

Marginal Protein Malnutrition in some Rhodesian African School Children.

ASSESSMENT FROM PLASMA AMINO
ACID IMBALANCE.

BY
DAPHNE A. NORDEN
AND
N. CHAIBVA

Department of Biochemistry, University of Rhodesia.

Children living on a poor diet and showing no clinical signs of protein deficiency may nevertheless have an imbalance of certain amino acids in their plasma (Whitehead, 1964; Whitehead and Dean, 1964). A small pilot survey has been undertaken in which the relative concentrations of these amino acids have been investigated in serum samples taken from children at schools either near Salisbury or in a rather remote country area, in order to obtain some idea of their nutritional status.

METHODS

Serum samples collected by the Department of Physiology (for other purposes) from children aged 8-10 years from schools at Epworth, near Salisbury, and from a school about 10 miles from Mtoko (in a country area) were used. The amino acid analysis by paper chromatography followed by staining with ninhydrin, elution of the spots with methanol and chlorimetric estimation, was by the method of Whitehead (1964). Descending paper chromatography was used. The essential amino acids, leucine, isoleucine, valine and methionine were eluted together and compared with a mixture of the non-essential amino glycine, serine, glutamine and taurine. These spots were located on the chromatogram by comparison with a mixture of pure standard samples. Optical density measurements were made on a Unicam SP 500 spectrophotometer.

RESULTS

207 serum samples from African children at Epworth and 22 serum samples from children at the school near Mtoko were tested. In 97 of the first group and 19 of the second group the ratio of non-essential to essential amino acids was higher than 2.0; a result concluded by Whitehead and Dean (1964) to indicate some degree of inadequacy of protein intake. The highest ratio recorded was 3.6. Clinical symptoms of kwashiorkor might be expected with a ratio above 4.0.

DISCUSSION

The method of Whitehead (1964) for detecting marginal protein malnutrition is ideal for use in this country. Only finger-prick blood samples are required and although these must be transported to a laboratory for analysis the method is not costly and after separation of the plasma the samples can be stored frozen until required. We found that an alternative method of sealing the heparinised capillary tubes containing blood samples using Critoseal (a vinyl plastic putty obtained from Brunswick Laboratories, St. Louis, Mo. 63103) was more satisfactory. When the tubes were sealed by heating it was sometimes difficult to avoid haemolysis.

The results indicate that the percentage of children with a plasma amino acid "imbalance" ratio higher than 2.0 and therefore with an unsatisfactory dietary intake of good quality protein is significant. The use of this method of assessing dietary status with respect to protein has been criticised on the grounds that consumption of a relatively small amount of readily available good quality protein (e.g. milk) can give a misleadingly low result. However, Whitehead and Dean (1964) conclude that a value greater than 2.0 is almost certainly abnormal, but blood samples should be taken as long as possible after a meal.

The precise effects of marginal protein deficiency have been the subject of a good deal of debate. Some evidence has been obtained that children suffering from kwashiorkor may have somewhat impaired mental ability as a result (Scrimshaw and Gordon, 1968). Davidson and Passmore (1969) conclude, "many children who suffer from PCM (protein-calorie malnutrition) pass through their formative years with their physical and mental faculties impaired as a result of their inadequate diet." These results do not represent a comprehensive survey and can be regarded only as a kind of "spot" test, but they indicate that perhaps there is need at least for further investigation into the nutrition of primary school children, especially in rural areas.

Acknowledgments

We would like to thank Mrs. D. J. Venturas and Mr. C. Matanganyidze, of the Department of Biochemistry, for technical assistance.

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