



LANDMARK DISCOVERIES

Undernutrition, brain growth and intellectual development

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'Twenty of the most grossly undernourished Cape Coloured infants who could be found, were collected over the period 1955 - 1960. They were matched for age and sex with a control group of 11 boys and 9 girls ... The birthweights of the undernourished group were said to be normal, ... First seen between the ages of 10 and 16 months ... all of them fell well below the 2.5 percentile of the average weight of Cape Coloured children of their age. The average weight of the control group at one year of age ... fell at the 10th percentile of the average weight for Cape Coloured children of this age.' Thus was the stage set for remarkable reports on an 11- and later 20-year follow-up study that were to appear from the pen of Stoch, Smythe and their colleagues from 1967 onwards.

The rationale underlying the selection of such a young group of underweight children for study was that 'previous investigators had stressed that the brain is spared during undernutrition but all the studies had been in individuals over 2 years of age, by which time growth of the brain is almost complete'. The children were examined at yearly intervals for height, weight and head circumference and biannually on psychological measures. Cognisant of the need to document intellectual growth on the basis of appropriate psychometric instruments, a variety of 'tests' was applied, where possible having been developed or adapted for the South African population and age-group-specific. In a further attempt to provide objective data on brain growth electroencephalographic (EEG) recordings were carried out. The latter were painstakingly analysed by detailed hand measurement of frequency and voltage characteristics.

In terms of growth the undernourished group had consistently smaller mean head circumference than the control or an American reference group, up to about 13 years of age; their mean heights and weights were similarly significantly below those of the controls. The clinical EEGs revealed two undernourished children with nonspecific abnormalities and the group as a whole revealed a lot of instability on provocation. Eight of the undernourished children showed slow activity and a lack of alpha patterns suggestive of maturational delay.

The psychometric measures revealed a statistically significantly poorer performance by the undernourished in comparison with the control group on two-thirds of the measures, though even the control group itself did not meet the standard set by population norms. In particular, non-verbal test scores were poorer among the undernourished group. No significant correlation was seen between the physical and psychometric measures. Classroom educational placement of the undernourished group was similarly very low compared with the population norm.

The authors concluded that 'there is cumulative and impressive evidence that severe undernutrition during the first two years of life, when brain growth is most active, has resulted in permanent reduction of brain size and defective intellectual development'.

The import of this paper can be found at several levels. The most evident is that the Stoch and Smythe paper has frequently been referred to as one of the best-controlled investigations in which the long-term effects of undernutrition have been documented. The advantages of longitudinal as opposed to cross-sectional experimental design in this context are self-evident, but these authors had the faith and courage to engage in the long-term commitment such a design implies.

This study has been the springboard of many attempts, not only in South Africa but across the world, to come to grips with the problems that beset research in this field, including, for instance, the definition of undernutrition and malnutrition in meaningful terms. The identification of adequate control groups against which to assess growth and behaviour is a complex problem. Even Stoch and Smythe did not really account for their control selection except to refer to local population growth norms, and subsequent research has still not come to grips with appropriate control groups, given the multidimensional nature of the problem. These early researchers in this field also pointed the way to the need for using relevant and culturally appropriate assessment tools with acceptable normative information for their psychometric assessments.

The value of the study can also be assessed from the point of view of one of the methods used to assess brain function. The EEG was not only used to check on clinical abnormalities, as most earlier EEG research had done. Stoch and Smythe engaged in tedious manual measurement of the detail of the EEG needed to document the changing patterns of frequency and amplitude in the maturing brain. Only later



did normative data become available on this measure, once the automation of computer measurement had been perfected for the EEG. Subsequent EEG studies were able to confirm the maturational delay reported by these authors in regard to brain development.¹

Though not many empirical data were presented in the paper with regard to social and emotional functioning, the authors did report on their impressions. It is noticeable that in both their own later publications and the work of other researchers confirmation of disturbed emotional and psychological factors, other than intellectual functioning, was found among individuals with a history of early undernutrition.

This paper is an example of pioneering research in the field of undernutrition and its effects on growth and behaviour. Reviewing it does however allow for speculation on issues that the authors may, given the state-of-the-art research today, wish the current generation of researchers would address. Three examples come to mind. The relatively recent identification of several points where spurts in growth as well as 'pruning'

take place in the developmental trajectory of children raises the question of repeated vulnerability once the all-important period of growth reported on by Stoch and Smythe has been weathered. What would improved techniques of monitoring of brain function reveal in a repeat of this classic study? Functional assessments of both metabolic and EEG indicators of the brain in action are now possible, allowing great resolution in both measurement and identification of maturing function in specific areas of the brain. What of a closer monitoring of social and emotional development over the early lifespan? Stoch and Smythe challenge us!

Reference

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