

Vol 45 (1) March , 2021

Print: ISSN 0304 4904
Online: ISSN 2305-820X



PAKISTAN PEDIATRIC JOURNAL



A JOURNAL OF PAKISTAN PEDIATRIC ASSOCIATION

Indexed in EMBASE/Excerpta Medica, Index Medicus WHO
IMEMR & Global Health/CAB Abstracts and UDL-EDGE Products and Services

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ORIGINAL ARTICLE

Etiological Spectrum of Secondary Malnutrition in Children (Under Five Years of Age) With Severe Acute Malnutrition Admitted At Nutritional Rehabilitation Center Stabilization Centre at CHC& ICH Multan

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Pak Pediatr J 2021; 45(1): 27-32

ABSTRACT

Objective: To find out the etiological spectrum of secondary malnutrition in children with severe acute malnutrition.

Study Design: Descriptive study

Duration and Place of Study: 01.01.2018 to 31.12.2018 at Nutritional Stabilization Centre at CHC&ICH, Multan.

Material and Methods: All children admitted with severe acute malnutrition, aged 1-59 months during the study period were included. Written consent was obtained from parents. Relevant data, detailed history and systemic examination were done in each child at the time of admission. Clinical and laboratory evaluation was also performed. The children were observed and evaluated daily during hospital admission to identify the common etiological factors including acute/chronic diarrhea, pneumonia, urinary infection, celiac disease, cerebral palsy and other respiratory illnesses like bronchiolitis, asthma and other underlining diseases.

Results: Among 835 patients, 703 (84.2%) had weight for height <-3SD, 60 (7.18%) had bilateral edema and 349 (41.79%) with severe wasting (Z-score <-4SD). The analysis of etiological factors in these children identified nephrological problems in 383 cases (45.87%), gastroenterological problems in 331 (39.64%), Infectious diseases in 265 cases (31.74%), Hematological problems in 256 cases (30.66%), and neurological problems in 97 cases (11.62%).

Conclusion: A wide range of diseases were identified as the etiological factors of secondary severe acute malnutrition including nephrological problems, gastroenterological problems and Infectious diseases being the three most frequent in this study. These diseases cannot be reversed without treatment and will worsen the degree of malnutrition, so these need to be identified at the earliest, thus decreasing the associated morbidity and mortality.

Key Words: *Diarrhea, Edema, Secondary malnutrition, Severe acute malnutrition,*

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Received 26th August 2019
Accepted for publication
20th January 2021

INTRODUCTION

Malnutrition refers to deficiencies, excesses or

imbalances in a person's intake of energy and/or nutrients. According to National Nutritional Survey

(NNS, 2018), 40% children (under five years of age) are stunted and almost 17.7% are suffering from wasting in Pakistan.^{1,2} It is also a major contributor of childhood deaths i.e. 54% (under five years of age) in Pakistan.³ Malnutrition in developing countries including Pakistan is not only due to low caloric intake, frequent infections and environmental factors but certain acute and chronic underlying diseases also act as contributory factor for severe acute malnutrition.^{2,4}

Primary malnutrition is defined as malnutrition resulting from inadequate food intake. Primary malnutrition is more common in underdeveloped countries and mainly results from decreased food intake, food insecurity, low socio-economic status, decreased supply of caloric needs, low birth weight, lack of adequate food, lack of breastfeeding, improper mixing of infant formula, repeated infections and environmental enteropathy.⁵

Secondary malnutrition in children is the outcome of an underlying disease that affects the growth and development of body directly or by its injurious effect on nutrient intake and absorption. These diseases and infections can result in loss of appetite and affect the nutritional status by initiating a catabolic state in the body. Multiple and frequent infectious diseases lead to secondary malnutrition by decreasing the consumption and absorption of both macro and micronutrients to the body, causing low bioavailability of these essential nutrients and increasing energy expenditure.⁶ Similarly in Crohn's disease, loss of nutrients leads to malnutrition, congenital heart diseases result in increased energy expenditure, extensive burns also increases catabolism and suppresses anabolism, and anorexia also leads to malnutrition. Secondary malnutrition, if neglected leads to higher risk of frequent infections, and triggers a poor response to treatment of the underlying cause. It is one of the leading causes of morbidity and mortality in children.⁷

Failure to thrive and malnutrition have multi factorial etiology-underlying pathological and organic causes that also needs to be evaluated in detail in order to get a positive response to the treatment of malnutrition. For example, a child presented with severe acute malnutrition and chronic diarrhea needs to be evaluated for celiac disease, as this child will not gain weight until the

celiac disease is diagnosed and treated with agluten free diet.⁸

Identifying the etiological spectrum of secondary malnutrition and pattern of morbidity/mortality at Nutrition Stabilization Centre may help to plan and improve community-based management of acute malnutrition (CMAM) services. The rationale of this study was to highlight the etiological spectrum of secondary malnutrition in children with severe acute malnutrition, so the child should be properly evaluated in detail and treated appropriately, thus reducing the associated morbidity and mortality.

MATERIAL AND METHODS

A descriptive study was carried out from January 1st 2018 to December 31st 2018 at Nutritional Rehabilitation Center CH&ICH, Multan. Out of total 5663 screened at outpatient department at CH & ICH, Multan during the study duration: 1655 patients (between age 1-59 months) were diagnosed as SAM according to WHO criteria for CMAM program (weight/length <-3 SD and MUAC <11.5 or presence of bilateral Oedema. These patients were subdivided into Primary and Secondary SAM. All admitted children with diagnosis of Secondary SAM (835 children) during the study period were included. A written, informed consent was obtained from parents. The children with primary SAM, those in critically state and where parents refused consent were excluded from the study. Simple random sampling technique was used to ensure the inclusion of maximum number of children.

Relevant data of children such as age, gender was documented. Detailed history and systemic examination from head to toe was done in each child at the time of admission by the specially trained medical officer. Every child was evaluated thoroughly clinically at bedside and laboratory evaluation was also done as needed. Relevant samples for investigations were sent to clinical laboratory (complete blood count, blood sugar, serum electrolytes and urinalysis). Further laboratory tests were performed based on the condition of patient like chest X-ray, blood culture, urine culture and sensitivity, arterial blood gases, and ultrasound abdomen. Nutritional rehabilitation was started as per CMAM guidelines.

The hospital management was carried out in two phases: an initial stabilization phase where the acute medical conditions were managed, specific deficiencies were corrected, metabolic abnormalities were reversed and feeding was initiated. The second phase was a longer rehabilitation phase for optimum weight gain. In the initial stabilization phase, malnourished children were fed F75 containing 75 kcal/100 ml and 0.9 gm protein/100 ml providing energy intake of 100 kcal/kg/day and protein intake of 1-1.5 gm/kg/day. In Rehabilitation phase, they received an energy - and protein dense, milk-based diet F100 containing 100 kcal/100ml and 2.9 gm protein/100 ml providing energy intake of 150-220 kcal/kg/day and protein intake of 4-6 gm/kg/day.¹⁴ The children were observed and evaluated daily during hospital admission to identify co-morbidities e.g. acute/chronic diarrhea, pneumonia, UTI, celiac disease, cerebral palsy and other respiratory illnesses like bronchiolitis, asthma and any other underlining diseases. Observations were recorded on a predesigned proforma.

The recorded data was analyzed by using SPSS version 21.0. The quantitative variables such as demographic characteristics, age, socio-economic status described as mean± standard deviation and the categorical variables such as comorbidity conditions were explained in terms of frequency distribution and percentage.

Operational definitions

Severe acute Malnutrition: Severe acute malnutrition is defined by a very low weight for height (below -3Z scores of the median WHO growth standards), by visible severe wasting, MUAC <11.5 cm or by the presence of bilateral edema.¹

Primary malnutrition: Defined as malnutrition caused by inadequate energy intake. This condition often occurs in relation to food insecurity or when adequate food is not available (in terms of total calories or specific micronutrients).⁹

Secondary malnutrition: Secondary malnutrition arises when an individual's dietary intake is sufficient, but energy is not adequately absorbed by the body as a result of infectious conditions such as diarrhea, measles or parasitic infections, or medical or surgical problems affecting the digestive system.⁹

Etiology: Is defined as manner of causation of disease.⁹

Socioeconomic status: Low socio-economic status was defined as household with income ≤500 \$ US annum and middle class was categorized as household with income 500-1000 \$ US annum).¹

RESULTS

From January 2018 to December 31, 2018, 845 children were admitted in the Nutrition rehabilitation center of CU&ICH, Multan. Among 835 studied subjects, 462 (55.33%) were male and 373 (44.67%) were female. Male to female ratio was 1.24:1. Majority of study cases belong to 1-6 months of age 339 (40.60%). The mean age group of children was 13.9 months. Most study cases belong to very low socio-economic status 663 (79.4%) with monthly income less than 15000/- Rs per month (table 1).

TABLE1: Distribution of gender, age and socio-economic status of children with SAM²⁴

Demographic detail	Total (n=835)	Percentage
Gender	N=835	
Male	462	55.33
Female	373	44.67
Age	n=835	
Less than 6Months	339	40.60
6-24 Months	316	37.80
25-60 Months	180	21.60
Socioeconomic status	n=835	
Lower	663	79.40
Middle	137	16.40
Upper	35	04.20

Among 835 patients, 643 (77%) had midupper arm circumference (MUAC) less than 11.5 cm, 563 (67.43%) with weight for height <-3SD, 88 cases (10.54%) with nutritional bilateral edema and 349 cases (41.79%) with visible severe wasting (table 2).

TABLE 2: Frequency distribution of criteria for SAM in studied children

SAM Criteria	Total N= 835	Percentage
MUAC (<11.5 cm)	643	77.00
Weight for Height (<-3Z- scores)	563	67.43
Severe Wasting(Wt/Ht<-4SD)	349	41.79
Nutritional Bilateral Edema	88	10.54

Common symptoms at admission were failure to

thrive, inability to gain weight, loose motions (fig1). Most common complaints at admission were failure to thrive, fever, diarrhea, pneumonia, septicemia, measles, severe anemia and urinary tract infection. Most common diseases present were nephrological problems 383 (45.87%), gastroenterological problems 331 (39.64%), infectious diseases 265 (31.74%), hematological problems 256 (30.66%), neurological problems in 97 cases (11.62%) table 3.

TABLE 3: Etiological spectrum of children with severe acute malnutrition (n=835)

System Diagnosis	Number of cases (%)
Nephrology	n=384(45.87)
Urinary tract infection	320(83.55)
Renal tubular acidosis	40 (10.44)
Acute Kidney disease	20 (5.22)
Multicystic Kidney Disease	02 (0.52)
Nephrotic syndrome	02 (0.52)
Gastroenterology	n=331(39.64%)
Acute diarrhea	126 (38.07)
Persistent diarrhea	80(24.17)
Celiac disease	70 (21.15)
Lactose intolerance	40 (12.08)
Glycogen storage disease	10 (3.02)
Acute hepatitis	05 (1.51)
Infectious diseases	n=265 (31.74)
Enteric fever	96(36.22)
Sepsis	65(24.52)
Scabies	57(21.05)
Otitis media	28(10.56)
Malaria	13(4.98)
Measles	05 (1.89)
Miliary TB	02 (0.75)
Hematology	n=256 (30.66)
Iron deficiency anemia	250 (97.65)
Thalassemia	06 (2.35)
Respiratory diseases	n=108 (12.94)
Pneumonia	52 (48.15)
Asthma	20(18.52)
Pulmonary TB	20 (18.52)
Bronchiolitis	10 (9.25)
Cystic fibrosis	04 (3.70)
Bronchiectasis	02 (1.86)
Neurology	n=97 (11.62)
Cerebral palsy	37 (38.15)
Meningitis	35 (36.08)
Hydrocephalus	13 (13.40)
TBM	09 (9.27)
Spina bifida	3 (3.09)

Cardiology	n=56 (6.70)
Ventricular septal defect	45 (80.36)
Atrial septal defect	5 (8.93)
Mitral stenosis	02 (3.57)
Tetralogy of Fallot	02 (3.57)
Down's syndrome with AVSD	02 (3.57)
Others	n=49 (5.87)
Down's syndrome	15 (30.62)
Pierre Robbin syndrome	15 (30.62)
Cleft palate	09 (18.37)
Cleft lip	06(12.25)
Immunodeficiency	03 (6.12)
Hyper IgE syndrome	01(2.04)
Endocrine	n=34 (4.07)
Hypothyroidism	25 (73.53)
CAH	05 (14.70)
Addison disease	03 (8.82)
Diabetes insipidus	01 (2.95)
Surgical	n=27 (3.25)
Intestinal obstruction	15 (55.56)
Malrotation of gut	04 (14.82)
Hirschsprung disease	03 (11.11)
Biliary atresia	02 (7.41)
Gastric outlet syndrome	02 (7.41)
Achalasiacardia	01 (3.70)

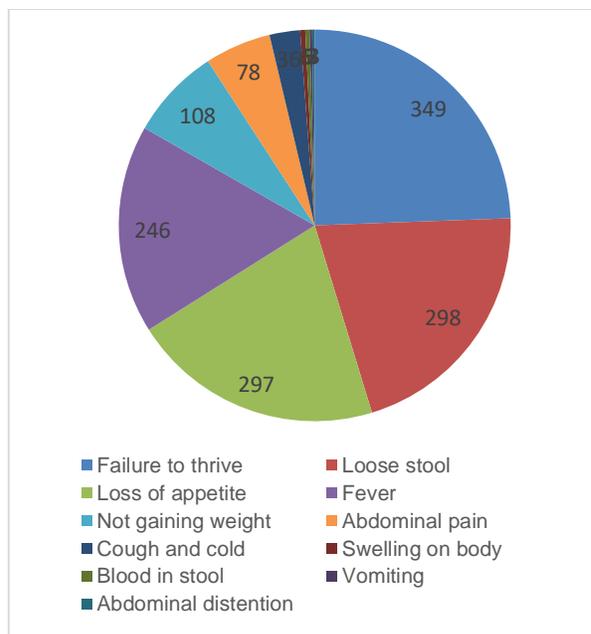


Fig 1: Distribution of symptoms at admission in SAM children (n=837)

DISCUSSION

Primary malnutrition is very common in children in

developing and low-income countries, due to wide range of factors ranging from food insecurity to poor IYCF (Infant young child feeding) practices, lack of hygiene and sanitation. Primary malnutrition is more social whereas secondary malnutrition is more biomedical.¹⁰

Secondary malnutrition contributes in increasing the malnutrition burden of any country and it results from underlying diseases that leads to compromise growth directly by suppressing appetite or through absorption of important macro or micro nutrients. In this study etiological secondary malnutrition is evaluated in children with SAM. This study focuses on data regarding etiological spectrum of secondary malnutrition in children with SAM.¹⁰

In the current study, we have included malnourished children from 1 day to 59 months, as this is most important age group in the development of a child. The mean age of children was 13.9 months which is low than a study conducted by Saini et al. (19.7 months).¹¹ Similar study was conducted by Chiabi et al. In 2017 which reported that 655 (78.40%) subjects were less than 24 months of age.¹² Another study by Chaurasiya et al. reported that 77.7% children with SAM aged less than 24 months.¹³ This strengthens the findings of our study that the majority of the subjects suffering from SAM were under two years of age.

This hospital based current study includes majority of males (55.33%) than females (44.67%) which was also observed in a study conducted by Tariq et al. (54.8%).¹⁴ On the contrary, Aguayo et al observed the prevalence of malnutrition was higher in females (55%).¹⁵ These findings were surprising because in our society more importance and preference is given to the care and diet of the male child than females, yet malnutrition was more prevalent in male children.

Out of total, 79.4% subjects belonged to low socio-economic status. Chaurasiya et al. and Kumar et al. also reported in past studies that majority of patients with SAM belonged to low socio-economic status (75% and 83.55% respectively).^{13,8} In present study, 349 (41.79%) patients had visible ever wasting and 60 (7.18%) children had bilateral edema which was comparable to a study conducted by Kumar et al.⁸

In this study the most common etiological factors were diarrhea, severe anemia, acute gastroenteritis and respiratory tract infection 55.9%, 25.89%, 23.64% and 22.13% respectively. Tariq et al. and Choudary et al also conducted studies with similar results. Although Choudary et al. reported that respiratory tract infection was 52% which is higher than current study.^{14,16} Severe weight loss (wasting), fever and loss of appetite were most common symptoms present in 65.47%, 55.72% and 46.15% samples respectively.

There are very few studies which attempted to find out the etiological factors of secondary malnutrition. Our results show that majority of factors were nephrological problems 383 (45.87%) cases and gastroenterological problems in 331 cases (39.64%). Among neurological problems, meaning it is was present in 35 (36.08%) cases which was less as compared to Prashanth MR et al and Chistietal.^{17,18} This research however, is subject to limitations, the primary limitation was limited time duration of twelve months, due to which random sampling technique was used. All the patients registered at the hospital during this period, fulfilling the inclusion criteria were recruited. A study done for longer period of time may provide more accurate results and strengthen the findings. All the etiological factors identified in this study might lead to increased risk of morbidity and mortality in SAM children. The early identification and diagnosis of these factors can not only decrease the prevalence of secondary SAM but also improve the treatment outcome in these children.

CONCLUSION

It is concluded that a wide range of clinical diseases are the etiological factors of secondary severe acute malnutrition such as Nephrological problems, gastroenterological problems and Infectious diseases being the most common ones in this study. Since these diseases cannot be reversed completely without treatment and if present long enough may aggravate the malnutrition, we need to identify these at the earliest, thus decreasing the associated morbidity and mortality.

Grant support and conflict of interest: No grants and funding were received for this study

from any organization/company/network and there is no conflict of interest of any sort regarding this research article.

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