VI. Policy Implication and Conclusion

Nutritional status plays a vital role in deciding the health status among children. Nutritional deficiencies give rise to various morbidities, which in turn, may lead to increased mortality. Under-nutrition is a known factor closely associated with child mortality rates (Rao et.al 2005). The health of children is of fundamental importance in every country. The school children population approximate one –fifth of the total population and forms the future hope of the Nation. Health of the children is the wealth of the nation. The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence. Malnutrition remains the world's most serious health problem and the single biggest contributor to child mortality. Nearly one third of the children in the developing world are either underweight or stunted and more than thirty percent of the developing world's population suffers from micronutrient deficiencies. More broadly, malnutrition in India is in a state of "Silent Emergency" and there by demand greater priority than ever before, the nutritional state of population therefore

critical to the development and well being of the nation (Singh Sunil Pal 2014). The incidence of malnutrition among children is widely viewed in slums of Mumbai Metropolitan Region. The incidence of severe malnutrition among male is higher in Ghatkopar and among female and it is higher in Kalwa. Highest severe incidence of malnutrition is found among male and female at lower age groups in Metropolitan Region. The illiterate mothers have higher incidence of severe malnutrition among children. But the incidence of severe malnutrition among children is higher with father's secondary education. The asset holding is higher with incidence of severe malnutrition among children. The household income of and BMI of children is very low. Children are most vulnerable to under nutrition due to their low dietary intake, less access to food, inequitable distribution of food within households, improper food storage and preparation, dietary taboos and infections with pathogens. Child under-nutrition can be mitigated through nutritional information campaigns, broader access to maternal and child health care practices and availing affordable, diverse, and nutrient-rich food (Degarege et. al. 2015).Therefore the municipal corporations must provide the infrastructural facilities in slums. The state government must provide the vocational education to male and female. It will improve their income. The income improvement will improve the qualitative diet of poor people. It will abolish the incidence of malnutrition among children. The birth weight and mother's education are the most important risk factors in the prevalence of severe malnutrition in urban children (Rikimaru et.al. 1998). The vocational training to unskilled workers will improve asset holding among poor households. Most of the households are poor and they cannot afford to buy different assets which are required for the daily needs. The children must be taught about nutrition in schools. In the present study, nutritional status and underweight was found highly related to the personal hygiene and socio-economic status. Main emphasis may be given to nutrition education, personal hygiene, health education, apart from the regular educational activities in the community (Hasan I. et.al. 2013). Health care staff must explain to poor households about importance of nutrition in day to day life. Government must provide affordable housing to poor people. It will improve their standard of living. All the above policies will certainly improve the nutritional status of school children in Mumbai Metropolitan Region.

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