INTELLECTUAL DEVELOPMENT AND ITS RELATIONSHIP TO THE NUTRITIONAL STATUS AMONG SCHOOL CHILDREN

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The relationship of malnutrition during infancy and the development of the brain is of interest to many investigators. Stoch and Smythe(1) demonstrate that malnourished children who have small head circumferences and underweight bodies give significantly lower I.Q. scores. This work is supported by the study of Cabak and Najdanvic(2) on Serbian children. They reveal that those who are malnourished during infancy show significantly lower I.Q. scores. Cravioto and associates(3) comment that an intelligence quotient deficit in malnourished preschool children improves as nutritional status returns to normal in an adequate environment. Pek and associates(4) reveal that intellectual development can be predicted with a high degree of accuracy on the basis of nutritional status during the preschool years. The lowest values are found in children who have been malnourished and have shown clinical signs of vitamin A deficiency during the 2 to 4 years age period, and the highest in those who have never been diagnosed as malnourished.

The purpose of this investigation is to confirm previous works on the relationship of intellectual development and growth. Secondly, we would like to know whether children who have shown clinical signs of riboflavin deficiency have a lower intelligence than normal. No one has reported such an association as yet. Since the influence of social standing and environmental factors are important and related to the development of intelligence, we tried to pair the children according to their familial background, socio-economic and environmental conditions.

Materials and Methods
Assessment of the nutritional status among school children, age 7-11 years, was performed in the Bangkhen Primary School. This school is in a suburban area of Bangkok, approximately 15 kilometers to the north. Most of the children were from families of a low socio-economic level. All 189 children attending on the day of the assessment were examined. Their weights were taken in minimal clothing on a platform scale with 0.1 kg. divisions. Because of the variation in body size from place to place, we preferred to use the weights of children in the Bangkhen study area, reported previously, as the standard weights for comparison.(5) Children who weighed under 90 per cent of the standard were grouped as the underweight. Finally, we got 34 of them drawn out of the total. Children who were normal in weight with similar age, sex, educational level, parents' occupation and socio-economic status were chosen to match with the underweight group in pairs. Those who could not be

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matched were dropped. By this method, there were 25 out of the 34 who could be paired. The children with an appearance of riboflavin deficiency were grouped and paired with normal by the same criteria. 10 cases out of 14 of the riboflavin deficiencies could be matched with the normal, we succeeded in this matching without difficulty due to the great co-operation of the school’s headmistress who had taught in this school for more than 20 years and was acquainted with all her children’s families.

For intellectual determination, the WISC test(6) was the method of choice. The children were tested by psychologically-trained examiners who knew nothing about the physical defects and familial backgrounds of the children.

**Results and Discussion**

The results in Table 1 demonstrate the variations of the I.Q. scores by sex, age and education level of children. It should be noted that their I.Q. scores are in the normal range. As can be seen from this Table, grades of study and ages of the children are directly related to the I.Q. scores. In other words, the increase of the scores varies with the number of years of environmental exposure.

Besides sex, age and education level, parents' occupations and socio-economic conditions were also considered in matching and pairing of the children. Richardson(7) concludes from his study that children whose parents have a low income, unskilled manual jobs, and minimal education, perform less well in school and in

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of Subj.</th>
<th>Intelligence Quotient Mean ± S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>70</td>
<td>94.3 ± 1.4</td>
</tr>
<tr>
<td>Boys</td>
<td>44</td>
<td>96.1 ± 1.8</td>
</tr>
<tr>
<td>Girls</td>
<td>26</td>
<td>91.2 ± 2.4</td>
</tr>
<tr>
<td><strong>Age (yrs.)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>90.0 ± 3.1</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>89.2 ± 3.3</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>90.5 ± 2.4</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>99.0 ± 2.8</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>103.8 ± 5.6</td>
</tr>
<tr>
<td><strong>Educational Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>88.5 ± 2.8</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>92.4 ± 2.2</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>90.9 ± 2.4</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>103.9 ± 3.1</td>
</tr>
</tbody>
</table>
intelligence tests than those children whose parents have a higher income, skilled technical or professional occupations and higher educational levels.

The mean of the I.Q. scores of the underweight group was 88.0 while the control group was 95.0. The difference of the means is significant, at less than a 5 percent limit. Because of the uniformity in socio-economic and other environmental factors of the paired samples and argument about its influence on intelligence, scores may be nullified. Our study is in agreement with the work in Indonesia performed by Pek and associates. They found the average I.Q. of 2 comparable groups of 72 for underweight and 80 for normal children, but they did not arrange the children in pairs as we did. Monkeberg concludes from his follow up study on 14 children with a history of severe marasmic malnutrition that the brain damage in infancy is permanent, at least up to the 6th year of life, despite later improvement in nutritional conditions. Stoch and Smythe comment that severe undernutrition during the first 2 years of life, when brain growth is most active, results in a permanent reduction of brain size and a restricted intellectual development. Though, in our study, we could not trace back the history of previous malnutrition of the children during their infancy and preschool periods, the inferiority of the intelligence of the underweight group may have been due to some causals which stopped the growth during infancy. Inadequate diet in children, certain nutritional diseases and illness are the most common causes among the low socio-economic class.

Regarding riboflavin deficiency, we studied the I.Q. because many reports in this country have confirmed the high incidence of this condition among school children. The prevalence of riboflavin deficiency varied in areas from 6 to 21 percent. Dietary surveys have been performed by ICNND, who concluded that the riboflavin intake is low in Thais. From such surveys, we assume that the children had been deficient in riboflavin since birth. We are interested in finding out whether prolonged riboflavin deficiency has any effect on the metabolism of brain tissue, especially on intelligence. The results in Table 2, show no difference in the means of the I.Q. scores between the riboflavin deficiency and normal groups. This reminds us of an experiment performed by ICNND on enlisted men.

Table 2. Intelligence Quotient and Nutritional Status of the Children.

<table>
<thead>
<tr>
<th>Clinical Diagnosis</th>
<th>No. of Subj</th>
<th>Intelligence Quotient Mean ± S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (under 90% of Bangkhen standard)</td>
<td>25</td>
<td>88.0 ± 2.1</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>95.0 ± 2.1</td>
</tr>
<tr>
<td>Riboflavin deficiency signs Control</td>
<td>10</td>
<td>99.0 ± 4.9</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>99.0 ± 3.8</td>
</tr>
</tbody>
</table>
with and without angular lesions. The amounts of urinary riboflavin excretion of both groups were not different, and it was concluded that those who did not show any signs may have been concealing a subclinical deficiency.

Summary

A study of the relationship between undernourishment and intelligence in children was performed by controlling some variables, such as sex, age, education level, parents’ occupation and socio-economic status. It was clearly shown that the underweight children were inferior in their I.Q. scores, compared to the group of normals. This may have been due to causals which affected the growth and development, especially of the brain, during infancy and early childhood. However, there was no evidence to support any relationship between riboflavin deficiency and intellectual development.

Acknowledgements

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REFERENCES:


8. Monckeberg, F.: Effect of Early Marasmic Malnutrition on Subsequent Physical and Psychological Development. Ibid.


การพัฒนาทางเข้าเว็บปัญญาในภาษาไทยของ
เจนเนอเรชั่นใหม่

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ทรงจง สุสมนัน พ.บ., สม.
วัลยทิพย์ ยามระดี ว.บ.

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คิดที่ไม่ได้ท้องสบายน์ โดยเฉพาะเด็กที่มี
ภาวะทางบกต่างๆ ปรานีควรจะมีแนวคิดที่แนวทาง
ที่จะวางแผนด้วยการสนับสนุนการพัฒนา
การศึกษาให้แก่เด็กที่มีภาวะทางบกต่างๆ
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การศึกษาให้พัฒนาอย่างต่อเนื่อง

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