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Pediatrics

STUDY OF FACTORS INFLUENCING WEIGHT GAIN IN SAM CHILDREN IN NRC UNIT, GOVERNMENT GENERAL HOSPITAL, ANANTHAPURAMU, ANDHRA PRADESH

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ABSTRACT

Objectives: Clinical study of SAM children admitted in NRC unit in Government General Hospital, Ananthapuramu and analysing the factors influencing the weight gain in those children. This study was planned to understand catch up growth in severe acute malnourished patients admitted to rehabilitation ward for providing nutrition.

These malnourished children with PEM have recurrent episodes of acute infections or chronic insidious infections which may go undetected. In this study, we tried to determine influence of these risk factors other than diet which are related to child and mother which could lead to SAM in children under the age of five.

Methods: Hospital based prospective clinical study.

Study included 165 children admitted in NRC unit during six months period (April 2017 to September 2017). These children categorised as target weight achieved and not achieved and compared with various variables like age, sex of hospital stay, infections and literacy of mother etc.

Results: Out of 165 patients studied 99(60%) patients mothers are literates and 66 (40%) patients mothers are illiterates. In total cases 49 (29.70%) children are less than 1 year of age and 116 (70.30%) are more than 1 year of age. Target weight gain in less than 1 year of age is statistically significant with p value of 0.004. There is no gender inequality in admitted children. 82(49.70%) are male and 83(50.30%) are female children. When target weight gain analyzed in this groups number of female children achieved target weight gain are 56 (69.14%) which is showing statistically significant value of Chi-square of 6.22 and Pvalue of 0.013 Out of 165 children target weight achieved are 97(58.79%) and not achieved are 68(41.12%). When it is compared with duration of hospital stay 52.63% achieved target weight gain in less than 14 days and 62.04% achieved in more than 14 days of duration which is not statistically significant with p value of 0.24. When clinicalcondition of admitted patients studied nearly 1/3rd of patients constitutes gastroenteritis, 1/3rd of patients constitutes anemia (27.27% each), 26.67% are admitted with lower respiratory infections, 7.8% of cases are admitted for the reason of not gaining weight. Remaining patients are admitted with other clinical conditions like fever, sepsis etc. When cultures are sent for different clinical conditions, Gram negative isolates are 10.91%, out of which E. coli is common. 1.82% of cases are Gram positive.

Conclusion: When various factors are analysed influencing weight gain, age factor and gender of child is going to influence the target weight gain in NRC units with statistically significant value. The other clinical conditions are not going to influence target weight gain significantly provided appropriate treatment is given in appropriate time.

KEYWORDS : Target weight gain, NRC Unit, SAM Child

INTRODUCTION

Malnutrition (due to both calorie and protein deficiency) remains a major public health problem throughout the developing world and is an underlying factor in over 50% of the children deaths under 5 years who die each year of preventable causes. Though poverty is the main contributing cause, it is greatly aggravated by lack of proper dietary knowledge. Nutritional rehabilitation of such patients is very important aspects of management.

Malnutrition is the gravest single treat to the world public health. PEM is one of the most widely spread health and nutritional problem of developing countries. It often causes disease and disability in the survivors. So WHO estimates malnutrition is the biggest contributor to the child mortality in under 5 and accounts for 54% of child death in world wide.

Of 146 millions underweight children from the developing world, India is home to 57 million. In 2013 as per global estimates of under 5, 1 in 4 children was chronically malnourished. 161 million were stunted, 51 were wasted and 17 million were severely wasted.PEM has higher incidence in nutritionally vulnerable groups in children between 6 months to 2 years.

Infectious disease worsens when malnutrition is present and conversely malnutrition weakens resistance to various infections which are more serious in a malnourished child. These malnourished children with PEM have recurrent episodes of acute infections or chronic insidious infections which may go undetected. Thus recurrent diarrhoeal diseases, lower respiratory infections and occult urinary tract infections are common and have high mortality. Tuberculosis and malaria must always be ruled out. Intestinal parasitosis like Ascariasis, Hook worm and Giardiasis must be treated. Septicaemia, especially in infants and toddlers, may be life threatening.

Regarding humoral immunity IgG, IgM, IgA concentrations are not significantly affected in mild and moderate forms of PEM, but depressed in severe forms of PEM with infections. Cell mediated immunity (CMI) is impaired in all grades of malnutrition except in grade I. This explains a high incidence of gram negative bacterial infections and serious morbidity and mortality to viral infections like Herpes and Measles.

Malnourished children are more susceptible to disease and have reduced capacity to learn and have deficits in cognitive functions, less likely to perform well in school. The evidence suggests that under nutrition have pervasive effects on immediate health and survival as well as on subsequent performance. These include effects on physical work capacity, productivity and economic growth. These defects are related to severity of PEM and can be decreased probably by combination of dietary and behavioural interventions, coupled with improvements to the overall quality of home/school environment. Such interventions appear to be much more effective if instituted in early life.

It is observed that impact of various non-dietary factors like Mother's education status, knowledge about feeding practices, socioeconomic status. Previoushistory, present evidence of infection is important in determining the weight of the child. As the most of the patients admitted in NRC unit are from rural background and ignorant of various things, hence details of feeding practices and socioeconomic status cannot valuably analysed. In this study we tried to determine the influence of these other factors.

The concept of nutritional rehabilitation centre, where patients are admitted are aimed at providing diet

1 Nutrition rehabilitation of these children with generous amounts of energy and protein along with other nutrients is associated with rapid weight gain.
2 Also facilitate education of mothers as well as monitoring of children for any complications and catch up growth.
3 Immunization gaps are met, and parents are prepared for further home management of the child.

So this study is planned to understand catch up growth pattern and various nutritional, non-nutritional factors influencing the weight gain.

MATERIALS AND METHODS
Out of 204 cases admitted in NRC unit during our study period (April 2017 to September 2017), 165 cases are included which is a prospective observational study. 39 cases are excluded from the study. These children categorised as target weight achieved and not achieved and compared with various variables like age, duration of hospital stay, infections and literacy of mother etc.

Criteria for admission in NRC unit is
1. Weight for height less than -3 sd
2. Severely wasted children.
3. Children with MUAC less than 11.5 cms.
4. Children with bilateral pedal edema.

Following admission these children are screened for sepsis which includes CBP, ESR, CRP, X-Ray chest PA view, Urine C/S, Stool C/S (with diarrhoea). Blood culture is collected from children with high total leucocyte count with neutropenia, Positive CRP, inadequate clinical response to therapy. Tubercular screening and retroviral screening done in patients with history of TB contact and suspected immune compromised child Positive septic screen defined as TLC < 5,000 or > 11,000, and either CRP positive or > 15 mm ESR or Blood culture positive.

Target weight is defined as 15% increase in the admission weight. Daily weight monitoring is done.

Literacy in this study defined as mothers who studied 10th class.

As criteria lay down in NRC unit as per NRHM recommendations wage compensation paid for the parents for 14 days. Hence in this study children are monitored for target weight gain on or within 14 days or beyond 14 days.

These children categorised as target weight achieved and not achieved and compared with various variables like age, duration of hospital stay, infections and literacy of mother etc.

Exclusion Criteria: Patients stayed less than 10 days in NRC unit were excluded from the study.

Statistical Analysis: The collected data analysed by chi-square test using CDC Epiinfo software build number 1.2.4.

RESULTS
Out of 204 cases admitted in NRC during April 2017 to September

2017, 39 cases were excluded from the study and 165 cases are included in the study.

Total number of male children in our study group 84 (50.91%), total number of female children 81 (49.09%). When target weight gain analyzed in this groups number of female children achieved target weight gain are 56 (69.14%) which is showing statistically significant value of Chi-square of 6.22 and Pvalue of 0.013.

Table showing Gender wise target weight achievement

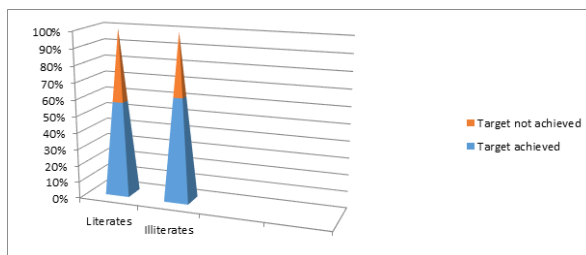| Gender	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	total	Percentage	
Males	41	48.81 %	43	51.19 %	84
Females	56	69.14 %	25	30.86 %	81
Total	97		68		165
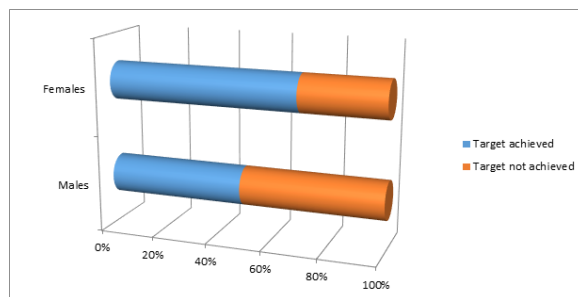
When literacy of the mothers of NRC patients is analysed 60% are literates i.e. is 99 and 40% are illiterates i.e. 66.(Table I)

Table showing mother's literacy wise target weight achievement

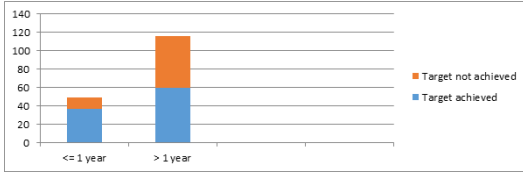| Literacy	Target achieved		Target not achieved		Total
	Total	Percentage	Total	Percentage	
Literates	56	56.57 %	43	43.43 %	99
Illiterates	41	62.12 %	25	37.88 %	66
Total	97	68			165

Significance of mother literacy status compared with target weight achievements using CDC Epiinfo version 1.2.4statistically found not significant with Chi square value of 0.48 and P Value of 0.47.

When children less than 1 year compared with children more than 1 year in terms of target weight gain, 75.51% infants achieved target weight in contrast to 51.71% more than 1 year of age, which is statistically very significant with Pvalue of 0.004 and Chi square of 8.04.

Table showing age wise target weight achievement

Age	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	Total	Percentage	
Less than or equal to 1 year	37	75.51 %	12	24.49%	49
More than 1 year	60	51.72 %	56	48.28 %	116
Total	97		68		165

In the study group target achieved patients compared with the reference to duration of hospital stay i.e< or >14 days. Patients who stayed < or = 14 days, 52.63% achieved target weight, whereas Patients who stayed more than 14 days 62.04% of patients achieved target weight gain. (10% increase). But statistically analysed using Apinfo version it is not significant with Chi square 1.36 and Pvalue 0.24.

Table showing duration of hospital stay vs target weight achievement chart

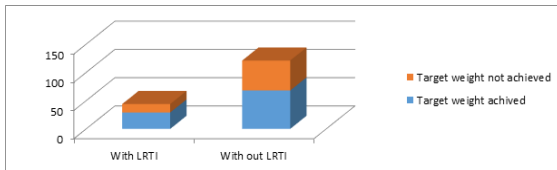| Number of days	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	Total	Percentage	
< or = 14 days	30	52.63 %	27	47.37%	57
>14 days	67	62.04 %	41	37.96 %	108
Total	97		68		165
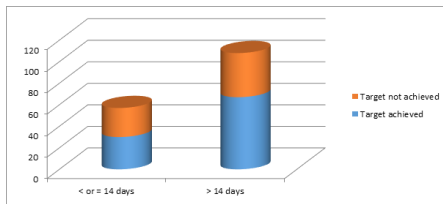
In study group children with various infections like lower respiratory tract infection, anemia and diarrhoeal diseases analysed with reference to weight gain following outcome is noted.

Out of 44 children with LRTI, 69.91% achieved target weight gain. Out of 121 without LRTI, 56.20% achieved target weight gain which is not significant when analysed statistically with Chi square 1.25 and P value 0.26.

Table showing incidence of LRTI vs target weight achievement chart
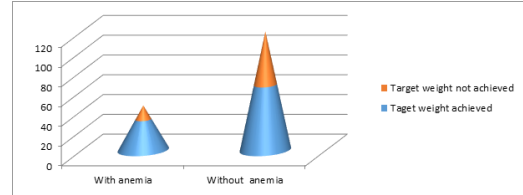
Type of infection	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	Total	Percentage	
With LRTI	29	65.91 %	15	34.09 %	44
Without LRTI	68	56.20%	53	43.80 %	121
Total	97		68		165

Out of 45 children with anemia, 68.89% achieved target weight gain. Out of 120 without anemia, 55% achieved target weight. When analysed statistically it is not significant with Chi square 2.6 and P value of 0.11.

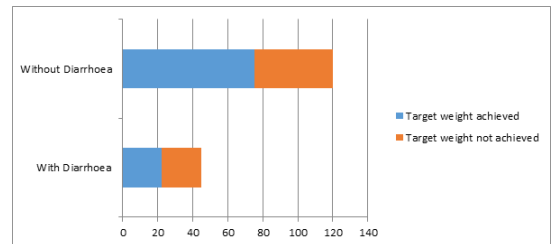**Table showing incidence of anemia vs target weight achievement chart.**

Type of disease	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	total	Percentage	
With anemia	31	68.89 %	14	31.11 %	45
Without anemia	66	55 %	54	45 %	120
Total	97		68		165

Out of 45 patients with acute diarrheal disease admitted in NRC unit, 48.89% achieved target weight, whereas out of 120 without diarrheal disease 62.5% achieved target weight gain.

Table showing diarrheal disease wise target weight achievement Chart

Type of disease	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	total	Percentage	
With Diarrhoea	22	48.89 %	23	51.11 %	45
Without Diarrhoea	75	62.50 %	45	37.50 %	120
Total	97	68			165

Out of 165 cases 40 cases (24.24%) are septic screen positive and 125 cases (75.76%) are negative. 67.5% of septic screen positive patients achieved target weight and 55.2% screen negative patients achieved target weight which is not showing statistically significant correlation.

Table based on Septic screen wise target weight achievement

Septic screen	Target weight achieved		Target weight not achieved		Total
	Total	Percentage	total	Percentage	
Positive	27	67.50 %	13	32.50 %	40
Negative	70	56 %	55	44 %	125
Total	97		68		165

When positive blood, urine and stool cultures were analysed etiologically 1.82% are Gram positive isolates and 10.91 were Gram negative isolates. Among Gram negative isolates E.coli outnumbered followed by Klebsiella, shigella and proteus.

Out of 165 cases, 97 cases (58.97%) achieved target weight gain and 68 cases (41.21%) not achieved weight gain. When various clinical conditions influencing weight gain were analysed in patients who have not achieved target weight, acute diarrheal diseases constitute maximum number of cases (36.76%), followed by LRTI (20.59%) and anemia with infections (14.71%).

DISCUSSION
When target weight gain is analyzed with reference to gender, number of female children achieved target weight gain are 69.14% which is showing statistically significant value of Chi-square of 6.22 and P value of 0.013. Which is not comparable with the study done by Jyothi Sanghvi et al published in ISRN pediatrics volume 2014 whose p value when analyzed between weight gain and not weight gain groups with reference to sex is 0.361. Similarly other study done by Mithulkumar B et al, an original research article published in International Achieves of Integrated Medicine, Volume 1, issue 2, October 2014, shows no correlation of sex with target weight gain in some patients.

As it is known fact females immune system is stronger than males which is evident in our study with significant association between sex and target weight gain achievement. Research say micro RNAs located on female X chromosome may give a woman an immune system advantage. Another reference from review article PubMed Chao TC et al, female sex hormones have distinct effects on the function of T cells, B cells, or mononuclear phagocytes. Presence of sex hormone receptors on the immune cells indicate effects of female sex hormone on these cells are mediated by these receptors.

Statistics show that in human as with other mammals female lives longer than the males and more able to fight off shock episodes from sepsis, infection or trauma. Said Libert – this is due to the X chromosome which contains 10% of all micro RNAs – important in immunity and cancer.

Researchers found that in women X chromosome have a great effect at activating immune system, T and B lymphocytes, killer cells that fight infections.

Essential role of surfactant protein A (SPA), a member of collecting family of proteins, in protecting respiratory system from infections. The finding of Mac Neill et al that SPA is expressed in the vagina. SPA has **ability to facilitate phagocytosis of microorganisms, stimulate chemo taxis, increase the oxidate burst by phagocytes and modulate pro inflammatory cytokine production by immune cells**. Production of soluble factors by female reproductive tract epithelial cells that inhibit the growth of micro-organisms. Among those are defensins, secretary leukocyte protease inhibitor (SLPI), the enzymes lysozyme and lactoferin and as well as other antimicrobial peptides.

Zhao and colleagues suggested that human beta defensins have a primary role to defend epithelial cells and mucosal surface from microbes, while alfa defensins function systemically to allow immune cells access to vascularized tissues.

When bactericidal activity was analysed Gram negative and Gram positive bacteria were inhibited by apical secretion from the uterine epithelial cells.

When target weight achieved is analysed comparing with mother literacy status it is not showing statistically significance value (P value 0.58), which is not correlated with Jyothi Sanghvi et al and Mithulkumar B et al with P values of 0.024 and 0.048 respectively.

The reason may be because of mothers of babies in the NRC unit irrespective of literacy status they were efficiently counselled by the trained nutritional counselors and social workers in NRC unit.

Target weight achievement when compared with age, like < 1 year and > 1 year, 75.51% of infants achieved target weight in contrast to 51.72% more than 1 year of age with statistically significant P value of 0.007. This correlates with study by Jyothi Sanghvi et al. In their study also children in higher age group did not gain weight as compared to children in lower age group with significant P value of 0.041.

The reason may be the infants in early weaning period have capacity to adjust to recommended food whereas older child because of its fussy eating habits cannot adjust to the recommended diet and also physiological anorexia accounts for.

When target weight gain is compared with duration of hospital stay 52.30% achieved target weights who has stayed less than 14 days whereas 62.04% achieved target weight who stayed more than 14 days which is statistically not significant with p value of 0.24. Which is comparable with the study done by Taneja G et al which is showing no statistical significant difference with respect to duration of stay with P value of 0.312.

The admission span of 14 days is not enough period to access the catch up growth as most of the guidelines and various studies suggested 2 – 8 weeks interval nutritional rehabilitation for catch up growth.

When target weight gain is compared with various infections like LRTI, anemia and acute diarrhoeal diseasesis not showing statistically significant correlation with p values of 0.26, 0.11, and 0.11 respectively. It is not comparable with study done by Jyothi Sanghvi et al which is showing statistically significant association between evidence of infection at admission in target weight gain and not weight gain groups (P value of 0.0038). Proper treatment of various infections in appropriate time is not going to influence the weight gain.

When data of septic screen is viewed 10.91% are Gram negative where as 1.82% are Gram positive. As it is described in standard text books of paediatrics.

As Cell mediated immunity (CMI) is impaired in all grades of malnutrition except in grade I, this explains a high incidence of gram negative bacterial infections and serious morbidity and mortality to viral infections like Herpes and Measles.

CONCLUSION
In conclusion present study confirms the association of age of the child and gender of the child significantly with target weight gain during the hospital stay of 14 days in NRC unit. Child feeding practices, socioeconomic status cannot exactly assessed owing to the ignorance on the part of parents coming from rural and drought prone areas. When other possible non-dietary factors which are influencing the weight gain in SAM children are analyzed like literacy status of the mother, duration of the hospital stay and the evidence of various infections like LRTI, septicaemia, acute diarrhoeal disease and status of anemia at admission or following admission is not going to influence the weight gain.

It concludes that if mothers are efficiently counselled by trained nutritional counsellors in NRC unit and if they are educated about child care and other important aspect of diet and nutritional practices for child growth literacy status of mother is not going to influence the target weight gain.

It shows that anemia and other infections if adequately and appropriately treated in time is not going to influence the management of SAM children and target weight gain.

FACTORS ASSOCIATED WITH GOOD/POOR WEIGHT GAIN

FACTORS	P VALUE
Age	0.007
Sex	0.013
Duration of stay	0.24
Literacy of mother	0.58
Anemia	0.11
LRTI	0.26
Acute diarrhoeal disease	0.11

REFERENCES
1. IAP text book of Paediatrics 6th Edition.
2. Nelson text book of Paediatrics.
3. Pubmed review article – female sex hormone and immune system. Chao TC Changgeng Yi xue – za zhi. 1996.
4. Immunology journal of cells molecules systems and technologies. The Innate immune system: Gate keeper to the female reproductive tract. Charles R Wiva & John V Fahey.
5. Article by Macneill et al
6. Jyothi sanghvi et, al, Sudhir Mehta, ISRN Pedaitrics Vol.2014, Ravindra kumar.
7. Mail online Health by Colin & Fernandez, Science correspondent for the daily mail.
8. Science daily Gene pharma – Build your RNAi. Researc let by Dr. Claude libert from Ghant University in Belgium.
9. Mitulkumar B. Kalathia 1*, Aarti M. Makwana 2, Palak T. Hapani 1, Yogesh M. Parikh 3.