ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PREVALENCE OF UNDER-NUTRITION AMONG CHILDREN (1-5 YEARS OF AGE) AND ITS ASSOCIATION WITH IMMUNIZATION STATUS AND MORBIDITY PROFILE IN ROHTAK CITY, HARYANA.

Community Medicine

Dr. Brijesh Kumar	Resident, Department of Community Medicine, PGIMS, Rohtak
Dr. R.B. Jain*	Senior Professor, Department of Community Medicine, PGIMS, Rohtak *Corresponding Author
Dr. Paritev Singh	Resident, Department of Community Medicine, PGIMS, Rohtak
Dr. Gaurav Rajawat	Resident, Department of Community Medicine, PGIMS, Rohtak
Dr. J.P. Rajliwal	Resident, Department of Community Medicine, PGIMS, Rohtak
Dr. Priyanka Choudhary	Resident, Department of Community Medicine, PGIMS, Rohtak

ABSTRACT

Background: As per National Family Health Survey IV (2015-16), prevalence of stunting, wasting and underweight among under-five children in India is 38.4%, 21% and 35.7% respectively. In India, U5MR is 43 per 1000 live births as per SRS 2015 and an estimated one third of deaths among under-five children are attributed to undernutrition.

Methods: This cross-sectional study was conducted in an urban area of district Rohtak from July 2016 to June 2017 among 400 children (1-5 years of age) which were randomly selected from 14 anganwadi centers. The anthropometric measurement and nutritional status categorization among children was done using WHO guidelines.

Results: The prevalence of stunting, wasting and underweight to be 33.8%, 21.5% and 34.5% respectively. Undernutrition rates were found to be higher in children who were partially immunized and having history of any morbidity.

Conclusion: It was revealed in this study that the prevalence of undernutrition was unacceptably high among the children. Every endeavor should be made to combat the undernutrition in children through multi-sectoral and multipronged approach.

KEYWORDS

undernutrition, children, urban, immunization.

INTRODUCTION

It is well acknowledged that investment in human resource development is a pre requisite for any nation to progress. Children of today are citizens of tomorrow, and hence improving nutritional status of children becomes extremely important. Early childhood, that is the first six years constitutes the most crucial period in life, when the foundations are laid for cognitive, social and emotional language, physical/motor development and cumulative lifelong learning. The young child under five years of age is most vulnerable to the vicious cycles of malnutrition, disease/ infection and resultant disability all of which influence the present condition of a child at micro level and the future human resource development of the nation at the macro level.[1] Health and physical consequences of prolonged states of malnourishment among children are: delay in their physical growth and motor development; lower intellectual quotient (IQ), greater behavioral problems and deficient social skills; susceptibility to contracting diseases.[2]

The United Nations Children Fund (UNICEF) conceptual framework of the determinants of child undernutrition defines the multifactorial causality of undernutrition. Nutritional status is influenced by three broad factors i.e. food, health and care. Food, health and care are affected by social, economic and political factors. The combination and relative importance of these factors differ from country to country.[3] Globally, prevalence of underweight, stunting and wasting among under-five children is 14.4%, 22.9% and 7.7% respectively.[4,5] One in every three malnourished children of the world lives in India.[6] As per National Family Health Survey IV (2015-16), prevalence of stunting, wasting and underweight among under-five children in India is 38.4%, 21% and 35.7% respectively. In Haryana as per National Family Health Survey IV, 34%, 21.2%, 29.4% and 9% of children below five years suffer from stunting, wasting, underweight and severe wasting respectively.[7,8]

Global under-five mortality rate (U5MR) is 43 per 1000 live births. Around 5.9 million children die every year before five years of age.[9] In India, U5MR is 43 per 1000 live births as per SRS 2015,[10] and contributes to the highest number of deaths among under-five children in South East Asia region and one-fifth of under-five deaths worldwide. An estimated one third of deaths among under-five children are attributed to undernutrition. Undernutrition puts children at far greater risk of death and severe illness due to common childhood infections, such as pneumonia, diarrhoea, malaria, HIV and AIDS and measles. A child who is severely underweight is 9.5 times more likely to die of diarrhoea than a child who is not, and for a stunted child the risk of death is 4.6 times higher.[11] Undernutrition weakens the immune system, putting children at higher risk of more severe, frequent and prolonged bouts of illness. Undernutrition is also a consequence of repeated infections, which may further worsen the child's nutritional status at a time of greater nutritional needs. This interaction between undernutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status.[3]

AIM AND OBJECTIVES

To estimate the prevalence of undernutrition among children (1-5 years) using anthropometric measurements and to determine the association with immunization status and morbidity profile.

MATERIAL AND METHODS

STUDY AREA:

This study was carried out in urban field practice area of the Department of Community Medicine, Pt. B.D Sharma PGIMS, Rohtak. A total of 14 anganwadi centers were there under this area.

STUDY DESIGN: descriptive study of cross-sectional design.
STUDY PERIOD: July 2016 to June 2017.

STUDY POPULATION:

The study population consisted of children 1-5 years of age, registered at respective anganwadi centers and residing in the study area for more than six months, along with their mothers.

SAMPLE SIZE DETERMINATION:

In Haryana, the prevalence of underweight among under-five children was 29.4% (NFHS-4)[29]. The optimal sample size was 398 on the basis of 30% prevalence (approximate) of underweight children using the

following formula, $n = (1.96)^2 p (1-p) / d^2$, where n= sample size, p= prevalence, d = allowable error i.e. 15% 0f p. [$n = (1.96)^2 * 0.3 * 0.7/0.045^2$]. For the purpose of the study, a sample size of 400 subjects was taken.

EXCLUSION CRITERIA:

1. Those children whose mothers were not willing to give consent.
2. Children with known congenital anomalies.

If the subject could not be contacted on three consecutive visits.

SAMPLING TECHNIQUE:

The total population of the study area, as per household survey conducted by MPHW with assistance of anganwadi workers, was 25077 (as on March 2015). A total of 14 anganwadi centers come under the area being served by the 3 Urban Health Posts. All the 14 anganwadi centers were selected for the study. From each selected anganwadi center, a list of 1-5 years of age children was prepared using anganwadi registers and 25 to 30 children were picked up from each anganwadi center, by simple random sampling (SRS) technique, to make a sample size of 400.

DATA COLLECTION

A pre-designed, pre-tested and semi-structured interview schedule was used to collect information from the child's mother after taking informed consent. Weight of the children was measured by Salter's weighing scale with minimum clothing and without shoes. Height of the children was measured with the help of a non-flexible measuring tape, by making the child, after removing the shoes to stand on a flat surface with feet parallel and with heels, buttocks, shoulders and back of head touching the wall. The head was placed in Frankfurt's horizontal plane with arms hanging at sides in natural manner. The children were classified according to their nutritional status using WHO Child Growth Standards.

UNDERNUTRITION INDICES:[12]

- **Underweight:** If Z-score of children for a given weight for age is less than -2 SD from median of the WHO Child Growth Standards.
- **Stunting:** If Z-score of children for a given height for age is less than -2 SD from median of the WHO Child Growth Standards.
- **Wasting:** If Z-score of children for a given weight for height is less than -2 SD from median of the WHO Child Growth Standards.
- **Moderate undernutrition:** If Z-score of children for a given weight for age or height for age or weight for height are in between -3 SD or below -2 SD of the median of the WHO Child Growth Standards.
- **Severe undernutrition:** If Z-score of children for a given weight for age or height for age or weight for height are below -3 SD of the median of the WHO Child Growth Standards.

DATA ANALYSIS:

The data was entered in the MS EXEL spread sheet, coded appropriately and cleansed for any possible typing error and then the data was analysed by chi-square statistical test using SPSS 20 (Statistical package for social sciences) software as per study objective. If the *P* value in Chi-square test was found <0.05 then the result was considered as significant.

RESULTS

The present study was carried out in urban field practice area of the Department of Community Medicine, Pt. B.D Sharma PGIMS, Rohtak and a total of 14 anganwadi centers are there under this area. All the 14 anganwadi centers were selected for the study. A sample size of 400 children were selected from these anganwadi centers using simple random sampling.

The present study included 58.8% boys and 41.2% girls. Out of all the children, 28.8% were partially immunized and 71.2% of children were fully immunized. It was found that 37.5% of children were having any type of morbidity in last 15 days and out of these children 54.6% were having respiratory infections, 40.7% were having gastrointestinal infections and 30.0% were having others cause for morbidity. As far as past history for any illness requiring hospitalization was concerned, 17.5% of children were hospitalized due to any illness. Out of these children, 40.0% of children were having respiratory cause for hospitalization and 47.1% of children were having gastrointestinal cause for hospitalization while 12.9% were hospitalized due to any other reasons. (Table 1)

Table 1: Distribution of children according to immunization status and morbidity profile.

Characteristics	Frequency (N=400)	Percentage
Sex		
Male	235	58.8
Female	165	41.2
Immunization status		
Fully immunized	285	71.2
Partially immunized	115	28.8
History of morbidity in last 15 days		
Yes	150	37.5
No	250	62.5
Cause of morbidity*		
Respiratory infections	82	54.6
Gastrointestinal infections	61	40.7
Others	45	30.0
Past illness requiring hospitalization		
Yes	70	17.5
No	330	82.5
Cause for hospitalization		
Respiratory	28	40.0
Gastrointestinal	33	47.1
Others	9	12.9

*Total count may exceed to 150 due to multiple morbidities in children

The prevalence of stunting was found to be **33.8%** (moderate stunting being **24.8%** and severe wasting being **9.0%**), prevalence of wasting was 21.5% (moderate wasting being 13.5% and severe wasting being **8.0%**) and prevalence of underweight was 34.5% (moderate underweight being **25.3%** and severe underweight being **9.2%**). (Table 2)

Table 2: Prevalence of undernutrition among children using WHO child growth standards

Characteristics	Boys (N=235)	Girls (N=165)	Total (N=400)	
	Frequency (%)	Frequency (%)	Frequency(%)	
Height for age				**$\chi 2$ = 0.005 df= 2 p=0.997**
No stunting	156 (66.4)	109 (66.1)	265 (66.2)	
Moderate stunting	58 (24.7)	41 (24.8)	99 (24.8)	
Severe stunting	21 (8.9)	15 (9.1)	36 (9.0)	
Weight for height				
No wasting	185 (78.7)	129 (78.2)	314 (78.5)	**χ^2 = 0.049 df = 2 p = 0.976**
Moderate wasting	31 (13.2)	23 (13.9)	54 (13.5)	
Severe wasting	19 (8.1)	13 (7.9)	32 (8.0)	
Weight for age				
No underweight	159 (67.6)	103 (62.4)	262 (65.5)	**χ^2 = 1.577 df = 2 p = 0.454**
Moderate underweight	54 (23.0)	47 (28.5)	101 (25.3)	
Severe underweight	22 (9.4)	15 (9.1)	37 (9.2)	

The prevalence of stunting, wasting and underweight was found higher in children who were partially immunized (38.3%, 26.1% and 40.0% respectively) as compared to children who were fully immunized (31.9%, 19.6% and 32.3% respectively) but this difference was not found to be statistically significant. (Table 2)

Table 2: Association between nutritional status of children and immunization status.

Characteristics	Boys (N=235)	Girls (N=165)	Total (N=400)	
	Frequency (%)	Frequency (%)	Frequency(%)	

Height for age				
No stunting	156 (66.4)	109 (66.1)	265 (66.2)	χ^2 = 0.005 df= 2 p=0.997
Moderate stunting	58 (24.7)	41 (24.8)	99 (24.8)	
Severe stunting	21 (8.9)	15 (9.1)	36 (9.0)	
Weight for height				
No wasting	185 (78.7)	129 (78.2)	314 (78.5)	χ^2 = 0.049 df = 2 p = 0.976
Moderate wasting	31 (13.2)	23 (13.9)	54 (13.5)	
Severe wasting	19 (8.1)	13 (7.9)	32 (8.0)	
Weight for age				
No underweight	159 (67.6)	103 (62.4)	262 (65.5)	χ^2 = 1.577 df = 2 p = 0.454
Moderate underweight	54 (23.0)	47 (28.5)	101 (25.3)	
Severe underweight	22 (9.4)	15 (9.1)	37 (9.2)	

The prevalence of stunting, wasting and underweight was found higher in children who were partially immunized (38.3%, 26.1% and 40.0% respectively) as compared to children who were fully immunized (31.9%, 19.6% and 32.3% respectively) but this difference was not found to be statistically significant. (Table 2)

Table 2: Association between nutritional status of children and immunization status.

Imm. status & Stunting	**No Stunting (n=265)**	**Moderate (n=99)**	**Severe (n=36)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Fully immunized (n=285)	194 (68.1)	67 (23.5)	24 (8.4)	χ^2 = 1.482 df = 2 p = 0.477
Partially immunized(n=115)	71 (61.7)	32 (27.8)	12 (10.5)	
Imm. status & Wasting	**No wasting (n=314)**	**Moderate (n=54)**	**Severe (n=32)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Fully immunized (n=285)	229 (80.4)	33 (11.5)	23 (8.1)	χ^2 = 3.149 df = 2 p = 0.207
Partially immunized(n=115)	85 (73.9)	21 (18.3)	9 (7.8)	
Imm. Status & Underweight	**No underweight (n=262)**	**Moderate (n=101)**	**Severe (n=37)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Fully immunized (n=285)	193 (67.7)	68 (23.9)	24 (8.4)	χ^2 = 2.241 df = 2 p = 0.326
Partially immunized(n=115)	69 (60.0)	33 (28.7)	13 (11.3)	

The prevalence of stunting, wasting and underweight was found to be higher in children who had history of hospitalization (47.1%, 28.6% and 57.1% respectively) as compared to children who had no history of hospitalization (30.9%, 20.0% and 29.7% respectively) but this difference was found to be statistically significant for stunting and underweight rates only. (Table 3)

Table 3: Association between nutritional status of children and history of past illness requiring hospitalization.

Hosp. history & Stunting	**No Stunting (n=265)**	**Moderate (n=99)**	**Severe (n=36)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=70)	37 (52.9)	25 (35.7)	8 (11.4)	χ^2 = 6.975 df = 2 p = 0.031
No (n=330)	228 (69.1)	74 (22.4)	28 (8.5)	
Hosp. history & Wasting	**No wasting (n=314)**	**Moderate (n=54)**	**Severe (n=32)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=70)	50 (71.4)	12 (17.1)	8 (11.5)	χ^2 = 2.621 df = 2 p = 0.270
No (n=330)	264 (80.0)	42 (12.7)	24 (7.3)	
Hosp. history & Underweight	**No underweight (n=262)**	**Moderate (n=101)**	**Severe (n=37)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=70)	30 (42.9)	32 (45.7)	8 (11.4)	χ^2 = 21.149 df = 2 p = 0.000
No (n=330)	232 (70.3)	69 (20.9)	29 (8.8)	

The prevalence of stunting, wasting and underweight was found higher (40.0%, 27.3% and 42.0% respectively) in children having history of morbidity in last 15 days as compared to children having no history of morbidity in last 15 days (30.0%, 18.0% and 30.0% respectively). (Table 4)

Table 4: Association between nutritional status of children and history of morbidity in last 15 days.

Morbidity history & Stunting	**No Stunting (n=265)**	**Moderate (n=99)**	**Severe (n=36)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=150)	90 (60.0)	44 (29.3)	16 (10.7)	χ^2 = 4.193 df = 2 p = 0.123
No (n= 250)	175 (70.0)	55 (22.0)	20 (8.0)	
Morbidity history & Wasting	**No wasting (n=314)**	**Moderate (n=54)**	**Severe (n=32)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=150)	109 (72.7)	27 (18.0)	14 (9.3)	χ^2 = 5.174 df = 2 p = 0.075
No (n= 250)	205 (82.0)	27 (10.8)	18 (7.2)	
Morbidity history & Underweight	**No underweight (n=262)**	**Moderate (n=101)**	**Severe (n=37)**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	
Yes (n=150)	87 (58.0)	46 (30.7)	17 (11.3)	χ^2 = 5.976 df = 2 p = 0.050
No (n= 250)	175 (70.0)	55 (22.0)	20 (8.0)	

DISCUSSION

Prevalence of stunting in the present study was found to be 33.8% which was comparable with the studies of **NFHS-4 (2015-16, Haryana)**[8] (33.4%) and **DLHS-4 (2012-13, Haryana)**[13] (31.8%). The prevalence of wasting was found to be 21.5%. Similar findings were observed in **NFHS-4 (2015-16, Haryana)**[8] (21.0%) but prevalence of wasting was found higher in **DLHS-4 (2012-13, Haryana)**[13] (30.3%). Prevalence of underweight was found to be 34.5% which was similar as found in **DLHS-4 (2012-13, Haryana)**[13] (32.9%) but was higher as compared in **NFHS-4 (2015-16, Haryana)**[8] (28.5%).

Prevalence of stunting, wasting and underweight was found higher in children who were partially immunized (38.3%, 26.1% and 40.0% respectively). This might be due to high prevalence of common infections causing childhood diseases in partially immunized children who might then enter into vicious cycle of infection and undernut rition.

Similar results were found in the studies conducted by **Agarwal et al (2014, Uttar Pradesh)**[14] in which prevalence of undernutrition was 63.3% in partially immunized children, **Abedi and Srivastava (2012, Uttar Pradesh)**[15] in which prevalence of stunting, wasting and underweight was 57.5%, 19.9% and 48.2% respectively in partially immunized children and **Bhavsar et al (2012, Maharashtra)**[16] in which prevalence of undernutrition was 54.3% in partially immunized children. **Mane et al (2015, Karnataka)**[17] reported that prevalence of

stunting, wasting and underweight was 42.3%, 26.9% and 38.5% respectively in partially immunized children.

The prevalence of stunting, wasting and underweight in the children having history of morbidity in last 15 days was 40.0%, 27.3% and 42.0% respectively which was higher compared to children who did not have any morbidity in last 15 days (30.0%, 18.0% and 30.0% respectively). This difference might be due to the vicious cycle of infection and undernutrition.

Similar results were reported in the study of **Agarwal et al (2014, Uttar Pradesh)**[14] in which prevalence of PEM in children having history of diarrhea, acute respiratory infection and worm infestation in last 15 days was 78.5%, 67.8% and 56.3% respectively which was higher as compared to the children who did not have any morbidity (42.3%, 52.6% and 54.1% respectively).

Popat et al (2014, Gujarat)[18] reported that prevalence of stunting, wasting and underweight in children having history of diarrhea in last 15 days was 62.6%, 34.7% and 72.1% respectively, in children having history of fever was 57.5%, 28.3% and 54.1% respectively, in children having history of cough was 59.5%, 29.7% and 62.7% respectively, in children having history of worm infestation was 55.2%, 29.6% and 56.0% respectively. **Sengupta et al (2010, Punjab)**[19] observed that prevalence of stunting, wasting and underweight in children having up to 2 episodes of infections per year was 71.2%, 35% and 25% respectively, in children having 3-4 episodes of infection was 73.6%, 50% and 26.4% respectively and in children having more than 4 episodes per year was 79.2%, 41.7% and 41.7% respectively. Children who had history of worm infestation had 78.9%, 47.4% and 52.6% prevalence of stunting, wasting and underweight respectively.

Limitation:

In the present study, children aged 1-5 years were included to improve the participation of study subjects and reduce non-response rate, as participation of recently delivered mothers including infants in the study was difficult.

CONCLUSION AND RECOMMENDATION

It is the health status of children that represents the overall health status of the people of country. Since this growing generation is going to be the future working citizens of the country, they should be healthy enough to make use of the full potential of their productive age.

It was revealed in this study that the prevalence of undernutrition was unacceptably high among the children. Every endeavor should be made to combat the undernutrition in children through multi-sectoral and multipronged approach such as health education of mothers, growth monitoring and early diagnosis and treatment of morbidity besides providing environment conducive to health. A collective attempt by the government, non-governmental organizations and the community is crucial to decrease the load of undernutrition among children. There is urgent need for strengthening of the existing public health interventions and programs to tackle this problem of under nutrition amongst the most vulnerable population of our country.

REFERENCES

1. Government of India. Children in India 2012– A Statistical Appraisal [Internet]. New Delhi: Ministry of Statistics and Programme Implementation, Government of India; September 2012 [cited on 2017 Aug 17]. Available from: http:// mospi.nic.in/ sites/ default/files/publication_reports/Children_in_India_2012-rev.pdf
2. Walker N. Nutrition in pediatrics. In: Duggan C, John B. Watkins, W. Allan, editors. Basic science and clinical application. 6th ed. Hamilton: BC Decker; 2008. p. 127–41.
3. United Nations Children's Fund. Improving child nutrition: The achievable imperative for global progress [Internet]. New York: UNICEF; 2013 [Cited 2017 Aug 18]. Available from: https://www.unicef.org/gambia/Improving_Child_Nutrition_-the achievable imperative for global progress.pdf
4. World Bank. Prevalence of underweight, weight for age [Internet]. Washington DC: The World Bank; 2017 [Cited 2017 Aug 18]. Available from: https:// data. worldbank.org/ indicator/SH.STA.MALN.ZS
5. Levels and Trends in Child Malnutrition: Joint child malnutrition estimates by UNICEF, WHO and World Bank Group [Internet]. Geneva: WHO; 2017 [Cited 2017 Aug 18]. Available from: https://data.unicef.org/resources/joint-child-malnutrition-estimates-2017-edition/
6. United Nation International Children's Emergency Fund. The State of the World's Children [Internet]. New York: UNICEF; 2016 [Cited 2017 Aug 18]. Available from: http://www.unicef.org/sowc/
7. International Institute for Population Sciences. National Family Health Survey-4 (2015–16) – India Fact Sheet [Internet]. Mumbai: Ministry of Health and Family Welfare, Government of India; 2016 [Cited 2017 Aug 21]. Available from: http://rchiips.org/NFHS/pdf/NFHS4/India.pdf
8. International Institute for Population Sciences. National Family Health Survey-4 (2015–16) – Haryana Fact Sheet [Internet]. Mumbai: Ministry of Health and Family Welfare, Government of India; 2016 [Cited 2017 Aug 21]. Available from: http://rchiips.org/NFHS/pdf/NFHS4/HR_FactSheet.pdf
9. World Health Organization. Global Health Observatory (GHO) Data: Under-five mortality [Internet]. Geneva: WHO; 2017 [Cited 2017 Aug 21]. Available from: http://www.who.int/gho/child_health/mortality/mortality_under_five_text/en/
10. Office of the Registrar General & Census Commissioner. SRS Statistical Report 2015 [Internet]. New Delhi: Ministry of Home Affairs, Government of India; 2015 [Cited 2017 Aug 17]. Available from: http:// www. censusindia. gov. in/ vital statistics SRS Reports 2015.html
11. Black RE, Allen LH, Bhutta ZA, Caulfield LE, De Onis M, Ezzati M. Maternal and child undernutrition: Global and regional exposures and health consequences. Lancet. 2008;371:243-60.
12. 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 [Internet]. Geneva: World Health Organization; 2006 [Cited 2017 Aug 22]. Available from: http:// www.who. int/ childgrowth/standards/technical_report/en/
13. International Institute for Population Sciences. District Level Household and Facility Survey-4 (2012-13) – Haryana Fact Sheet [Internet]. Mumbai: Ministry of Health and Family Welfare, Government of India; 2013 [Cited 2017 Aug 27]. Available from: http://rchiips.org/pdf/dlhs4/report/HR.pdf
14. Agarwal N, Sharma RP, Chandra S, Verma P, Midha T, Nigam S. Immunization status and childhood morbidities as determinants of PEM among under-five children in slums of Kanpur. Indian J Community Health. 2014;26(4):396-400.
15. Abedi AJ, Srivastava JP. The effect of vaccination on nutritional status of pre-school children in rural and urban Lucknow. J Acad Indus Res. 2012;1(4):173-5.
16. Bhavsar S, Mahajan H, Kulkarni R. Maternal and environmental factors affecting the nutritional status of children in Mumbai urban slum. International Journal of Scientific and Research Publications. 2012;2:111-6.
17. Mane V, Naik TB, Mallappa O, Ambure O. Protein energy malnutrition among preschool children: a cross sectional study. International Journal of Scientific Study. 2015;3(2):109-113.
18. Popat CN, Chaudhari AI, Mazumdar VS, Patel SV. A cross sectional study to measure the prevalence of malnutrition and factors associated with malnutrition among under five children of an urban slum of Vadodara city. Journal of Research in Medical and Dental Science. 2014;2(3):59-64.
19. Srivastava A, Kumar B, Mahmood SE, Shrotriya VP, Mishra SP, Shaifali I. Nutritional status of under five children in urban slums of Bareilly. Indian J Matern Child Health. 2012 ;14(1):1-8.