

Role of Micro and Macro Nutrients in Malnourished Children Attending Médecins Sans Frontières (MSF), Divisional Head Quarter Hospital, Dera Murad Jamali, Balochistan

Kaniz Fatima, Faria Khurshid*, Sajjad Haider, Noman Ul Haq, Muhammad Yonus, Marvi

Faculty of Pharmacy University of Balochistan, Balochistan, PAKISTAN.

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*Correspondence to:

Faria Khurshid,

Faculty of Pharmacy University of Balochistan,
Balochistan, PAKISTAN.

Email.id: fariakhurshid@yahoo.com

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Abstract

Background: Balochistan continues to have a high prevalence of acute malnutrition. **Aim:** The objective of this study was to evaluate the role of micro and macro nutrients in malnourished children attending Medecins Sans Frontieres (MSF), Divisional Head Quarter Hospital, Dera Murad Jamali, Balochistan. **Materials and Methods :** It was hospital based longitudinal-sectional study, among patients admitted to the outpatient department. At first stage data was collected through questionnaire. The study includes patients aging 2-5 years attending OPD of MSF Dera Murad Jamali. **Results:** At enrolment there were 287(n) children aging between 2 to 5 years. 182(63.41 %) were 2 years old, 69(24%) were 3 years old. Among 287 children 148 were male (51.6%), 139 were female (48.4%). The immunization status showed that 139 children (48.44%) had been immunized while majority 148 (51.56%) had not been immunized. Among 192 children whose family monthly income was <15000 rupees, 102(33.79%) had excellent dietary practices and 90(33.1%) had unsatisfactory dietary practices. **Conclusion:** It is concluded that there is need to improve mother's knowledge regarding healthy eating, hygiene, complementary feeding and breastfeeding etc. Contributing factors of malnutrition among children were illiteracy, poverty, large family size, un-immunization, inadequate hygiene, and dietary practices.

Keywords: Child malnutrition, Macronutrients, Micronutrients, Ready to use therapeutic food.

INTRODUCTION

"Malnutrition refers to all deviation from adequate nutrition". This includes caloric under nutrition and over-nutrition, and specific deficiencies or excess of essential nutrients such as vitamins and minerals.^[1] Balochistan has the second highest rate of nutritional stunting under age 5 i.e. (52.2%), underweight (39.6%) and wasting prevalence is (16.1%).^[2]

Malnutrition can develop due to insufficiency of food mainly due to mother restriction of child's intake of breast milk which is rich in high quality proteins.^[3] On the other hand long term breast feeding of an infant can cause a delay in complimentary feeding as human milk contains low quantities of iron and zinc which results in the deficiency of micronutrients.^[4] The risk of infections is high when there is early introduction of complimentary food which thus reduces breast milk consumption and can lead to malnutrition. Micro and macronutrients (glucose, protein, fats, iron, Vitamin A, iron etc) deficiencies can lead to different disease conditions such as hypoglycemia, skeletal muscle problems, weight loss, anemia, night blindness, immune system issues.^[5]

To reduce mortality rate of children from malnutrition several programs have been introduced that focus on changing behaviors of mothers, supplying of flour to the malnourished and giving lectures on poverty and security of food.^[6]

MATERIALS AND METHODS

Study Design

It was hospital based longitudinal-sectional study, among patients admitted to the outpatient department. At first stage data was collected through questionnaire. Verbal consent was taken from mothers of patient. To know various factors causing malnutrition the care takers of children were asked various questions as family income, their occupation, educational status, eating and hygiene practices, vaccination of their children etc. First child was selected according to table of random numbers and then every third child was taken (systematic random sampling).

All the results were documented. Computerized applications were used to

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sort out all frequencies, percentages, and associations. Patient ID and their hospital card numbers were kept secret. The primary analysis was completed at this stage. Second stage consisted of anthropometric assessment of children as age, height, MUAC etc. After discharge the parents of patients were given micro and macronutrient rich ready to use therapeutic food (RUTF) for their children and asked to visit at each follow-up. RUTF was used as a standard protocol to treat malnourished children in MSF.

Study Duration

The study was carried over a time of 1 year i.e., from September 2019 to August 2020.

Study Eligibility Criteria

Inclusion criteria

The study includes patients aging 2-5 years attending OPD of MSF Dera Murad Jamali.

Exclusion criteria

Patients above 5 years and without complications like Infectious T.B, congenital heart disease, celiac diseases, chronic renal diseases, diabetes etc. were excluded.

Sample Size

(For population greater than 10,000)

$$n = z^2 pq / d^2$$

whereas,

- n = sample size desired ($n=287$)
- z = reliability co-efficient at 95% confidence interval (1.96)
- p = target population proportion that have particular characteristics.
- $q=1-p$ (target population proportion not having the particular characteristics) ($1-0.5=50\%$)
- d = degree of error, assumed (0.05)

Sampling Method/ Technique

Probability (systematic random) sampling technique was used.

Study Instrument

All the assessment protocol was carried out as height, MUAC initially. (MUAC) was measured with a bracelet placed on left arm. For the height (cm) measuring board was used.

Study Procedure

At initial stage the data was collected which included various questionnaires about the factors effecting malnutrition. Parents of malnourished children were asked various questions about their feeding practices, income status, and vaccination of their children, their dietary practices, hygiene, and diseases if any.

Second stage consisted of anthropometric assessment of children as age,

height, MUAC etc. The third stage consisted of monitoring of all measures until 8 weeks of follow-up to check if there is any increase in anthropometric measures. Mean baseline and end-line anthropometric measures were noted and difference was documented.

RUTF paste rich in micro and macronutrients was given to each patient. Anthropometric measures and cut-offs for children 6-59 months MUAC was <11.5 and WHZ <-3 for SAM patients and MUAC was between 11.5-12.5cm and WHZ between -2 & -3 for MAM patients according to WHO Growth Standards (2006).

Statistical Analysis

All the data was entered in SPSS (Statistical Package for Social Sciences, IL, Chicago, USA) version 20. The quantitative variables like age, height, weight etc. were presented as mean or Standard deviation (SD). Outcomes were monitored at each visit (MUAC, WHZ) but height was measured after four weeks. The results were presented as estimated means and Standard error and a p value (<0.05).

Ethical Considerations

Prior permission was taken for data collection from administrative authorities of District Nasirabad through a written letter from university of Balochistan. Ethical approval was obtained from Research and Ethics Committee of Faculty of Pharmacy and Health Sciences, University of Balochistan (Appendix B).

RESULTS

Socio-demographic parameters

At enrolment there were 287(n) children aging between 2 to 5 years. 182 (63.41%) were 2 years old, 69 (24%) were 3 years old, 33 (11.49%) were 4 years old, while 3 (1.04%) were 5 years old. Among 287 children 148 were male (51.6%), 139 were female (48.4%).

The immunization status showed that 139 children (48.44%) had been immunized while majority 148(51.56%) had not been immunized, likewise 107(37.28%) had immunization card while 180 (62.72%) had no immunization card available. Marital status of mothers showed that among 287 mothers of children, 267 (93.03%) were married and 20 (2.78%) were divorced. The educational status showed that among 287 mothers of children 144(50.17%) were illiterate while, 143(49.83%) were educated.

Among 287 fathers of children 190 (66.2%) were employed and 97(33.80%) were unemployed. According to family income we asserted that among 287 children, majority 192 (66.90%) had family monthly income less than 15,000 rupees and 89 (31.01%) had income 15,000-30,000 rupees while 6 (2.09%) children had family monthly income above 50000.

Association of Family monthly income, Immunization status and MUAC with dietary practices of children.

Among 192 children whose family monthly income was <15000 rupees, 102(33.79%) had excellent dietary practices and 90(33.1%) had unsatisfactory dietary practices. Among 95 children whose family monthly income was ≥ 15000 rupees, 55(19.2%) had excellent dietary practices, 40(13.98%) had unsatisfactory dietary practices. The result was found statistically insignificant (P value = 0.38). Among 139 children who had been immunized, 82 (28.57%) had excellent dietary practices, 57(19.85%) had unsatisfactory dietary

Sociodemographic Parameters and Their Frequency Distribution.		
Observed Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	148	51.6
Female	139	48.4
Immunization Status		
YES	139	48.44
NO	148	51.56
Immunization Cards		
YES	107	37.28
NO	180	62.72
Marital status of mothers		
Married	267	93.03
Divorced	20	6.97
Educational status of mothers		
Educated	143	49.83
Uneducated	144	50.17
Parents Occupation		
Employed	190	66.2
Unemployed	97	33.80
Family monthly income		
<15000	192	66.90
15000-30000	89	31.01
Above	6	2.09

practices. Among 148 children who had not been immunized, 91 (31.70%) had excellent dietary practices while 57 (19.87%) had unsatisfactory dietary practices. The result was found statistically insignificant (P value = 0.19).

Among 58 children who were with MUAC <12.5 cm, 38(13.2%) had excellent dietary practices, 20 (7.0%) had unsatisfactory dietary practices. Among 229 children who were normal with MUAC 12.5-13.5 cm, 144 (50.2%) had excellent dietary practices, 85 (29.6%) had unsatisfactory dietary practices. The result was found statistically significant (P value = 0.01). Association of Family monthly income, Immunization status and MUAC with dietary practices of children is described in the table below; (Table 1).

Anthropometric analysis after 8 weeks of follow-up (56 days)

Primary Outcomes

For children aging 2 years: ($n=182$), The mean baseline height was 72cm, the mean end-line height was 73.5cm; the difference observed was 1.5cm which showed good gain in height. Similarly, the mean baseline MUAC for was 118mm, the mean end-line MUAC was 128mm, the difference observed was 10mm which showed a significant gain in MUAC. The baseline WHZ was <-3, the mean end-line WHZ was >-2 which showed a significant gain in WHZ.

For children aging 3 years: ($n=69$), The mean baseline height was 77cm, the mean end- line height was 78cm, the difference observed was 1cm which showed an optimal gain in height. Similarly, the mean baseline MUAC was 120mm, the mean end- line MUAC was 130 mm, the difference observed

Table 1: Association of Family Monthly Income, Immunization Status and MUAC with Dietary Practices of Children.

Dietary Practices		
Excellent	Unsatisfactory	Total
102 (33.79%)	90 (33.1%)	192 (66.89%)
55 (19.2%)	40 (13.98%)	95 (33.18%)
157 (52.91%)	130 (47.08%)	287 (100%)
82 (28.57%)	57 (19.85%)	139 (48.43%)
91 (31.70%)	57 (19.87%)	148 (51.57%)
173 (60.27%)	114 (39.72%)	287 (100%)
38 (13.2%)	20 (7.0%)	58 (20.2%)
144 (50.2%)	85 (29.6%)	229 (79.8%)
182 (63.4%)	105 (36.6%)	287 (100 %)

was 10mm which showed a significant gain in MUAC. The baseline WHZ was <-2, The mean end-line WHZ was >-2, which showed a significant gain in WHZ.

For children aging 4 years: ($n=33$), The mean baseline height was 82cm, the mean end-line height was 83.5cm, the difference observed was 1.5cm which showed less gain in height. Similarly, the mean baseline MUAC was 122mm, the mean end-line MUAC was 132mm, the difference observed was 10mm which showed a significant gain in MUAC. The baseline WHZ was <-2, the mean end-line WHZ was >-2, which showed a significant gain in WHZ.

For children aging 5 years: ($n=3$), The mean baseline height was 88cm, the mean end-line height was 89.5cm, the difference observed was 1.5cm which showed optimal gain in height. Similarly, the mean baseline MUAC was 124mm, the mean end-line MUAC was 132mm, the difference observed was 8mm which showed a significant gain in MUAC. The baseline WHZ was <-2, the mean end-line WHZ was >-2, which showed a significant gain in WHZ.

Secondary Outcomes

Calculations based on T-test (age 2-5 years)

For Height: Mean difference was 5.5, estimated SD error was 2.065

For MUAC: Mean difference was 38, estimated Standard error was 14.25

Anthropometric analysis after 8 weeks of follow-up (56 days) is shown in table below; (Table 2).

DISCUSSION

In Balochistan 52 percent children suffer from stunting due to shortage of food and water. Mortality rate is much higher in children under 5 years. Many initiatives have been taken by the government to overcome malnutrition. In nations with low GNP per capita, micro and macronutrient insufficiency is additionally normal. In such situations, it is essential to carryout nutritional based programs. Previous studies used MUAC as standard percentages (15-20%) for discharge criteria. The criteria do not prove complete recovery from severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) but in our study we proved a gain in all anthropometric measures in SAM & MAM children by analyzing and monitoring them for the period

Table 2: Anthropometric Analysis after 8 Weeks of follow-up.

No. of Observations(n)	Age(years)	Mean Baseline MUAC (mm)	Mean Endline MUAC (mm)	Baseline WHZ	Endline WHZ
182	2	118	128	<-3	>-2
69	3	120	130	<-2	>-2
33	4	122	132	<-2	>-2
03	5	124	132	<-2	>-2

of 8 weeks so that there is no chance of any misconception in patients being untreated and discharged before any recovery. Our trial is also sufficient to prove that micro and macronutrients are alone sufficient in treating SAM & MAM patients whether or not using home-based food after being discharged. Our study had a limitation of conducting trial with deadline up to 8 weeks, which was a degree of freedom from malnutrition, but if it was conducted for more couple of weeks the children might come out of danger from malnutrition for their life time. Secondly the trial result showed mean values of gain in anthropometric measures, this is not applicable for individual participants. Thirdly, the study is limited for not being able to control the factors like hygiene, sanitation and feeding practices for outpatients.

In our trial we also studied various factors that were responsible for the cause of malnutrition which proved that those were seriously affecting growth of children. Globally it is studied that diet, limited incomes, low hygiene practices causing long term diarrhea, negligence in immunization of children, low breast feeding, complementary feeding all lead to severe malnutrition.^[7] Our trial also proves that in our area similar factors are responsible for the cause of malnutrition and death of children.

RUTF used for nutritional enhancement in underweight children have a significant role, showing a drastic improvement in MUAC in children aging 2 to 5 years. These results could have been better if we had any knowledge about complete dose being given to the patients. The height was measured after four weeks, which usually do not increase every week. The WHZ score values showed a good change from severe to moderate to no malnutrition that is from <-3 to >-2.

Our study showed significant decrease in malnutrition with the help of micro and macro nutrients.

CONCLUSION

In this trial it is concluded that there is need to improve mother's knowledge regarding healthy eating, hygiene, complementary feeding and breastfeeding etc. Contributing factors of malnutrition among children were illiteracy, poverty, large family size, un-immunization, inadequate hygiene and dietary practices. Further our study proves RUTF to be ideal in decreasing malnutrition.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ABBREVIATIONS

MSF: Medecins Sans Frontieres; **RUTF:** Ready to use therapeutic food; **MUAC:** Mid upper arm circumference; **SAM:** Severe acute malnutrition; **WHZ:** Weight for height z score.

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