GROWTH FALTERING AND DEVELOPMENTAL DELAY IN CHILDREN WITH PEM

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ABSTRACT

Anthropometric measurements, Somatic Quotient (SQ), Development Quotient (DQ), Motor Quotient (MoQ) and Mental Quotient (MeQ) in 136 children in the age group 1-24 months with varying degrees of protein energy malnutrition (PEM) were compared with an equal number of comparable well nourished children. There was a progressive reduction in SQ, DQ, MoQ and MeQ as the degree of PEM advanced. There was a direct linear correlation between SQ and DQ and between height and DQ in 4° PEM. However, there was no direct correlation between head circumference and either DQ or MeQ.

Key words: *Protein energy malnutrition, Somatic Quotient (SQ), Developmental assessment, Bayley scales of infant development (BSID).*

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It has been suggested that protein energy malnutrition (PEM) affect the growth of brain, the most vital organ in the body, if it occurs during the period of rapid brain growth(1). Malnourished children may have smaller head size and they may perform less well in a variety of intelligence tests than normal children(2). With this in mind an attempt was made to look into the correlation between growth faltering as measured by anthropometry and developmental delay as measured by development scores in children with PEM.

Material and Methods

One hundred and thirty six children in the age group 1-24 months with varying degrees of PEM admitted to SAT Hospital during the period June, 1987 to August, 1988 were studied. Children with low birth weight, congenital anomalies, genetic and metabolic disorders and central nervous system infection were excluded from the study. Children under study (Group A) were categorised into 4 sub groups as per Jelliffe's grading of PEM(3). An equal number of well nourished children belonging to the same group and same socio economic status and environment were selected to form Group B. Socio economic status was assessed according to Kuppuswamy (Urban) socio economic status scale(4) in which the total score is based on the education status and occupation of the family head and total income of the family. Maternal education status was also recorded in each case.

Anthropometry including weight, height, occipito frontal head circumference (OFC) and midarm circumference were measured and compared with NCHS standards as advocated by Ghosh(5). Degree of stunting was graded according to

Waterlow's grading(6). The Somatic Quotient (SQ) was computed as the mean of weight, height, head circumference and midarm circumference each expressed as a percentage of the expected(7). Mid arm circumference was excluded from the calculation in infants due to lack of comparable standards. After controlling the acute illness and mental apathy, developmental assessment was done using the Baroda Norms of Bayley Scales of Infant Development (BSID)(8).

The Motor age and Mental age were assessed separately using the prescribed tests of BSID. The mean of the Motor and Mental Age (Mean Bayley Score) was taken as the Developmental Age. Development Quotient (DQ) was calculated as

$$\frac{\text{Developmental Age}}{\text{Chronological Age}} \times 100.$$

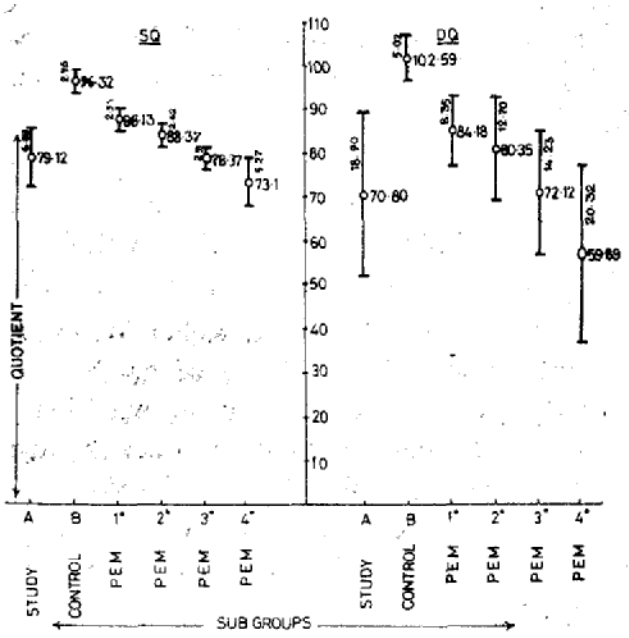
Similarly, Motor Quotient (MoQ) and Mental Quotient (MeQ) were also calculated from the Motor Age and Mental Age of the child, respectively. Motor Age to Mental Age ratio was assessed to look for any dissociation between the two. The ratio 0.9 - 1.1 was taken normal(9). Anthropometric and developmental assessments were also done with the well nourished children belonging to Group B. The correlation coefficient 'r' was computed between the variables and statistically tested using the Student's 't' test.

Results

The mean age in Groups A and B was comparable (15.37± 7.3 and 13.9 ± 7.34, respectively). Socio economically they all belonged to upper middle, lower middle and upper lower class (Classes II, III & IV). There was no significant difference in the maternal education status in both the groups. In group A 42% belonged to 4° PEM and 18, 21 and 19% belonged to 1°, 2° and 3° PEM, respectively. Clinically, 34.6% had marasmus, 7.35% had marasmic kwashiorkor, 4.41% had kwashiorkor and the rest had undernutrition. In Group A, stunting was noted in a majority indicating chronic malnutrition; 42.65, 33.82 and 16.00% had 1°, 2° and 3° stunting, respectively. In Group A, 63.9% had very low head circumference below the 3rd centile and in 4° PEM 87.7% had this feature (*Table I*). All the anthropometric and development scores were in the normal range in Group B. The somatic, development, motor and mental quotients in the various subgroups are given in *Figs. 1 & 2*. There was a progressive reduction in SQ, DQ, MoQ and MeQ as the degree of PEM advanced and the development scores had started falling even in those with 1° PEM (80-90% of the expected weight). The reduction in the development scores in Group A compared to the normal Group B was statistically significant ($p < 0.01$). There was no dissociation between motor and mental age in 51.4% in Group A (ratio 0.9 - 1.1) and in 37.5% the mental age was more reduced (ratio 1.1)(*Fig.3*). There was a direct linear correlation between SQ and DQ and between height and DQ in 4° PEM (*Table II*). In the other sub groups there was no such correlation. Similarly there was no direct correlation between head circumference (OFC) and either DQ or MeQ in any of the sub groups.

TABLE I–*Distribution (%) According to Head Circumference*

Centile	Group A (n = 136)	4° PEM (n = 57)	Group B (n = 136)
>50	1.5	1.7	26.2
5-50	30.2	5.3	68.0
3-5	4.4	5.3	5.8
<3	63.9	87.7	-



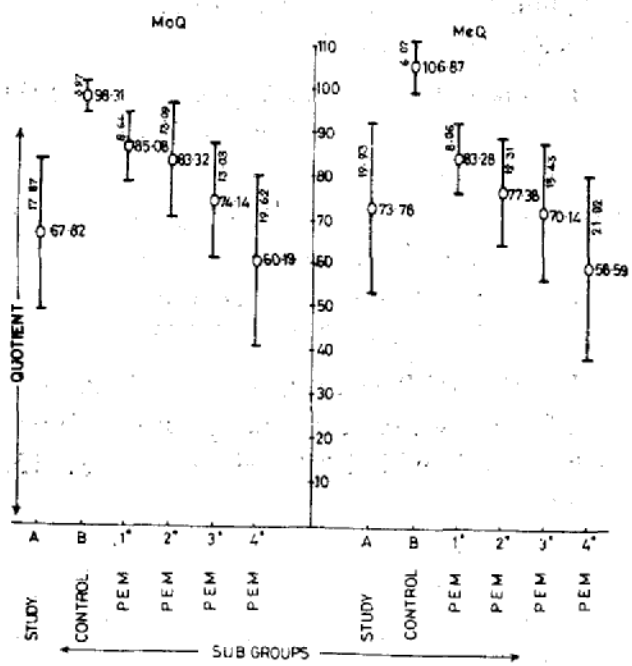
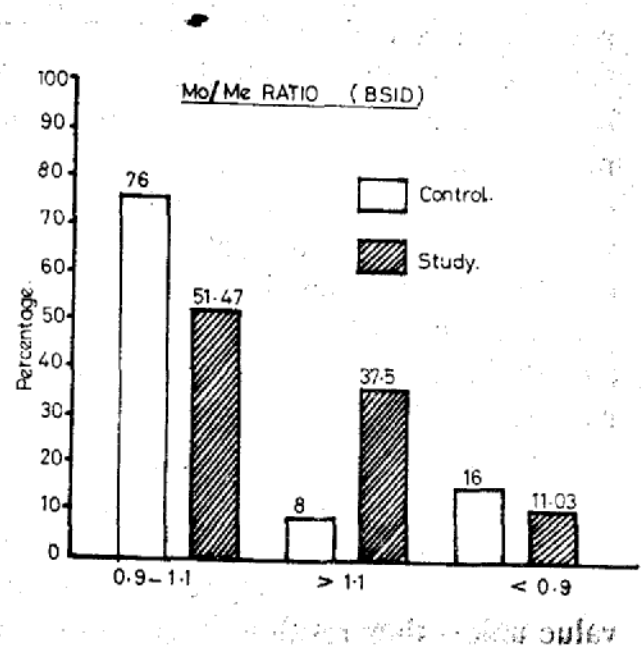


TABLE II—*Correlation Between Anthropometric and Development Scores.*

Variables	Correlation coefficient (r)+ 4° PEM (n = 57)	P value
SQ and DQ	0.40	<0.05
Height and DQ	0.27	<0.05
OFC centile and MeQ	0.22	>0.05
OFC centile and DQ	0.24	>0.05



Discussion

A significant reduction was noted in head circumference, DQ, MoQ, MeQ in the study group compared to the controls. It has been brought out by various other studies also that given proper environment for growth, Indian children are capable of attaining growth in par with Harvard NCHS standards(10). Head circumference below the 3rd centile in nearly 2/3rd of children with PEM noted in our study is comparable with other reports from our country(11). This may be the sum effect of prenatal and early postnatal malnutrition, genetic and racial factors plus malnutrition passed on from generation to generation. However, we could not demonstrate any direct linear correlation between head circumference and either DQ or MeQ, even though there are previous reports that head circumference correlates well with Intelligence Quotient (IQ) in older children and Adaptive Quotient (AQ) in infants(12). The progressive reduction noted in DQ, MoQ and MeQ, as the degree of PEM advanced, is of great concern in a country like India where 85% of child

population is malnourished(13). The fact that more number of children with PEM had reduced mental age than motor age may be due to lack of stimulation. The linear correlation between height and DQ noted in 4° PEM is also of significance as nutritional dwarfism is still a common presentation of PEM in our country. It has already been reported that physical stunting goes hand in hand with stunting of performance(2). However, there is difference of opinion as to whether the development studies in the first 3 years have predictive value. In general screening tests are of little value unless they result in intervention and treatment(14). Hence, the children under study are being followed up. Some form of developmental management, therefore, also may have to be incorporated into the treatment package for PEM. The effect of PEM in reducing intellectual achievement is so difficult to separate from that of other retarding social and environmental factors. Good nutrition and early stimulation may enable the child to make better use of available environment to achieve the endowed genetic potential for intelligence.

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