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THE EFFECT OF MODERATE PROTEIN-ENERGY MALNUTRITION ON  
SEVERAL BIOCHEMICAL PARAMETERS IN PRESCHOOL CHILDREN

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INTRODUCTION

In Cameroon most cases of protein-energy malnutrition in infants and children are mild or moderate. These moderate forms are often overlooked because people don't recognize them since they show no characteristic clinical signs. They are also hard to detect because of the lack of appropriate techniques.

Most techniques used to estimate protein-energy malnutrition require simple anthropometric tests. These tests, however, do not allow an early detection of P.E.M. because they are based on bodily alterations and it is obvious that the children's bodily development is already impaired when the measurements are taken. On the contrary, one can assume that food protein-energy deficiencies quickly lead to some alterations in the proteic metabolism detectable in some blood and urine parameters. Actually, few studies are available as to the use of biochemical indicators of mild forms of malnutrition. Most authors describe the biochemical alterations occurring in severe malnutrition states.

In the present study we intend to compare the levels of several biochemical variables in healthy children with those in moderately malnourished children (excluding the severe clinical forms). We have utilized biochemical parameters known to decrease in cases of severe P.E.M.

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## METHODS

810 children from 1 to 60 months old have been observed in the South-Cameroonian forest area. Their staple diet is characterized by a low intake of poor quality protein sometimes associated with energy deficiency.

The children have been divided into two groups according to their nutritional status which was estimated by means of anthropometric tests.

Group I (control children) is composed of children whose measurements are as follows:

- Weight for age over 80 per cent of the 50th percentile of Harvard standards;
- Weight for height over 90 per cent;
- Arm circumference for age over 85 per cent of Wolanski standards;
- Arm head ratio over 0.290.

The simultaneous use of several weight and arm tests has ensured a better diagnosis of nutritonal status.

Group II (moderately malnourished children) is composed of children with at least one anthropometric test below the above stated thresholds. Their anthropometric deficiencies are moderate and never attain levels associated with severe malnutriton states.

However the means of all anthropometric tests in Group I and II differ significantly (0.001).

Blood samples were taken by venous puncture in the femoral vein. Urine was collected once in the morning. Samples were stored at  $-20^{\circ}\text{C}$  before analyses and all were treated in the same controlled conditions. The following biochemical parameters were determined:

- Total serum protein by the method of GORNALL;
- Electrophoretic fractions of the serum protein on cellulose acetate strips stained with ponceau red;
- Prealbumin, transferrin, third component of complement by radial immuno-diffusion;
- Urinary hydroxyproline by the method of HABICHT and the index calculated according to WHITEHEAD;

Differences between mean values and significance of correlation coefficients were assessed by STUDENT's test.

## RESULTS

The total serum proteins do not significantly differ from one group to the other ( $P$  over 0.05), on the contrary highly significant decreases (0.001) of prealbumin, transferrin hydroxyproline index and the albumin/globulins ratio appear in the malnourished group; the differences concerning albumin and the third component of complement are less significant (0.01).

Correlation coefficients between each anthropometric test and each biochemical variable were calculated. Although many coefficients were relatively weak, most of them were statistically significant (0.001).

Hydroxyproline index, transferrin, albumin/globulins ratio and prealbumin proved to be biochemical parameters best related to all anthropometric tests.

The correlations are generally stronger with the arm for age and the arm/head ratio tests than with the weight for age and the weight for height ones.

## DISCUSSION

Our results show a slight but significant influence of moderate malnutrition on several biochemical variables.

However, can such results entitle us to draw conclusions as to the use of biochemical variables in the early detection of malnutrition? - Many things must be taken into consideration.

FIRST - The comparison of the results of our control group with those of other works show that values given as norms can vary considerably. Such variations can be explained by differences between ecological zones studied as well as by different criteria used to define nutritional status.

SECONDLY - Even for the most sensitive parameters the levels recorded in group II were always much higher than those encountered in severe malnutrition.

Thus it appears that the effects of moderate malnutrition on biochemical parameters can only be revealed in comparison with well nourished children from the same population.

FINALLY - Some recent studies have demonstrated that the interpretation of an isolated biochemical indicator is usually questionable because of the interaction of factors other than malnutrition (parasitism and infections). These interac-

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tions and the relatively low variations observed make us think that one of the variables considered in this study can be used alone to ensure a diagnosis of mild malnutrition.

On the contrary, as assessment of nutritional status based on several parameters seems to be more advisable. A reduction of several variables should be considered as a sign of a global metabolism dysfunction determined by moderate malnutrition.

Thus albumin/globulins ratio, prealbumin, transferrin and hydroxyproline index could form a viable set of tests to be used in determining mild forms of malnutrition.

These parameters show highly significant correlations (0.001). These correlations probably reflect a simultaneous decrease of the concentrations of the parameters concerned.

In conclusion, these biochemical tests may be of value for an early detection of malnutrition but only if used together. Comparison of results must be made with those of a control group composed of children out of the same population and of the same age. In the future it seems very important to establish normal values of biochemical parameters which are modified by P.E.M.