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Original Research Article

Study of ecology of malnutrition with respect to infection, infestation pattern, immunization and feeding practices in children attending tertiary care hospital

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ABSTRACT

Background: It often quipped that half of the world is starving and other half is tyring to lose weight!!.Unfortunately India is in the former half of the world. Out of 667 million children under age five worldwide, 151 million children are stunted and 50 million children are wasted.
Methods: The present study showed a very poor immunization status of malnourished children only 7.26% were completely immunized and 74.39% and 8.47% of malnourished children were partially immunized and unimmunized respectively. Study also showed a high incidence of wrong feeding practices like early weaning, prolonged exclusive breast feeding without adequate supplementation, and top feeding in the malnourished cohort. Study also showed a high prevalence of bronchopneumonia, UTI, GI infections in the study group. Tubercular meningitis, pyogenic meningitis, aspiration pneumonia contributed to majority of deaths. Malnourished children are more likely to have anemia, xerophthalmia, bacteremia, bacteriuria, pneumonia, GI infection and tuberculosis. The study was conducted in the Department of Pediatrics, VIMS and Head Quarters Hospital Bellary from December 2006 to December 2007.
Results: In this study out of 8 HIV positive children 6 children had been breast fed and 2 were top fed. Study also showed a high prevalence of bronchopneumonia, UTI, GI infections in the study group. Tubercular meningitis, pyogenic meningitis, aspiration pneumonia contributed to majority of deaths. Malnourished children are more likely to have anemia, xerophthalmia, bacteremia, bacteriuria, pneumonia, GI infection and tuberculosis. In cases with severe malnutrition, screening for HIV infection must be done.
Conclusions: Education regarding early initiation of breast feeding within one hour of birth, exclusive breast feeding for 4 to 6 months and continued breast feeding for 2 years or beyond with adequate supplementation must be emphasized. Last but not the least, the importance of immunization in breaking the vicious cycle of infection and malnutrition should be made known to the community at large through effective usage of mass media.

Keywords: Immunization, Infections**,** Protienenergy malnutrition

INTRODUCTION

It often quipped that half of the world is starving and other half is trying to looseweight!! Unfortunately India is in the former half of the world. Out of 667 million children under age five worldwide, 151 million children are stunted and 50 million children are wasted.[1] (Global nutrition report 2016) rapid survey on children 2013-2014 (ROSC) national report shows that in India among the children aged 0-59 months 39 percent are stunted, i.e.,

they are short for their age, 15 percent are wasted or thin for their height and 29 percent are underweight or light for their age.[2]

The same survey showed 34.2%, 17% and 18.5% of Karnataka's (a state of India, where this study was conducted) 0-59 month old children were stunted, wasted and underweight respectively.[2]

Protein-energy malnutrition is associated with a significant impairment of cell-mediated immunity, phagocyte function, complement system, secretory immunoglobulin A antibody concentrations, and cytokine production.[3] On the other hand infections adversely affect nutritional status through reductions in dietary intake, increased catabolism and sequestration of nutrients that are required for tissue synthesis and growth.[4,5] Hence PEM and infections work in tandem to precipitate and perpetuate each other.

Lack of confidence in mother, coupled with non-availability of skilled help and social pressures put tremendous pressure on mother to start early artificial feeds which are inadequate in calories and are of poor nutritional quality. It is also fraught with dangers of infections from unhygienic feeding bottles and nipples.

According to ROSC2 data on complimentary feeding practices only 36 percent of breast feeding children were fed the recommended number of times, only 20 percent children met the required dietary diversity and only 11 percent children received minimum acceptable diet. In other words, for most of the children aged 6-23 months complementary feeding was not of acceptable quality.

This leads to inadequate caloric supply to growing child as breast milk alone will not be sufficient to meet the caloric demands of the child, thus leading to malnutrition. In India, a majority of infants are breastfed and show satisfactory weight gain during the first 4 to 6 months. But thereafter, growth faltering occurs due to delayed and inadequate introduction of supplementary foods.

Repeated pregnancies, inadequate child spacing, foods taboos, broken homes and separation of child from his parents and poor socio economic status are other important social factors that contribute development of PEM in children. Study research attempted to study the interplay of these factors in our population of PEM children.

METHODS

The study was conducted in the Department of Pediatrics, VIMS and Head Quarters Hospital Bellary from December 2006 to December 2007 (1 year). The study included 112 cases of malnutrition that fulfilled the inclusion criteria.

Inclusion criteria

All children fulfilling criteria of wellcome trust classification for PEM ranging from 1 month to 59 months i.e.

Weight between 60-80% of expected

- With edema kwashiorkor
- Without edema under nutrition

Weight below 60% of expected

- With edema marasmic kwashiorkor
- Without edema nutritional marasmus

Exclusion criteria

All the patients who come under any of the following categories

- Children <1month.
- Children >59 months
- Children with cardiac disease
- Children with mental retardation, cerebral palsy
- Children with major congenital anomalies
- Children with LBW.

Method of collection of data

- Informed consent from parents/guardians/ appropriate attender of malnourished children was taken
- Information was collected in structured proforma for each case
- All cases which were eligible, were included in the study (time bound)
- Routine and specific investigations were done to confirm respective infection/infestation.

PEM is the common cause of morbidity and mortality in children. There are multiple factors responsible for malnutrition among children. Following were the aims and objectives of our study.

The objective of this study was to study morbidity and mortality of children with infection and infestation among protein energy malnutrition cases admitted in pediatric medical ward in VIMS and Head Quarters Hospital Bellary. And to know the influence of feeding practices in the study group. To study the extent of immunization coverage in the study group.

Microbiological methods

Blood culture

1 ml (for children aged less than 1 year) and 5ml (for children aged more than 1 year) blood was collected by

venepuncture taking aseptic precautions and inoculated into brain heart infusion broth. Two sets of blood culture were done, second sample drawn one hour after 1st sample. The bottles were incubated at 37°C for 24 hours and monitored for growth by alternate day repeat subcultures on solid media. Bottles positive for growth were further processed for identification and antibiotic susceptibility by standard methods. Blood cultures were declared negative after 7 days of incubation.

Urine culture

Clean catch mid-stream (CCMS) urine was collected (in case of older children), or urine was obtained by suprapubic aspiration (in younger children or as per the indication). Within an hour it was transported to microbiology laboratory and inoculated on MacConkey agar and blood agar. The plates were incubated at 37°C for 24 hours and read. Any significant growth was further processed for identification and antibiotic susceptibility by standard methods. Colony counts were reported as estimated by semi quantitative method.

Stool culture for enteric pathogens

Stool samples (faeces) collected from the patients was inoculated in enrichment broth like alkaline peptone water and selenite F broth. After 8 hours it was subcultured on MacConkey agar, blood agar, TCBS agar and XLD agar plates. The plates were incubated at 37°C for 24 hours. Suspected pathogenic bacterial colonies were further processed for identification and antibiotic susceptibility by standard methods.

Stool examination (stool microscopy) for ova/cyst

Macoscopic examination was done to look for any worms and segments of worms. Saline mount and iodine mount were prepared and examined for presence of ova, cysts, trophozoites of parasites. Other structures like RBCs, WBCs, fat globules, vegetable matter, and yeasts were also noted (can be omitted).

Hanging drop preparation

In children having watery diarrhea, hanging drop preparation was done and examined for darting motility suggestive of vibrio cholera.

Thick and thin smears

From each child, thin and thick blood films were prepared, giemsa-stained, and read by experienced laboratory technicians. At least 100 high power microscopic fields of the thin film were examined to exclude the diagnosis of malaria

HIV 1and 2 ELISA

Study did HIV 1 and 2 ELISA for only children who were aged more than 18 months after taking consent from parents. Parents were given pre and post-test counseling.

Tuberculosis

Diagnosis of tuberculosis was done in these cases either clinically, radiologically, histopathologically (FNAC of lymphnodes) or bacteriologically (gastric lavage for AFB).

Radiological investigation

Chest X-ray

Chest X-ray was done for children in whom it was clinically indicated viz, cough, hurried breathing or in whom tuberculosis was clinically suspected. X-rays were reported by qualified radiologist. Completely immunized children who have received minimum of one dose of BCG, three primary doses of DPT, 3 doses of oral polio in first 9 months of age and one dose of measles .

Partial but up to date immunized

Children who have received the appropriate number of recommended doses for their respective age.

Partially immunized

Children who missed one or more doses of recommended vaccines for their age.

Unimmunized

Children who have not received any doses of vaccine recommended for their age.

Inadequate supplementary food

For children aged 6-23 months

If the diet lacked minimum meal frequency* and dietary diversity#

For children aged 24-59 months

If the diet lacked dietary diversity and deficient in minimum calories and protein recommended for their respective age and sex.

**Minimum meal frequency*

The minimum number of times or more the breastfed and non-breastfed children 6-23 months of age should receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) - two for 6-8 months, three for 9-23 months, and four for 6-23 months (if not breastfed).

#dietary diversity

The children 6-23 months of age should receive foods from four or more food groups out of seven groups. The seven food groups include the following:

- Grains, roots and tubers
- Legumes and nuts
- Dairy products (milk, yoghurt, cheese)
- Flesh foods (meat, fish, poultry, and liver/organ meats)
- Eggs
- Vitamin A rich fruits and vegetables
- Other fruits and vegetables.

RESULTS

Out of 112 children majority of the children were between 1-24 months of age. Males constituted 56.24% of all the cases. Most of the patients (60.71%) were from rural area. Malnutrition is most prevalent in poorest sections (class IV and V based on modified kuppuswamy classification) 7 of the society (75.88%).

Table 1: Presenting symptoms in malnourished children.

Presenting symptoms	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Fever	47	24	09	01	81	72.31
Cough	33	15	08	-	56	49.99
Loose stool	28	17	10	02	57	50.88
Vomiting	19	12	05	-	36	32.14
Ear discharge	02	05	05	-	12	10.71
Refusal of feeds	04	04	02	-	10	8.92
Failure to thrive	02	06	02	-	10	8.92
Skin lesions	03	04	03	-	10	8.92
Swelling of limbs	-	-	03	02	05	4.46
Altered sensorium	03	03	-	-	06	5.35
Seizures	07	01	-	-	08	7.14
Blindness	-	-	01	-	01	0.89
Jaundice	-	01			01	0.89

Table 2: Pattern of infection and infestation in malnourished children.

Pattern	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
GI infections	24	10	05	02	41	36.60
Ascariasis	03	02	01	-	06	5.35
Giardiasis	-	01	01	-	02	1.78
Meningitis	08	03	01	-	12	10.71
Otitis	10	10	09	-	29	25.89
Bronchopneumonia	17	09	04	-	30	26.78
Lobar pneumonia	05	02	01	-	08	7.14
Empyema	02	01	00	00	03	2.67
Tuberculosis	12	09	04	-	25	22.32
UTI	12	20	10	01	43	38.39
HIV	02	03	01	00	06	5.35

Commonest presenting symptom in our study was fever (72.31%) followed by loose stools (50.88%). Third commonest symptom was cough which was present in 56 cases (49.99%). Many of the patients had more than one symptom. UTI was the commonest infectious disease observed in the malnourished children which featured in 38.39% (43/112) of cases. GI infection was the second commonest infection encountered in the study; it was present in 36.60% (41/112) of cases. Respiratory infectious diseases bronchopneumonia, lobar pneumonia and empyema thoracis) featured in 36.60% (41/112) of cases.

Blood culture was done in 110 children. Blood culture was positive in only 12.72% (14/110) of cases. Gram

negative organisms were isolated in 8.18% (9/110) of cases. Out of 14 children, whose blood cultures were positive 11 children had fever. Organisms isolated from urine of malnourished children (N = 93).

Urine culture was done in 93 children. Gram negative organisms were isolated in 46.23% (43/93) of cases *E. coli* was the commonest organism isolated (24.72%). Two children grew providentia species in their urine.

Table 3: Organisms isolated from blood of malnourished children (N = 110).

Organism	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
E.coli	01	01	01	-	03	2.72
H influenza	01	01	-	-	02	1.81
Pseudomonas	-	01	01	-	02	1.81
Providentiaspp	-	01	-	-	01	0.90
Salmonella	01	-	-	-	01	0.90
S aureus	02	01	-	-	03	2.72
CONS	-	01	01	-	02	1.81
Contamination	02	03	02	-	07	6.36
No growth	58	20	09	02	89	80.90
Total	**65**	**29**	**14**	**02**	**110**	**100**

Table 4: Organisms isolated from stool of malnourished children (N = 64).

Organisms	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
E. coli	08	06	02	01	17	26.56
Klebsiellaspp	-	03	01	-	04	6.25
Salmonella	01	01	-	-	02	3.12
V. cholera	01	-	-	-	01	1.56
Shigella	03	-	01	-	04	6.25
Normal commensals	19	10	06	01	36	56.25
Total	**32**	**20**	**10**	**02**	**64**	**100**

Table 5: Chest X-ray findings in malnourished children (N = 77).

CXR Findings	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total (57)	Percentage (%)
PPC	02	01	-	-	03	2.67
PPD	03	01	-	-	04	3.57
Miliary	02	02	-	-	04	3.57
Pleural effusion	03	01	-	-	04	3.57
Bronchopneumonia	20	10	07	01	38	33.92
Lobar pneumonia	05	03	02	-	10	8.92
Normal	28	10	05	01	44	39.28
Not done	02	02	01	-	05	4.46
Total	**65**	**30**	**15**	**02**	**112**	**100**

Stool culture was done in 64 malnourished children. Gram negative organisms were isolated in 43.74% (28/64) cases.

Normal commensals were isolated in 56.25% (36/64) cases.

Chest X-ray was done in 107 children. Bronchopneumonia was the commonest chest X-ray finding in malnourished children which featured in 35.51% (38/107) of cases. Military tuberculosis, PPD and pleural effusion were noticed in chest X-rays of 4 children each.

Table 6: Pattern of tuberculosis in malnourshed children (N=25).

Type	Under nutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Pulmonary	06	04	02	-	12	48
Disseminated	-	01	02	-	03	12
Lymph node	02	02	-	-	04	16
Meningeal + military	04	02	-	-	06	24
Total	**12**	**09**	**04**	**-**	**25**	**100**

Diagnosis of tuberculosis was done in these cases either clinically, radiologically, histopathologically, or bacteriologically. 3 cases were positive for AFB by gastric lavage. History of contact with tuberculosis was present in 7 cases. Parents were source of contact in 6 children (85.71%) out of 7 children. In this study we did HIV and 2 testing by ELISA only on children who were aged above 18 months. Among 68 tested 8 (11.76%) were found to be positive for HIV.

LP was done in 20 cases. Four patients had pyogenic meningitis and six patients had tubercular meningitis and two patients had aseptic meningitis. Neuroinfection was observed in 10.71% (12/112) of children.

None of the CSF samples that were sent for culture returned positive. The diagnosis of nature of meningitis was done based on clinical picture and CSF findings rather than bacteriology.

Total of 13 children died in our study. Tubercular meningitis, septicemic shock, aspiration and pyogenic meningitis contributed to majority of deaths.one patient died of acute liver failure.

Table 7: Neuroinfection in malnourished children (N = 20).

Type	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Pyogenic meningitis	02	01	01	-	04	20
Tubercular meningitis	04	02	-	-	06	30
Aseptic Meningitis	02	-	-	-	02	10
No infection	04	03	01	-	08	40
Total	**12**	**06**	**02**	**-**	**20**	**100**

Table 8: Causes of death in malnourished children (N = 13).

Causes of death	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total
Septicemic shock	-	02	-	-	03
Aspiration	01	02	-	-	03
Disseminated TB	-	-	01	-	01
Pyogenic meningitis	-	01	01	-	02
Tubercular meningitis	01	02	-	-	03
Acute liver failure	-	01	-	-	01
Total	**02**	**08**	**03**	**-**	**13**
Percentage	15.38	61.53	23.07	-	100

In the present studyonly 12.49% were completely immunized. 66.96% and 10.71% of malnourished children were partially immunized and unimmunized respectively. 9.82% children were partial butupto date in their immunization.

In this cohort of malnourished children only 43 children received exclusive breast feeds for appropriate time. Early introduction of complementary foods was seen in 9.82% cases. Delayed initiation on complementary foods was seen in 44.63% cases and no breast feeding was given in 8 cases (7.14%).

Table 9: Immunization status* in malnourished children.

Immunization status	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Completely immunized	13	01	-	-	14	12.49
Partial but up-to-date immunized	07	04	-	-	11	9.82
Partially immunized	39	22	13	01	75	66.96
Unimmunized	06	03	02	01	12	10.71
Total	**65**	**30**	**15**	**02**	**112**	**100**

Table 10: Duration of exclusive breast feeding in malnourished children.

Duration of EBF (months)	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
<4	03	02	05	01	11	9.82
4-6	32	08	02	01	43	38.39
7-12	27	06	03	-	36	32.14
>12	03	09	02	-	14	12.49
No breast feeding	-	05	03	-	08	7.14
Total	**65**	**30**	**15**	**02**	**112**	**100**

Table 11: Complementary feeding in malnourished children (up to age of 24 months).

Supplementation	Undernutrition	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Breast feeding alone without supplementation for >1year	11	09	02	-	22	19.64
Breast feeding with inadequate supplementary food	22	10	10	02	44	39.28
No breast milk but diluted milk and inadequate supplementary feeds	-	05	03	-	08	7.14
Supplementation	**Under nutrition**	**Marasmus**	**Marasmic Kwashiorkor**	**Kwashiorkor**	**Total**	**Percentage (%)**
Breast feeding alone without supplementation for >1year	11	09	02	-	22	19.64
Breast feeding with inadequate supplementary food	22	10	10	02	44	39.28
No breast milk but diluted milk and inadequate supplementary feeds	-	05	03	-	08	7.14

Among 78 children who were below 24 months of age only 4 (5.12 %) children received adequate supplementary food in addition with or without breast milki.e the supplementary food with appropriate frequency and appropriate food diversity. In rest of the children the supplementary food was either not started or it was inadequate.

In this study out of 8 HIV positive children 6 children had been breast fed and 2 were top fed.

DISCUSSION

This prospective descriptional/observational study was conducted in government medical college hospital which caters to a large number of PEM children every year.112 children who met our inclusion criteria during the study period was enrolled. Similar to many studies conducted earlier the majority of cases (70.53%) in our study were in the age group of 1 month to 24 months. In concordance with Dani et al majority (75.88) of our malnourished cohort came from poorest (class IV and V) socioeconomic class.[8]

Presenting symptoms

In the present study, it was noticed that fever was the commonest presenting symptom, found in 72.31% of cases. The other common symptoms observed were cough (49.99%), loose stool (50.88%) and vomiting (32.14%). Many of the patients had more than one symptom. Mathur GP et al had reported that 54.7% of malnourished cases presented with respiratory tract infection and 50% with diarrhea.[9]

Pattern of infection and infestation

Mathur GP et al in their study had reported respiratory tract infection, diarrhea and parasitic infestations in 54.7%, 50% and 4% respectively in their study children.[9] In this study, respiratory infections (bronchopneumonia, lobar pneumonia and empyema) and GI infections were noted in 36.60% and 36.60% of children respectively. Parasitic infestation was found in 7.14% of cases. Tuberculosis was seen in 22.32% cases. Urinary tract infections were noted in 38.39% (43/112) cases. HIV seropositivity was noted in 7.14% (8/112) of cases.

Diagnosis of tuberculosis was done either clinically/ radiologically/ histopathologically/ bacteriologically. Severe forms of tuberculosis like miliary, meningeal and disseminated tuberculosis were seen in 8.03% (9/112) of cases, whereas pulmonary and lymph node tuberculosis was seen in 10.71% (12/112) and 3.57% (4/112) of cases respectively. History of contact with tuberculosis was present in 7 cases. Parents were source of contact in 6 children (85.71%) out of 7 children. In the present study, bacteremia was seen in 12.72% (14/110) of cases. Gram negative organisms were isolated in 8.18% (9/110) cases. Berkowitz FE had reported bacteremia, most commonly due to gram negative enteric bacilli in 19% (13/68) of severely malnourished children in their study.[10] The seemingly lesser incidence of bacteremia in our study may be attributed to higher incidence of pre referral usage of antibiotic in children.

In 46.23% (43/93) of cases gram negative organisms were isolated from urine. Berkowitz FE had reported UTI in 31% (5/16) of severely malnourished children, all were due to E. coli.[10] Reed RP et al reported 35 children out of 134 (26.1%) had proven urinary tract infection in their study.[15] High incidence of UTI noted in our study than the literature data, might be related to the method of urine collection, because we used cleanly caught mid-stream (CCMS) urine in sterile vials in most of the cases rather than suprapubic aspiration due to the lack of consent from parents for the procedure. The other reason may be related to high incidence of hypovitaminosis A, as xerophthalmia was noted in 27.67% of cases. Neuroinfection was detected in 10.71% (12/112) of children, among which 4 (3.57%) patient had pyogenic meningitis and 6 (5.35%) had tubercular meningitis. None of the CSF samples that were sent for culture returned positive.

Mutombo, et al reported HIV seropositivity in 25.1% (46/183) of undernourished children and Fischer GD et al got 2.58% (2/70) sera positive for anti-HIV1 antibody by both ELISA and Western blot out of their 70 children cohort.[12,13] In this study we did HIV 1 and 2 ELISA for only children who were aged more than 18 months after taking consent from parents. HIV seropositivity was seen in 11.76% (8/68) of children.

Imaculada M et al and Mathur GP et al reported GI infestation in 75% and 2.67% (4/150) of PEM children respectively.[9,14] In the present study, parasitic infestation of GI tract was seen in 7.54% (8/106) of children. Low incidence (8.75%) of intestinal worm infestation noted in our study may be due to improved sanitation, periodic deworming by practitioners and geographical variations.

Mortality

In the present study, case fatality rate was 11.60% (13/112). Tuberculosis (30.76%), pyogenic meningitis (15.38%), aspiration pneumonia (23.07%), septicemia (15.38%), contributed to 84.59% to the total case fatality rate. Shimeless D et al had reported 32% case fatality rate due to septicemia, gastroenteritis, pneumonia and disseminated tuberculosis and Reed RP et al had reported 20.8% case fatality rate in severe malnourished children.[11,15] Low case fatality rate noted in our study may be due to reduction in mortality due to diarrhea.

Feeding practices

According to ROSC 65% of children aged between 0-5 months were exclusively breast fed. As far as complimentary feeding was concerned, only 12 percent of the non-breastfed children received minimum acceptable diet. For the combined group of breastfed and non-breastfed children aged 6-23 months, only 11 percent received minimum acceptable diet. Even among the children aged 18-23 months only 14 percent received minimum acceptable diet. In the present study, only 7.14% children were given breast feeding within one hour of birth, only 43 children received exclusive breast feeds for appropriate time. Early introduction of complementary foods was seen in 9.82% cases. Delayed initiation on complementary foods was seen in 44.63%

cases and no breast feeding was given in 8 cases (7.14%). Among 78 children who were below 24 months of age only 4 (5.12 %) children received adequate supplementary food in addition with or without breast milk i.e the supplementary food with appropriate frequency and appropriate food diversity. In rest of the children the supplementary food was either not started or it was inadequate. In our study out of 8 HIV positive children 6 children had been breast fed and 2 were top fed. The feeding practices noted in our cohort of children were worse on all fronts compared to national statistics given out by ROSC.

Immunization status

Overall immunization status in the present study was very poor. The immunization status in our study was comparable to other similar studies done in Indian children. Results showed that, 82.13% (92/112), 42.85% (48/112), 42.85% (48/112), 24.99% (28/112) malnourished children had received BCG, DPT (3 doses), OPV (3doses) and measles vaccine, respectively. Out of 82 malnourished children only 38.39% (43/112) had Basic (BCG+DPTIII+OPVIII) vaccination and only 12.49% (14/112) had complete immunization (Basic+Measles) as per the vaccination schedule recommended by the Government of India.[16] Monica Tandonet al reported 81.4%, 43%, 43%, and 47.65% of severely malnourished children had received BCG, DPT (3 doses), OPV (3 doses) and measles vaccine respectively.[17] Out of 43 severely malnourished children, only 32.5% had basic immunization and only 18.6% had complete immunization.

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