

PATTERN OF PROTEIN-ENERGY MALNUTRITION IN SUDANESE CHILDREN AND COMPARISON WITH SOME OTHER MIDDLE EAST COUNTRIES

By

HASSAN O. OMER

ABBS (Kh.), MRC.P (LONDON) (D.C.H. LONDON)

M.I.A. Omer O.O. Khalifa

MBRS(Kh., MRCP,(UK), DCH(LONDON)

Department of Paediatrics and Child Health,
Faculty of Medicine, University of Khartoum,
Khartoum, Sudan.

SUMMARY:

The classification of protein-calorie malnutrition suggested by the Wellcome Trust Working party was employed in 119 children under the age of 4 years admitted to Khartoum Hospital with severe malnutrition between May and December 1973. Our findings compare closely with findings from other centres using the same classification. All children were below 80% of the Boston standard for weight. 58% were under-weight or marasmic, kwashiorkor and marasmic-kwashiorkor being 16% and 26% respectively. Marasmus the most frequently seen type was common in the second year of life. Males were double the number of females. Hair and skin changes were seen in over 50% of cases of kwashiorkor and marasmic-kwashiorkor, being much less common in marasmic and under-weight children.

Psychomotor changes were found in all three classes. Half the children with kwashiorkor and marasmic kwashiorkor had hepatomegaly. It was found in a fifth of children with marasmus. Anaemia, with megalocytic changes in some cases was a very common finding.

INTRODUCTION:

Of the various methods suggested for the classification of the type and severity of malnutrition (W.H.O. Tech.Rep.Ser) and (McLaren D.S. Lancet 1967) the one suggested by the Wellcome Trust Working Party, (Lancet 1970) based on weight deficit and the presence or absence of oedema, appears to be the most simple. We have, therefore, applied it to 119 patients with malnutrition treated in hospital over a six month period. We have compared our figures with the figures from other centres where the same classification was adopted (Adnan S. et al Lancet 1972).

PATIENTS AND METHODS:

Altogether 143 children were admitted to the ward between May and December, 1973. 23 died and are excluded because of incompleteness of the data. The 119 who survived and were discharged in good condition are the subject of this report

METHODS:

Age was obtained in months using when available birth certificates, otherwise the months of the arabic year were resorted to. Weight was recorded and checked and some of the clinical signs outlined (in the monograph) by Jelliffe (Jelliffe W.H.O. Monog Ser.) were used. All children had a thorough clinical examination.

Haemoglobin, haematocrit, white cell count and blood films were done on 97 of the 119 children using the methods described by Dacie and Lewis (Dacie & Lewis Practical Haem.) Serum total protein was estimated by the Buret method (Micro Analysis in Med. Bioch.) and albumin by the dyebinding method (Varley, Prac. Chem. Bioch.) on 61 randomly selected children. All children had chest X-Rays, Mantoux test 1:1000, thin and thick blood film for malaria parasites, blood culture and widal and stools and urine examination.

RESULTS:

Table 1 shows the distribution of cases according to the type of Malnutrition. 49% were marasmic, 26% marasmickwashiorkor, 16%kwashiorkor and 9% under weight. Altogether there were 79 males and 40 females giving a male: female ratio of 3:1. Figure 1 shows the age distribution of all cases. There were only 4 children under the age of 6 months. Two of these were twins, one had cleft lip and palate, and one had congenital hypertrophic pyloric stenosis. The great majority were between 7 months and 24 months with a peak between 12 and 18 months. Only 13 of the 58 marasmic cases were below the age of one year.

CLINICAL FEATURES:

Table 11 shows the incidence of some selected physical signs. Hair and skin changes are common in Kwashiorkor and marasmic kwashiorkor and much less so in marasmus.

Psychomotor changes are common but more frequent in kwashiorkor and marasmic kwashiorkor. Hepatomegaly was noticed in over 50% with kwashiorkor and marasmic kwashiorkor and was seen in less than a fifth of the marasmic cases.

BIOCHEMICAL FEATURES:

Table III shows some biochemical features in the different groups. mean

**TABLE 1:
CLASSIFICATION OF MALNUTRITION**

NUTRITIONAL STATUS	OEDEMA	WEIGHT FOR AGE % OF STANDARD CHILDREN	%
MARASMUS	—	—60	58
MARASHMUSKWASHIORKOR	—	—60	31
KWASHIORKOR	—	60—80	19
UNDER WEIGHT	—	60—80	11
TOTAL		199	100

**TABLE 2:
CLINICAL FEATURES IN THE DIFFERENT GROUPS OF MALNOURISHED CHILDREN**

CLINICAL FEATURES	MARASMUS	MARASMIKWASHI- SHIORKOR	KWASHIORKOR	UNDER WEIGHT
OEDEMA	58	31	19	11
HAIR THIN	0	31	19	NIL
OEPIG:	10	25	13	1
SKIN CHAN.	8	22	12	0
PSYCHOMETOR				
APARTHY	25	18	12	1
IRRITABLE	32	23	10	1
HEPATOM	11	17	10	1

TABLE 3:

NUMBER, AGE DISTRIBUTUION, WEIGHT AND SOME HAEMATOLOGICAL AND BIOCHEMICAL FEATURES IN THE DIFFERENT GROUPS OF MALNUTRITION

	MARASMUS	MARASMIKWASHI- SHIORKOR	KWASHIORKOR	UNDER WEIGHT
NO OF CHILDREN	58 49%	31 26%	19 16%	11 9%
AGE (MO.)	17.68 -8.72	19.29 -6.76	20.73 -8.83	11.73 3.09
WEIGHT (KG)	5.12 -1.24	6.0 -1.03	7.76 -1.26	7.05 -0.71
WEIGHT (% OF STANDARD)	46.77 -6.57	52.09 -6.04	66.15 -4.16	70.78 -4.88
HB. (g/100 ML)	8.17 -1.85	8.27 -2.25	8.98 -1.68	9.00 -1.88
HCT. %	28.56 -6.17	28.83 -7.22	31.43 -6.08	30.75 -6.24
TOTAL PLASMA PROTEIN g/100ml)	6.42 -1.18	5.06 -0.94	4.81 -0.78	(6.5) (7.2)
PLASMA ALBUMIN (g/100ml)	-0.67 -0.67	-0.58 -0.58	-0.63 -0.63	(5.08) (5.08)

total plasma protein was 4.81g/100 ml in kwashiorkor, 5.01g/100ml in marasmic kwashiorkor and 6.42g/100ml in Marasmus. The respective values for albumin were 2.18; 2.52 and 3.79g/100ml. Anaemia was common in all cases. Haemoglobin ranged from 2.4g/100ml to 11.8g/100ml. On the basis of the blood films only 50.5% were (Table V) classified as hypochromic microcytic; 34% as dimorphic 12% megalocytic and 3.1% normochromic. Table VI shows the tendency for those with dimorphic and megalocytic changes to have lower haemoglobin levels.

Table IV shows a comparison of our findings with those from Baghdad (Adnan S. et al Lancet 1972) where the same classification was applied and also with findings from Jordan (Adnan S. et al Lancet 1972) where the McLaren scoring system was employed. There is close similarity with the Baghdad findings in the average age for each type of malnutrition, the average weights and the plasma protein levels. The comparison is less close with Jordan figures with respect to age and weights but there is close similarity with the plasma protein figures.

OTHER FINDINGS:

Almost 90% of children had *diarrhoeal* disease on admission, with 42 children (35%) with *dehydration* requiring intravenous fluids. 23 children (19%) had *bronchopneumonia*. 0 (7%) had positive blood films for malignant tertian malaria. Measles preceded the malnutrition state in 9 cases (7%). Six children had enteric fever proven by blood culture and/or widal and there were two X-Ray and Mantoux positive cases of tuberculosis.

FEEDING:

All 119 children were breast fed for sometime after birth. However 66 (55%) were weaned abruptly at an average age of 11.8 months because of illness in the baby in 29, because of another pregnancy in 19 and in 8 children because of illness in the mother. Various other causes were the cause of sudden weaning in 10 children. 30 children were still being breast fed at an average age of 12 months while 12 children had been gradually weaned to a mixed diet at an average age of 15.6 months. In 10 cases the details of breast feeding were not available.

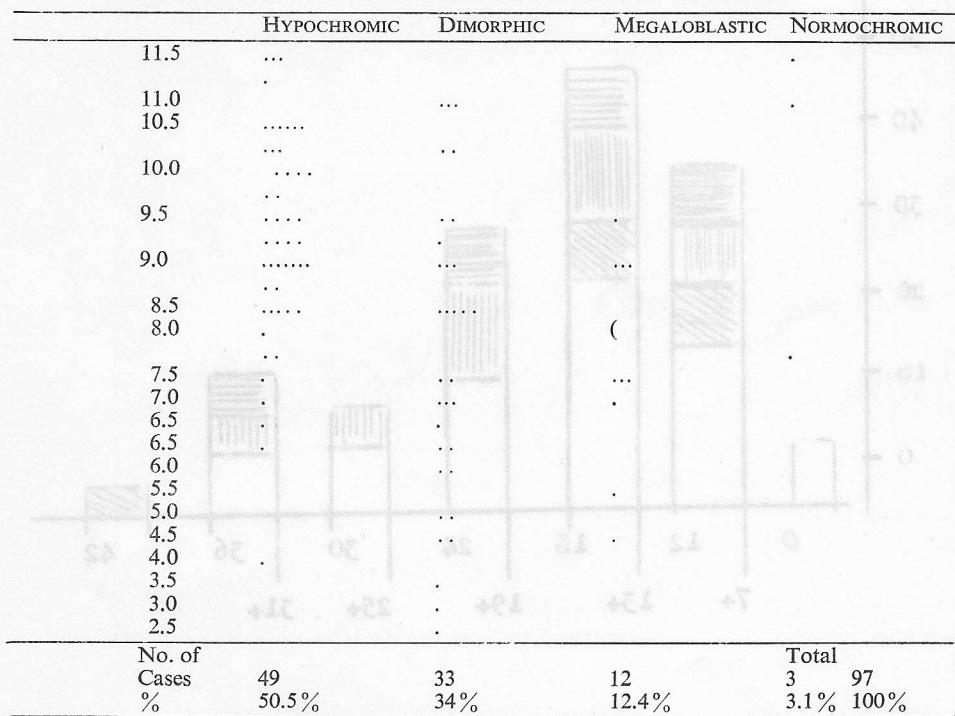
DISSCSSION:

A simple method for defining and classifying malnutrition is needed in countries where childhood malnutrition is rife and where medical auxiliaries look after vast number of children. Reliance on clinical judgement will result in lack of recognition of malnutrition in a large number of children (Adnan S. et al Lancet 1972 & McLaren D.S. Trans. R. Sec. Trop. Med. Hyg. 1970).

TABLE 4:
DISTRIBUTION BY SEX OF MALNUTRITION

SEX	MALE	FEMALE
MARASMUS	40	18
MARASMIC-KWASHIORKOR	18	13
KWASHIORKOR	10	9
UNDER WEIGHT	9	2

TABLE 5:
HAEMOGLOBIN VALUES IN THE FOUR TYPES OF ANAEMIA

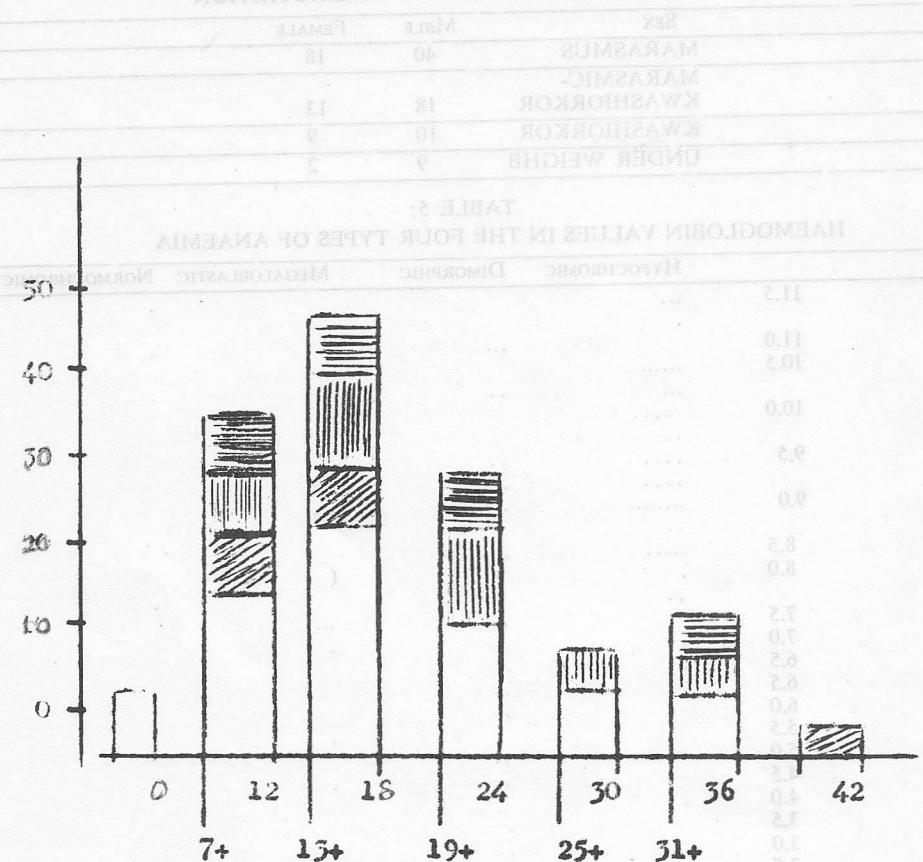


COMPARISON BETWEEN &UR FINDING AND THOSE OF MCLAREN AND ADNAN SHAKIR

	MARASMUS			MARASMIC KWASHIORKOR			KWASHIORKOR		
	KHAR- TOUM	BAGH- DAD	JORDAN	KHAR- TOUM	BAGH- DAD	JORDAN	KHAR- TOUM	BAGH- DAD	JORDAN
AGE (MO.)	17.68	16.9	12.8	19.29	21.8	15.5	20.73	21	17.3
WEIGHT % OF BOSTON STANDARD.	46.77	51.52	52.57	52.09	49.10	54.71	66.15	46.14	51.61
HB. g/100 ml	8.17	10.64	10.01	8.27	9.76	9.69	8.98	9.46	91.6
HCT. %	28.56	32	33.57	28.83	31.3	33.03	30.75	29.9	31.56
SERUM TOTAL PROTEIN	6.42	6.49	6.79	5.06	6.04	6.13	4.81	4.70	4.78
ALBUMIN g/100 ml	3.79	3.27	3.52	2.52	2.50	2.85	2.18	1.70	1.76

FIGURE I

LIST I: ESTIMATED OF MALNUTRITION BY AGE



AGE GROUPS.

AGE (MO.)	STANDARD X OF BOSTON	METHOD	COMPARISON BETWEEN SURVIVING AND THOSE OF MIGRATION	
			SHARE	PERCENT
0-12	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	100
0-12	MARASMIC	MARASMIC	MARASMIC	100
0-12	KWASHIORKOR	KWASHIORKOR	KWASHIORKOR	100
0-12	UNDER WEIGHT	UNDER WEIGHT	UNDER WEIGHT	100
13-18	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	100
13-18	MARASMIC	MARASMIC	MARASMIC	100
13-18	KWASHIORKOR	KWASHIORKOR	KWASHIORKOR	100
13-18	UNDER WEIGHT	UNDER WEIGHT	UNDER WEIGHT	100
19-24	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	100
19-24	MARASMIC	MARASMIC	MARASMIC	100
19-24	KWASHIORKOR	KWASHIORKOR	KWASHIORKOR	100
19-24	UNDER WEIGHT	UNDER WEIGHT	UNDER WEIGHT	100
25-30	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	100
25-30	MARASMIC	MARASMIC	MARASMIC	100
25-30	KWASHIORKOR	KWASHIORKOR	KWASHIORKOR	100
25-30	UNDER WEIGHT	UNDER WEIGHT	UNDER WEIGHT	100
31-42	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	MARASMIC KWASHIORKOR	100
31-42	MARASMIC	MARASMIC	MARASMIC	100
31-42	KWASHIORKOR	KWASHIORKOR	KWASHIORKOR	100
31-42	UNDER WEIGHT	UNDER WEIGHT	UNDER WEIGHT	100

In the Sudan Ministry of Health report for 1973 (Ministry of Health & Social Welfare, 1973) malnutrition is not listed among the important causes of morbidity and mortality in childhood while community surveys have shown a high incidence of malnutrition among pre-school children (Yousif Babiker, Proc. of the 3rd. Sud. Paed. Conf. 1973) and (M%Y. Sukkar Sud. Med. J. 1971). This points to an obvious lack of awareness of the problem by health workers.

The mean age incidence of our marasmic children is higher than elsewhere (Calorie Def. & Prot. Def. Widdonson Churchill Ltd. 1967) It was more commonly seen in the second year of life. This is possibly due to the very little supplementary food given and the frequent gastro-intestinal infections. Almost all the mothers are unemployed and breast-feed satisfactorily for at least the first year, unless another pregnancy supervene. The more important problem appears to be the lack of awareness of the need to supplement breast feeding from an early age. The little supplements that were given were often dilute and inadequate and appear to be given for taste rather than nourishment. Thus, the working mother with the subsequent decline in the practice of breast feeding and marasmus in the first year of life as happens elsewhere (Calorie Def. & Prof. Def. Widdonson Churchill Ltd. 1967) is not yet an important problem in this community.

The mean age incidence of marasmic-kwashiorkor and kwashiorkor is like elsewhere (Dean R.F.A. Recent Advancer in Paed. 1965).

The sex incidence in this series shows a marked preponderance of males. This is the opposite of what is seen in middle-eastern countries (Adnan S. et al 1972). Although the same cultural factors which favour the male and lead to better care of him are operating in the society. The same sex preponderance is not seen in community nutrition surveys. This may represent a better utilisation of the limitedly available treatment services for male children or that the severe forms of malnutrition are possibly more common in males as McLaren has reported a better prognosis for malnutrition in females.

BIOCHEMICAL AND HAEMATOLOGICAL FEATURES:

The plasma protein values compare with those from Baghdad and Jordan (Adnan S. et al Lancet 1972). We applied the scoring system (McLaren D.S. Lancet 1967) to 25 marasmic children, 23 marasmic-kwashiorkor and 10 kwashiorkor cases. Two of the marasmic scored zero and would have been considered normal, one scored 4 and would have been considered marasmic kwashiorkor but 22 scored between 1-3. All the marasmic-kwashiorkor and kwashiorkor scored above 4 but the separation into the two categories did not agree with the system we adopted in that 12 of our marasmic-kwashiorkor

would have been considered kwashiorkor and 5 of the kwashiorkor cases scored between 6-8 and would have been classified as marasmic-kwashiorkor.

Anaemia was very common with evidence of megalocytic changes in 45% of cases. Omer A. J. of Trop. Paed. Emir. Chld. Hlth. 1973) in a careful prospective study in selected patients has reported a much higher incidence of megaloblastic anaemia in Sudanese malnourished children due to folate deficiency. Many of our cases had out-patient treatment before admission and this might have influenced the blood picture.

OTHER FINDINGS:

Although we found malaria parasites in only 7% of the children this is probably an under estimate of the true incidence as many children had received anti-malarial treatment in out-patient. Typhoid thought to be uncommon in young children (Mulligan T.O. B.M.J. 1971) was found in 6 children.

ACKNOWLEDGEMENT:

We are grateful for Dr. Awad Omer for his help with the haematological work and Dr. S.A. Wahab for the estimation of the plasma proteins.

REFERENCES

1. Adnan Shakir, Damarchi M, El Milli Lancet 1972, 11, 143.
2. Calorie Deficiency and Protein Deficiency "Proceeding of a Colloquium held in Cambridge April, 1967" Editor Mc Cance R.A. and Elsie M. Widdonson Churchill Ltd.
3. Dacie, J.V. and Lewis S.M. (1963) Practical Haematology (3rd. ed.) London: Churchill Livingstone L.D.P.
4. Dean R.F.A. in Recent Advances in Paediatrics edited by D. Gairdner. London 1965.
5. Jelliffe, D.B., W.H.O. Monograph Ser. 1966, No. 53.
6. Joint FAO/WHO Expert Committee on Nutrition. Tech. Rep. Ser. W.H.O. 1971, No. 477.
7. Lancet 1970, 11, 302.
8. McLaren D.S., Pellet, P.L. Read W.C.C., Lancet 1967, 1, 533.
9. McLaren D.S., Kanawati A.A. Trans. R. Soc. Trop. Med. Hyg. 1970, 64, 754.
10. Ministry of Health and Social Welfare. Health Policy and annual report, 1973, Khartoum University Press.
11. Micro Analysis in Medical Biochemistry 4th ed., Churchill. London.
12. Mulligan T.O. B.M.J. (1971) vol. 4, 665.
13. Omer A., El Shazali H., Awad El Karim O., El Hassan A.M. Journal of Trop. Paed. Emir. Chld. Hlth., 1(1973) vol. 19 No. 2.
14. Sukkar M.Y. Johnson D., A/Gadir A.M. Yousif M.K. Sudan Med. J. (1971) vol. 9 No. 1.
15. Yousif Bakr. Proceeding of the 3rd. Sudanese Paediatrics Conf. 1(1973) Not. Published