Studies on Physical and Mental Growth of Prematurely Born Children

Series 1. Physical Development, Part 5
Synthetic Assessment on Physical Development of Prematurely Born Children in the Follow-up Study Throughout Nine Years From First Grade of Primary School to Third Grade of Junior High School

Ryu AIZAWA, Hideki TOMOYORI and Reiko KATADA*

Department of Public Health, Nagasaki University School of Medicine

Kazuo ETÔ*

Department of Neuropsychiatry, Nagasaki University School of Medicine, Nagasaki, Japan

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The present paper described the results of synthetic assessment on the physical development of prematurely born children in the follow-up study throughout 9 years from 1st grade of primary school to 3rd grade of junior high school. The prematurely born children were consistently more inferior in physical development when compared with the matched control group of maturely born children.

Since A. YLPPö’s study in 1919, numerous investigators have described the physical and mental development of prematurely born children, but little work has been done to conduct long-term follow-up study throughout the years from primary school to junior high school.

Since 1955, the follow-up study on physical and mental growth of prematurely born children has been conducted throughout 9 years from 1st grade of primary school to 3rd grade of junior high school in our department of public health.

* 柴沢 念, 友寄美智, 片田玲子, 衛藤和郎
Among 8213 live births registered in Nagasaki City for a year, from April 1, 1948 to April 2, 1949, 150 prematurely born children with a matched control group of 302 maturely born children were sampled for this survey when they were in the 1st grade of primary school. The selection of sample was made on the basis of sex, date of birth, residence and school class.

Owing to unavoidable losses from removal, 22 prematurely and 60 maturely born children have been out of the study when they were in the 3rd grade of junior high school. And then, excluding the absentees from the tests at each school age (mostly absence on account of illness), 91 premature and 171 mature, 262 children in total number have been given continuously the intelligence tests throughout 9 years.

**Fig. 1. Synthetic assessment on physique**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sample Size</th>
<th>Chi-Square</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>n = 2</td>
<td>$\chi^2 = 12.80$, $p &lt; 0.01$</td>
<td></td>
</tr>
<tr>
<td>Body weight</td>
<td>n = 2</td>
<td>$\chi^2 = 18.97$, $p &lt; 0.01$</td>
<td></td>
</tr>
<tr>
<td>Chest circumference</td>
<td>n = 2</td>
<td>$\chi^2 = 9.48$, $p &lt; 0.01$</td>
<td></td>
</tr>
<tr>
<td>Sitting height</td>
<td>n = 2</td>
<td>$\chi^2 = 10.36$, $p &lt; 0.01$</td>
<td></td>
</tr>
<tr>
<td>Head circumference</td>
<td>n = 2</td>
<td>$\chi^2 = 13.97$, $p &lt; 0.01$</td>
<td></td>
</tr>
<tr>
<td>Upper arm girth</td>
<td>n = 2</td>
<td>$\chi^2 = 5.52$, $0.10 &gt; p &gt; 0.05$</td>
<td></td>
</tr>
<tr>
<td>Length of lower limbs</td>
<td>n = 2</td>
<td>$\chi^2 = 8.20$, $p &lt; 0.01$</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
1. open bar ...... mature children, shaded bar ...... premature children
2. comparing premature and mature groups by chi-square test,
   height ...... $n = 2$, $\chi^2 = 12.80$, $p < 0.01$
   body weight ...... $n = 2$, $\chi^2 = 18.97$, $p < 0.01$
   chest circumference ...... $n = 2$, $\chi^2 = 9.48$, $p < 0.01$
   sitting height ...... $n = 2$, $\chi^2 = 10.36$, $p < 0.01$
   head circumference ...... $n = 2$, $\chi^2 = 13.97$, $p < 0.01$
   upper arm girth ...... $n = 2$, $\chi^2 = 5.52$, $0.10 > p > 0.05$
   length of lower limbs ...... $n = 2$, $\chi^2 = 8.20$, $p < 0.01$
Eto, himself among the authors, designed to assess synthetically the intellectual development of these 262 school children, testing for 9 years.

Corresponding to Eto's study, the present paper described the synthetic assessment on physical development of these 262 school children.

METHODS of SYNTHETIC ASSESSMENT

All individual results of these 262 children by sex and by each school age were assessed at superior, average or inferior physical development by the standards, as follows:

1. individual result $> (M + \frac{1}{2} \sigma)$: superior physical development.
2. $(M + \frac{1}{2} \sigma) \leq$ individual result $\leq (M - \frac{1}{2} \sigma)$: average physical development.
3. individual result $< (M - \frac{1}{2} \sigma)$: inferior physical development.

Note: M and $\sigma$ respectively are mean value and standard deviation in the mature group by sex and by each school age.

And then, finally the synthetic assessment on physical development of children in the follow-up study throughout 9 years was conducted by the standards, as follows:

1. superior development ...... being superior for 5 years or more.
2. inferior development ...... being inferior for 5 years or more.

Fig. 2. Synthetic assessment on physical index

Note: (1) open bar ...... mature children, shaded bar ...... premature children
(2) comparing premature and mature groups by chi-square test, body weight-height ratio ...... $n = 2, \chi^2 = 13.97, p < 0.01$
Wetzel's develop. level ...... $n = 2, \chi^2 = 16.15, p < 0.01$
3. average development ...... the remaining cases except the above-mentioned two standards.

The results of motility (peg board test), conducted only for 4 years from 6th grade of primary school to 3rd grade of junior high school, were described for reference. The standards of synthetic assessment were as follows:
1. superior development ...... being superior for 3 years or more.
2. inferior development ...... being inferior for 3 years or more.
3. average development ...... the remaining cases except the above-mentioned two standards.

RESULTS and DISCUSSION

The results, comparing the physical growth of prematurely born

![Graph showing synthetic assessment on physical strength]

Note: (1) open bar ...... mature children, shaded bar ...... premature children
(2) comparing premature and mature groups by chi-square test,
vital capacity ...... n = 2, $\chi^2 = 17.83$, $p < 0.01$
strength of back muscles ...... n = 2, $\chi^2 = 7.43$, 0.05 > $p > 0.01$
strength of hand grip ...... n = 2, $\chi^2 = 11.21$, $p < 0.01$
standing broad jumping power ...... n = 1, $\chi^2 = 3.04$, 0.10 > $p > 0.05$
(number in average and inferior groups was tested en bloc.)
children with that of maturely born children, were shown in Figures 1 – 4.

In almost all measuring items, the prematurely born children were consistently more inferior in the synthetic assessment on physical development, including physique, physical strength and motility, in the follow-up study throughout 9 years when compared with the maturely born children.

In other words, the prematurely born children were consistently over-represented among the inferior physical development and under-represented among the superior development when the results of the synthetic assessment on physical development for 9 years were compared between the prematurely and maturely born children.

One of the first studies of growth of premature infants was reported in 1919 by YLPPÖ\textsuperscript{14}. Since then, many reports have now been published on the physical development of premature infants but results are some-

Fig. 4. Synthetic assessment on motility (peg board test)

Note: (1) open bar ...... mature children, shaded bar ...... premature children
(2) In the peg board test (or Tweezer dexterity test),
pin test ...... the subject places pins in holes on a special board as rapidly as possible.
screwpin test ...... the subject screws screwpins with screw-driver in holes on a special board as many as possible for 3 minutes.
(3) comparing premature and mature groups by chi-square test,
pin test ...... $n = 2, \chi^2 = 5.97, 0.10 > p > 0.05$
screwpin test ...... $n = 2, \chi^2 = 6.15, 0.05 > p > 0.025$
times conflicting. This is probably due to the difficulty in selecting suitable samples and in conducting long-term follow-up study.

Capper\(^4\), Illingworth et al\(^8\), Blegen\(^3\), Alm\(^2\), Speirs\(^12\) and Knobloch et al\(^8\) reported varying degrees of permanent retardation in growth of prematurely born children. In the Edinburgh study, Drillien\(^9\) reported that on the average the prematurely born children had not reduced their height and weight handicaps by the age of 5 years. The results in our follow-up study\(^11\)\(^7\)\(^10\)\(^13\), measuring physique, physical strength and motility of prematurely born children with a matched control group of maturely born children, agreed with these findings.

But these reports, including our previous reports\(^11\)\(^7\)\(^10\), mostly compared the mean measurements of height, weight and others of prematurely born children at each age with those of maturely born children.

The synthetic assessment on physical development for 9 years, described in the present paper, also confirmed the handicaps of physical development, including physique, physical strength and motility, in prematurely born children.

**SUMMARY**

The present paper, describing the synthetic assessment on physical development of prematurely born children in our follow-up study throughout 9 years from 1st grade of primary school to 3rd grade of junior high school, concluded that the prematurely born children had not reduced their handicaps in physical development throughout 9 years when compared with the maturely born children.

**REFERENCE**