Original Article

OUTCOME OF A REFEEDING PROGRAMME IN MALNOURISHED INDIGENOUS CHILDREN IN A MALAYSIAN DISTRICT HOSPITAL

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Abstract

Introduction: Undernutrition is common among the children of indigenous Orang Asli in Malaysia. Refeeding program has been introduced to address this issue by improving their nutritional status therapeutically.

Objectives: The study aims to determine the outcome of refeeding program among undernourished Orang Asli children in Gua Musang, Kelantan.

Methodology: The study is a retrospective study involving undernourished Orang Asli children enrolled in a refeeding program in Gua Musang Hospital. Inclusion criteria are children of Orang Asli by ethnicity between the age of 6 months to 12 years, enrolled between 2012-2016 with weight-for-height Z score (WHZ) of < -1SD. Factors associated with success of the program as defined by WHZ > -1SD upon discharge are measured as primary outcomes. Relapse, failure or ability to sustain WHZ > -1SD on follow up are obtained as secondary outcomes.

Results: 175 children were enrolled into the refeeding program. The median age at presentation was 24 months (IQR 19-90). At discharge, 29.1% achieved WHZ of -1SD while 54.9% had improved by at least 1SD above baseline admission WHZ. Older children are more likely to be discharged with higher WHZ. There are no reported cases of refeeding syndrome or mortality. Only 35 children returned for follow-up. None of them had weight reduction when compared to discharge weight. From MLR analysis, age was the only significant predictive factor and for increment of age by one month.

Conclusion: The refeeding program is safe to improve WHZ to -1SD in about one third of children admitted for severe acute malnutrition, however more research needs to be conducted to address the high rate of defaulters.

Keywords: Refeeding program, malnutrition, indigenous, Orang Asli.

Introduction

Undernutrition is a global health problem with wasting and stunting affecting 6.7% and 22.0% of children under-5 worldwide. Asia and Africa are home to the majority of these affected children [1]. Sustainable Development Goal (SDG) aims to reduce the number of children under-5 with stunting by 50% and wasting to less than 3% by 2030 [2]. Undernutrition contributes to 45% of under-5 mortalities commonly in association with infectious

diseases such as diarrhea and pneumonia [3]. In long term, poor nutritional status leads to suboptimal brain development, cognitive and educational performance, contributing to reduced economic productivity in adulthood [4]. World Health Organization (WHO) defines malnutrition as presence of deficiencies, excesses or imbalance in an intake of energy and/or nutrients and broadly classified as undernutrition, micronutrient-related malnutrition and overweight, obesity and diet-related non-communicable diseases. This study will focus on wasting or severe acute malnutrition (SAM) which is one of the components in undernutrition. SAM is defined as weight for height Z score (WHZ) below -3SD. Children with SAM have a 9-fold higher risk of death compared to those with WHZ > -1SD. This cohort of children is found to benefit from a feeding program as they have better trajectory of weight gain when receiving therapeutic diet. As a result, WHO has published a guideline for inpatient management of SAM which has reduced malnutrition-related fatality rates from 30% to 5% and found to be feasible and sustainable in limited resources setting [5]. In Malaysia, the indigenous *Orang Asli* children are vulnerable to malnutrition due to poor socioeconomic status and differences in cultural way of life. This fact is supported by Malaysia's Millennium Developmental Goal (MDG) report which revealed high poverty rate at 30.4% among the *Orang Asli* [6]. As a consequence, they are at increased risk of malnutrition hence increased mortality secondary to its complications. Infant and perinatal mortality rate was reported to be three times higher than national average [7]. To combat this issue, Malaysia has adopted a refeeding program based on WHO guidelines to assist in the nutritional rehabilitation in these undernourished children. Since the initiation of program in 2012, little has been reported on the outcome of the program.

Materials And Methods

Study design and population study

This is a retrospective observational study conducted in Gua Musang district where 13% of the total 90,057 population comprise of indigenous Orang Asli people. Gua Musang Hospital (GMH) is one of the pioneer district hospitals for the refeeding program in Malaysia. All malnourished Orang Asli children aged between 6 months to 12 years old with WHZ of < - 1SD, who were admitted into the refeeding programme in GMH during the period of August 2012 until 2016 were included in the study (Figure 1). On discharge, these children were followed-up in 5 Orang Asli health clinics in Gua Musang. The distance of the health clinics from GMH are Gua Musang, 1km; Kuala Betis, 30 km; Bertam, 50 km; Aring, 80 km and Lojing, 90 km.

Refeeding programme

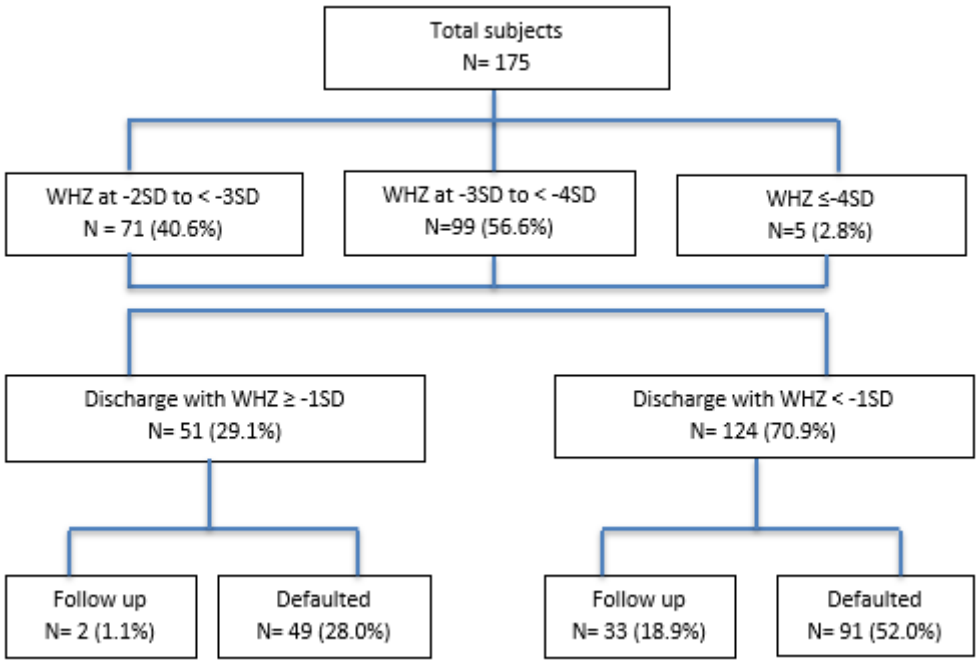
The refeeding program is a hospital-based nutritional rehabilitation program adapted from WHO guidelines and modified locally to accomodate for the cultural lifestyles [8]. Malnourished children with WHZ ≤ -2SD who were admitted to hospital were enrolled into the program. The children were considered fit for enrollment once their presenting medical conditions were stabilized. They were then subjected to a diet regimen based on WHO recommendations with local modification to enable maintenance of the diet at home following discharge. Initial diet consists of low osmolality and low lactose milk in small quantities with a total calorie of 75 to 100 kcal/kg/day (stabilization phase). The diet was then gradually upgraded to increase the calories to 170- 220 kcal/kg/day (rehabilitation phase). Local foods were added during this phase. The local hospital dietician would ensure that total daily calories and protein provided by the diet were within the recommendation. At the start of the programme, baseline blood investigations were taken. The children were examined daily for signs of refeeding syndrome and weighed every third morning. Blood investigations were only repeated as required by the attending medical officers.These children were considered to be fit for discharge once their WHZ reached at least -1SD or they attained 15-20% increment in weight and have a good appetite. Upon discharge, each patient was prescribed a food basket. Prior to 2014, there were no standard operating procedure for follow up measures. It was only from 2015 onwards that children who were discharged were followed-up and monitored. Follow-up was scheduled for the first, third, sixth and twelfth months post-discharge in one of the respective local health clinics, where they

were reviewed by dieticians and weights were measured. Those who failed to turn up for appointments would be traced and followed up by mobile clinics.

Data collection

Patients' demographic and clinical data during the refeeding program were retrieved from the medical records in GMH. Follow-up data were collected from records in the health and mobile clinics. Figure 1 below shows that the subject enrollment in this study.

Figure 1 Subject Enrollment



Statistical analysis

Data entry and statistical analysis was performed using GNU PSPP Statistical Analysis Software version 1.3. Descriptive statistics were used for continuous variable in the form of median and interquartile range (IQR). Logistic regression is implemented to adjust for confounding variables affecting the predictive factors for children being discharged with WHZ of -1SD. Statistical analysis was considered significant if p value < 0.05.

Results

A total of 175 children were enrolled into the refeeding program during the study period (Table 1). Almost two-thirds (61.7%) of the children were males and the median age on admission was 24 months (IQR 19-90 months). 52% of the children were between the age of 6 to 24 months. The same age group forms the largest proportion of children being admitted for SAM. The majority of children enrolled into the program did not have any comorbidities and almost all had received their immunizations according to the Malaysian national immunization program. 40% of children admitted had WHZ of <-2SD and 56.6% of the children had a WHZ of <-3SD (Table 2).

Table 1 Demographic Data on Admissions for Refeeding Programme

Demographic Data	N = 175
	n (%)
Age, month (median [IQR])	24 [19-90]
Gender	
Male	108 (61.7)
Female	67 (37.7)
Reason for admission	
Malnutrition	170 (97.2)
Malnutrition with medical illnesses e.g	5 (2.8)
Peneumonia, gastroenteritis	
Type of feeding	
Breastfeeding solid	9 (5.1)
Mixed breast and bottle feeding + solid	24 (13.7)
Mixed diet	42 (24.0)
Unknown	100 (57.2)
Immunization	
Immunized	170 (97.2)
Incomplete immunization	3 (1.7)
Unimmunized	2 (1.1)

Note: Interquatile Range (IQR)

Table 2 Age Group Distribution in Relation to Severity of Malnutrition

Age group n= 175	Weight for height z score, n (%)			Total, n (%)
	-2 SD	-3SD	-4SD	
6-24 months	33(18.9)	55(31.4)	3(1.7)	91 (52.0)
2-5 years	34 (19.4)	37 (21.1)	2 (1.1)	73 (41.7)
5-12 years	4 (2.3)	7 (4.0)	0 (0)	11 (6.3)

Weight for height z score: anthropometric indicators based on WHO growth standards classifying the nutritional status across population

The median weight on admission was 8.0 kg (IQR 2.9-9.7) and the median rate of weight gain was 5.63 mg/kg/day (IQR -2.14-13.4mg/kg/day). Median percentage weight increment during the refeeding program was 8.85% (IQR 1.13-18.8%). The median weight at discharge was 8.65 kg (IQR 2.72-10.2kg) (Table 3).

Table 3 Outcome of the Refeeding Programme

	Median (IQR)
Weight on admission, kg (median[IQR])	8 [2.9-9.7]
Weight on discharge, kg (median[IQR])	8.65[2.72-10.2]
Percentage of weight gain, % (median[IQR])	8.85[1.13-18.83]
Rate of weight gain, gm/kg/day (median[IQR])	5.63[-2.14-13.4]
Length of stay, days (median[IQR])	15[4-26]
Outcome, n (%)	N = 175
Discharge	147 (84)
Absconded	8 (4.6)
Discharge at own risk	20(11.4)
Death	0(0)
Follow up post discharge, n (%)	
Total Individual	35(20)
1 month	26(14.9)
3 month	27(15.4)
6 month	26(14.9)
12 month	26(14.9)

IQR: Interquatile Range

The parents of 8 patients (4.6%) left the ward without informing the staff and 20 (11.4%) were discharged against medical advice. These children had been admitted with WHZ of < -2SD and <-3SD.

Table 4 Predictive Factors for Children Discharged with WHZ at -1SD

Variables	**OR**	**95%CI**	**P-value**
Age, month	1.04	1.01-1.08	0.030
Length of stay, days	0.99	0.97-1.02	0.579
Gender	0.92	0.45-1.88	0.826
Weight on admission, kg	0.90	0.66-1.24	0.342

Rate of weight gain, gm/kg/day	1.04	0.98-1.09	0.190

WHZ: Weight-for-height Z-score

OR: odd ratio estimated using logistic regression method

CI: confidence interval

From multiple logistic regression (MLR) analysis, only one significant predictor was found as the determinant towards children discharged with WHZ at -1SD; age was the only significant predictive factor and for every increment of age by one month (Table 4). Based on the Odds ratio (OR) value, age by one month is 1.04 less likely to be discharge with WHZ at -1SD.

Follow-up data were available from one month to one year after discharge. Only 35 children had records of returning for follow-up at the health clinics; two (1.1%) from the group discharged at WHZ at -1SD and 33 (18.9%) were from the group discharged at < -1SD. All of these children showed weight gain or were able to maintain their discharge weight. Three children who had WHZ of <-3SD when they were discharged against medical advice, were readmitted with WHZ of <-3SD a year later. There were no complications related to refeeding syndrome. There was also no reported mortality during the hospital phase of nutritional rehabilitation.

Discussion

Childhood undernutrition is a global public health problem especially in middle- and low-income countries with the highest burden in South Asia and sub-Saharan countries. Childhood undernutrition in Malaysia is portrayed by the Orang Asli with a prevalence rate as high as 60% [7]. Half of total admissions were from the younger age group of 6 to 24 months. The underlying causes are multifactorial which might be possibly due to poor quality of intrauterine nutrition or suboptimal complementary feeding during this rapid physical development [9]. They are also less likely to be discharged with WHZ of -1SD. The younger age group predominance is also seen in a study from India [10]. Our study showed a higher proportion of undernutrition among boys, similar to other studies in Africa [11,12]. However, gender does not play a significant role in determining success of the program in our study. In contrast to our findings, Aguayo et al showed that girls in India had a higher risk for severe acute malnutrition due to lower social caste. Having lower weight on admission, they were less likely to be discharged at -1SD [13]. The median increment of weight gain in this study is only at 5.63 gm/kg/day which is below the international recommendation of 8 gm/kg/day [14]. Due to the retrospective nature of this study, we are unable to determine the causes for the slow weight gain. Palatability of the diet is an important issue to consider as these children were fed with formula milk that was not part of their routine diet at home. Success of the program can also be determined by the children and family member's adherence and acceptance. On average, these children need to stay for a median of 2 weeks before being discharged. This long duration of hospital stay is affecting the socio-economic dynamics of the whole family as most of the parents are day-wage earners. As a result, parents tend to bring their children home prior to the completion of the refeeding program and contributing to 20% of respondents absconded or discharged at own risk. The only significant predictive factor is the age group with older children were more likely to be discharged with WHZ -1SD. However, the finding might be influenced by a smaller proportion of older children being enrolled with SAM.

Limitation

In this study, missing data and non-standardized measurements of weight and height did not allow proper comparisons to be made. The study also reported a high defaulter rate among the children most likely due to poor access to health care, possibly related to geographical and climate challenges as they usually live in remote areas. Although mobile clinics are provided, nomadic lifestyles practiced by the Orang Asli also contributes to the poor

turn-up. Factors associated with success of the program such as parental income level or size of the family and acceptance of the diet regimen by the Orang Asli are not studied due to retrospective nature of the study.

Conclusion

The protocol of gradual increment in caloric intake in the refeeding programme could be safely implemented and achieved a WHZ of -1SD in a third of the malnourished children. Age was found to be a significant predictive factor in patients being discharged with -1SD. More comprehensive data is required for follow-up malnutrition management in the community.

Ethical Consideration

Approval to conduct this study were obtained from Research and Ethics commitee of Universiti Kebangsaan Malaysia and Malaysian Medical Research and Ethics Committee (MREC) (Reference ID: 28835). Permission to access the medical records were also obtained the Kelantan State Health Office and the Gua Musang Hospital prior to commencement of the study.

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References

1. UNICEF, WHO, W. B. G. (2021). Joint Child Malnutrition Estimates. *Who*, *24*(2), 51–78. https://www.who.int/publications/i/item/9789240025257

2. Unicef. (2018). *SDG Global Indicators Related to Children*. 73. file:///C:/Users/iddri/AppData/Local/Temp/SDG-briefing-note-1_introduction.pdf

3. Walson, J. L., & Berkley, J. A. (2018). The impact of malnutrition on childhood infections. *Current Opinion in Infectious Diseases*, *31*(3), 231–236. https://doi.org/10.1097/QCO.0000000000000448

4. Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., Ezzati, M., Grantham-Mcgregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, *382*(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X

5. Statement, A. J. (n.d.). *WHO child growth standards and the identification of severe acute malnutrition in infants and children*. http://apps.who.int/iris/bitstream/10665/44129/1/9789241598163_eng.pdf?ua=1

6. Economic Planning Unit of Prime Minister Department, United Nation Country Team: Malaysia Millenium Development Goals Report 2015. Kuala Lumpur (MY): Jan 2016: 115-133.

7. Dr Amar-Singh HSS. (n.d.). *Mortality, Morbidity & Malnutrition*. *August 2008*, 1–10.

8. Standard Operating Pocedure Pusat Transit Gua Musang. Adapted from Guidelines for the inpatient treatment of severely malnourished children. Geneva (WHO) and malnourished Orang Asli Protocols, Perak (MY): Gua Musang District Health Clinic and Gua Musang Hospital: November 2014: 10-51

9. Mayneris-Perxachs, J., & Swann, J. R. (2019). Metabolic phenotyping of malnutrition during the first 1000 days of life. *European Journal of Nutrition*, *58*(3), 909–930. https://doi.org/10.1007/s00394-018-1679-0

10. Burza, S., Mahajan, R., Marino, E., Sunyoto, T., Shandilya, C., Tabrez, M., Kumari, K., Mathew, P., Jha, A., Salse, N., & Mishra, K. N. (2015). Community-based management of severe acute malnutrition in India: New evidence from Bihar. *American Journal of Clinical Nutrition*, *101*(4), 847–859. https://doi.org/10.3945/ajcn.

11. Kimutai D, Maleche-Obimbo E, Kamenwa R, Murila F. Hypophosphatemia in children under five years with kwashiorkor and marasmic kwashiorkor. East Afr Med J 2009;86(7):330-336

12. Santana e Meneses JF, Leite HP, de Carvalho WB, Lopes E. Hypophosphatemia in critically ill children: Prevalence and associated risk factor. Pediatr Crit Care Med 2009;10(2):234-8

13. Aguayo VM, Jacob S, Badgaiyan N, Chandra P, Kumar A, Singh K. Providing care for children with severe acute malnutrition in India. Public Health Nutr 2014;17(1):206-11

14. The Sphere Project. Humanitarian Charter and Minimum Standards in Humanitarian Response. Third edition (Rugby UK): The Sphere Project2011: 84-91. Available from www.ifrc.org/PageFiles /95530/The-Sphere-Project- Handbook -2011.pdf.

APPENDIX

Weight-for-length reference chart (below 87 cm)

Boys` weight (kg)					Length	Girls` weight (kg)				
-4 SD	-3 SD	-2 SD	-1 SD	Médian	(cm)	Médian	-1 SD	-2 SD	-3 SD	-4 SD
1.7	1.9	2.0	2.2	2.4	45	2.5	2.3	2.1	1.9	1.7
1.8	2.0	2.2	2.4	2.6	46	2.6	2.4	2.2	2.0	1.9
2.0	2.1	2.3	2.5	2.8	47	2.8	2.6	2.4	2.2	2.0
2.1	2.3	2.5	2.7	2.9	48	3.0	2.7	2.5	2.3	2.1
2.2	2.4	2.6	2.9	3.1	49	3.2	2.9	2.6	2.4	2.2
2.4	2.6	2.8	3.0	3.3	50	3.4	3.1	2.8	2.6	2.4
2.5	2.7	3.0	3.2	3.5	51	3.6	3.3	3.0	2.8	2.5
2.7	2.9	3.2	3.5	3.8	52	3.8	3.5	3.2	2.9	2.7
2.9	3.1	3.4	3.7	4.0	53	4.0	3.7	3.4	3.1	2.8
3.1	3.3	3.6	3.9	4.3	54	4.3	3.9	3.6	3.3	3.0
3.3	3.6	3.8	4.2	4.5	55	4.5	4.2	3.8	3.5	3.2
3.5	3.8	4.1	4.4	4.8	56	4.8	4.4	4.0	3.7	3.4
3.7	4.0	4.3	4.7	5.1	57	5.1	4.6	4.3	3.9	3.6
3.9	4.3	4.6	5.0	5.4	58	5.4	4.9	4.5	4.1	3.8
4.1	4.5	4.8	5.3	5.7	59	5.6	5.1	4.7	4.3	3.9
4.3	4.7	5.1	5.5	6.0	60	5.9	5.4	4.9	4.5	4.1
4.5	4.9	5.3	5.8	6.3	61	6.1	5.6	5.1	4.7	4.3
4.7	5.1	5.6	6.0	6.5	62	6.4	5.8	5.3	4.9	4.5
4.9	5.3	5.8	6.2	6.8	63	6.6	6.0	5.5	5.1	4.7
5.1	5.5	6.0	6.5	7.0	64	6.9	6.3	5.7	5.3	4.8
5.3	5.7	6.2	6.7	7.3	65	7.1	6.5	5.9	5.5	5.0
5.5	5.9	6.4	6.9	7.5	66	7.3	6.7	6.1	5.6	5.1
5.6	6.1	6.6	7.1	7.7	67	7.5	6.9	6.3	5.8	5.3
5.8	6.3	6.8	7.3	8.0	68	7.7	7.1	6.5	6.0	5.5
6.0	6.5	7.0	7.6	8.2	69	8.0	7.3	6.7	6.1	5.6
6.1	6.6	7.2	7.8	8.4	70	8.2	7.5	6.9	6.3	5.8
6.3	6.8	7.4	8.0	8.6	71	8.4	7.7	7.0	6.5	5.9
6.4	7.0	7.6	8.2	8.9	72	8.6	7.8	7.2	6.6	6.0
6.6	7.2	7.7	8.4	9.1	73	8.8	8.0	7.4	6.8	6.2
6.7	7.3	7.9	8.6	9.3	74	9.0	8.2	7.5	6.9	6.3
6.9	7.5	8.1	8.8	9.5	75	9.1	8.4	7.7	7.1	6.5
7.0	7.6	8.3	8.9	9.7	76	9.3	8.5	7.8	7.2	6.6
7.2	7.8	8.4	9.1	9.9	77	9.5	8.7	8.0	7.4	6.7
7.3	7.9	8.6	9.3	10.1	78	9.7	8.9	8.2	7.5	6.9
7.4	8.1	8.7	9.5	10.3	79	9.9	9.1	8.3	7.7	7.0
7.6	8.2	8.9	9.6	10.4	80	10.1	9.2	8.5	7.8	7.1
7.7	8.4	9.1	9.8	10.6	81	10.3	9.4	8.7	8.0	7.3
7.9	8.5	9.2	10.0	10.8	82	10.5	9.6	8.8	8.1	7.5
8.0	8.7	9.4	10.2	11.0	83	10.7	9.8	9.0	8.3	7.6
8.2	8.9	9.6	10.4	11.3	84	11.0	10.1	9.2	8.5	7.8
8.4	9.1	9.8	10.6	11.5	85	11.2	10.3	9.4	8.7	8.0
8.6	9.3	10.0	10.8	11.7	86	11.5	10.5	9.7	8.9	8.1

Weight-for-height reference chart (87 cm and above)

Boys' weight (kg)					Height	Girls' weight (kg)				
-4 SD	-3 SD	-2 SD	-1 SD	Médian	(cm)	Médian	-1 SD	-2 SD	-3 SD	-4 SD
8.9	9.6	10.4	11.2	12.2	87	11.9	10.9	10.0	9.2	8.4
9.1	9.8	10.6	11.5	12.4	88	12.1	11.1	10.2	9.4	8.6
9.3	10.0	10.8	11.7	12.6	89	12.4	11.4	10.4	9.6	8.8
9.4	10.2	11.0	11.9	12.9	90	12.6	11.6	10.6	9.8	9.0
9.6	10.4	11.2	12.1	13.1	91	12.9	11.8	10.9	10.0	9.1
9.8	10.6	11.4	12.3	13.4	92	13.1	12.0	11.1	10.2	9.3
9.9	10.8	11.6	12.6	13.6	93	13.4	12.3	11.3	10.4	9.5
10.1	11.0	11.8	12.8	13.8	94	13.6	12.5	11.5	10.6	9.7
10.3	11.1	12.0	13.0	14.1	95	13.9	12.7	11.7	10.8	9.8
10.4	11.3	12.2	13.2	14.3	96	14.1	12.9	11.9	10.9	10.0
10.6	11.5	12.4	13.4	14.6	97	14.4	13.2	12.1	11.1	10.2
10.8	11.7	12.6	13.7	14.8	98	14.7	13.4	12.3	11.3	10.4
11.0	11.9	12.9	13.9	15.1	99	14.9	13.7	12.5	11.5	10.5
11.2	12.1	13.1	14.2	15.4	100	15.2	13.9	12.8	11.7	10.7
11.3	12.3	13.3	14.4	15.6	101	15.5	14.2	13.0	12.0	10.9
11.5	12.5	13.6	14.7	15.9	102	15.8	14.5	13.3	12.2	11.1
11.7	12.8	13.8	14.9	16.2	103	16.1	14.7	13.5	12.4	11.3
11.9	13.0	14.0	15.2	16.5	104	16.4	15.0	13.8	12.6	11.5
12.1	13.2	14.3	15.5	16.8	105	16.8	15.3	14.0	12.9	11.8
12.3	13.4	14.5	15.8	17.2	106	17.1	15.6	14.3	13.1	12.0
12.5	13.7	14.8	16.1	17.5	107	17.5	15.9	14.6	13.4	12.2
12.7	13.9	15.1	16.4	17.8	108	17.8	16.3	14.9	13.7	12.4
12.9	14.1	15.3	16.7	18.2	109	18.2	16.6	15.2	13.9	12.7
13.2	14.4	15.6	17.0	18.5	110	18.6	17.0	15.5	14.2	12.9
13.4	14.6	15.9	17.3	18.9	111	19.0	17.3	15.8	14.5	13.2
13.6	14.9	16.2	17.6	19.2	112	19.4	17.7	16.2	14.8	13.5
13.8	15.2	16.5	18.0	19.6	113	19.8	18.0	16.5	15.1	13.7
14.1	15.4	16.8	18.3	20.0	114	20.2	18.4	16.8	15.4	14.0
14.3	15.7	17.1	18.6	20.4	115	20.7	18.8	17.2	15.7	14.3
14.6	16.0	17.4	19.0	20.8	116	21.1	19.2	17.5	16.0	14.5
14.8	16.2	17.7	19.3	21.2	117	21.5	19.6	17.8	16.3	14.8
15.0	16.5	18.0	19.7	21.6	118	22.0	19.9	18.2	16.6	15.1
15.3	16.8	18.3	20.0	22.0	119	22.4	20.3	18.5	16.9	15.4
15.5	17.1	18.6	20.4	22.4	120	22.8	20.7	18.9	17.3	15.6

Data collection sheet

Demographic data

Name	
MRN	
Age (months) Date of birth	
Male/female	
Duration of stay in nutrition ward (d)	
Cause of admission	
Weight on admission (in kg to nearest 2 decimal points) Weight on discharge	
Rate of weight gain (weight gain over the days of admission)	
Baseline WHZ score (per WHO protocol)	
Complications of refeeding - Refeeding syndrome (abnormalities in fluid balance, glucose metabolism,hypomagnesemia, hypokalemia) - feeding intolerance: vomiting, abdominal distension	

No of persons per household	
Birth weight (SGA/AGA)	
Infant feeding practice including duration of breastfeeding	
History of worm infestation and treatment of worm infestation	
Immunization history	
Underlying medical or systemic illness	

Data on follow up

	Weight	Z score
1 month		
3 month		
6 month		
12 month		