The Relationship Between Birth Month, Physical Size, Motor Ability and Physical Activity Evaluated by Kindergarten Teachers Among Japanese Young Children

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Objective: The purpose of this study was to examine the relationship between birth month, physical size, motor ability, and physical activity evaluated by kindergarten teachers, of young Japanese children by using structural equation modeling.

Methods: We collected the data from 329 children (160 four-year-old children: 76 male and 84 female, and 169 five-year-old children: 85 male and 84 female). Ten teachers in charge of children's classes in the kindergarten were administered questionnaires, and the children's physical size, motor ability, and children's physical activity, as determined by kindergarten teachers, were investigated. Structural equation modeling was used to examine the above-mentioned variables in each grade.

Results: The results showed significant goodness of fit in both 4- and 5-year-old children. Specifically, the model in 4-year-old children showed a significant scale, a good fit to the model according to the approximate fit indices (Goodness of Fit Index [GFI]=0.938, Adjusted Goodness of Fit Index [AGFI]=0.894, Comparative Fit Index [CFI]=0.967, and Root Mean Square Error of Approximation [RMSEA]=0.043). The model in 5-year-old children showed a significant scale and a good fit to the model according to the approximate fit indices (Goodness of Fit Index [GFI]=0.938, Adjusted Goodness of Fit Index [AGFI]=0.894, Comparative Fit Index [CFI]=0.936, and Root Mean Square Error of Approximation [RMSEA]=0.043). In both 4- and 5-year-old children, birth month influenced physical activity evaluated by kindergarten teachers, mediating physical size and motor ability.

Conclusions: We concluded that the birth months influenced children’s physical activity evaluated by kindergarten teachers through physical size and motor ability.

Key words: relative age effect, physical size, motor ability, evaluation from teachers

Introduction

In Japan, various measures have been considered to resolve problems such as decline in physical fitness and reluctance to exercise in children due to their negative attitude to exercise and sport activities1). On this basis, the Course of Study for Preschools and Guidelines of Nursing for Nursery Schools in Japan were revised in 2008. In the guidelines, improvement of physical strength and health was indicated as necessary, for which everyday play time and exercises are considered essential2) 3). Moreover, in 2014, “Physical Activity Guideline for Japanese Young Children” was developed as a specific guideline for the types of exercises that were performed and the types of capabilities to be acquired according to the developmental stages in children4).

In recent years, “relative age effect (RAE)” has become a focus for a positive or negative attitude to exercise or sports among children5). RAE is defined as the consequence of relative age differences between individuals within the same cohort, either in school or on sports teams6). Children born from April 2 in a year to April 1 in the next year enter schools in the same grade under the Japanese
school education system. In such a setting, up to 365
days of difference in the growth period between children in the same grade is inevitably associated
with a difference in growth and development (observed, in particular, in younger children). Such
difference in relative age not only causes differences in growth and development but also
affects learning and proficiency. Especially in case of professional athletes (playing soccer,
baseball, and basketball) in a sport domain, a large numbers of players with high relative age have a
benefit in terms of growth and development.

Although the mechanism underlying RAE is still unclear in previous research, the following is
considered: relatively older children experience a greater benefit in terms of physical size, motor
ability, and physical activities or sports scenes. This experience fosters self-concept, sport competence
and motivation for physical activity. RAE may
cause a positive cycle in relatively old children and vice versa. In other words the relatively old
children have a blessed physical size with age,
thereby they are able to get the score of motor
ability better than relatively young children, and to
get the many opportunity for challenges of sports.
In this way the relatively old child is able to get an
advantage of sports and positive cycle. However,
few studies have verified a model of RAE in a sports
setting.

In Japan, RAE on physical size, and motor ability,
and physical activity evaluated by kindergarten
teachers has been reported. Moreover, motor
ability and evaluation by teachers are correlated. In
other words, the difference in development caused
by birth month (relative age) may be associated
either directly or indirectly with physical size and
motor ability, and physical activity, as evaluated by
kindergarten teachers.

Therefore, the purpose of this study was to examine the relationship between birth month,
physical size, motor ability, and physical activity
evaluated by kindergarten teachers in young
Japanese children by using structural equation
modeling.

Method

1. Participants

We collected the data from 329 children (160
four-year-old children: 76 male and 84 female, and
169 five-year-old children: 85 male and 84 female)
in July 2011. We conducted a questionnaire
investigation with 10 teachers in charge of children’s classes in the kindergarten.

2. Measurements

We investigated demographic data (sex, age, and
grade), children’s physical size (body height, the
body weight, and sitting height), motor ability
(20-m sprint, standing broad jump, and softball
throwing), and physical activity evaluated by
kindergarten teachers.

a) Demographic data

We asked children’s sex, grade, age, birthdate
from the kindergarten teachers using a short
questionnaire.

b) Physical size

Children’s physical size was measured using
body height, body weight, and sitting height.

c) Motor ability

Children’s motor ability was assessed using 20-m
sprint time, the standing broad jump, and softball
ball throwing. For the 20-m sprint, we set a 25-m
straight alley and created goal lines at 20-m (true
goal line) and at 25-m (fake goal line). The mea-
surer stood at the 25-m goal line, and they recorded
each child’s time from the start cue (“set and go”) to
the moment children went through at the 20-m line.
For the standing broad jump, we set a 3-m tape on
the floor and drew a balk line. We instructed the
children to jump as far as they could from the balk
line, using both their right and left feet at the same
time. For the softball throwing, we adopted a
relatively smaller official softball (the size of the ball
was No.1 for school education). We instructed the
children to throw the ball as far as possible, using
their dominant hand. Before the measurement
trials, we first showed the children how each of
these activities were to be performed. Two trials
were carried out to assess motor ability, and the
best score was used in the analysis. All measure-
ments were performed at around 10:00 am..

d) Evaluation of children’s physical activity by
kindergarten teachers

Children’s physical activity, evaluated by kinder-
garten teachers, was based on children’s attitude,
motivation, skills, and enjoyment in the physical
activity field. We asked the kindergarten teachers
to answer the following questions: “How do you feel
3. Analysis

Before the analysis, data were checked to adjust for any missing value. Subsequently, we performed a statistical analysis. All statistical analyses were conducted using the SPSS 21.0 for Windows and the AMOS 21.0. In order to examine the relationship between children’s birth month, physical size, motor ability and physical activity evaluated by kindergarten teachers, we used structural equation modeling, which is a statistical method to test a conceptual or theoretical model. We assumed that birth month influences physical activity evaluated by kindergarten teachers, reflecting an influence on physical size and motor ability. Figure-1 shows the hypothetical model of this study.

Results

Figure-2 and Figure-3 shows that the results of structural equation modeling. We obtained significant goodness of fit for both 4- and 5-year-old children. Specifically, the model for 4-year-old children showed a significant scale $\chi^2 (\chi^2=126.19, \ df=78, \ p<0.001)$, a good fit to the model according to the approximate fit indices (Goodness of Fit Index [GFI] = 0.938, Adjusted Goodness of Fit Index [AGFI] = 0.894, Comparative Fit Index [CFI] = 0.967, and Root Mean Square Error of Approximation [RMSEA] = 0.043). Furthermore, the standardized path coefficients for items (the path from birth month to physical size, the path from physical size to motor ability, and the path from motor ability to evaluation) were higher than 0.3 and were significant (Figure-2).

The model for 5-year-old children showed a significant scale $\chi^2 (\chi^2=126.19, \ df=78, \ p<0.001)$, a good fit to the model according to the approximate fit indices (Goodness of Fit Index [GFI] = 0.938, Adjusted Goodness of Fit Index [AGFI] = 0.894, Comparative Fit Index [CFI] = 0.936, and Root Mean Square Error of Approximation [RMSEA] = 0.043). Furthermore, the standardized path coefficients for items (the path from birth month to physical size, the path from physical size to motor ability, and the path from motor ability to evaluation) were higher than 0.3 and were significant (Figure-3). In both 4- and 5-year-old children, birth month influenced children’s physical activity evaluated by teachers, mediating physical size and motor ability.

Discussion

The main goal of this study was to clarify the
Figure 2  The structural equation modelling (4-year-old children)
\[ \chi^2=126.19, \quad df=78, \quad p<0.001, \quad GFI=0.938, \quad AGFI=0.894, \quad CFI=0.967, \quad RMSEA=0.043 \]
*p<.05., **p<.01., ***p<.001., n.s.: not significant

Figure 3  The structural equation modelling (5-year-old children)
\[ \chi^2=126.19, \quad df=78, \quad p<0.001, \quad GFI=0.938, \quad AGFI=0.894, \quad CFI=0.966, \quad RMSEA=0.043 \]
*p<.05., **p<.01., ***p<.001., n.s.: not significant
relationship between children’s birth month, physical size, motor ability and physical activity evaluated by kindergarten teachers. Our study had the following four major findings.

First, birth month influenced children’s physical activity through physical size and motor ability. These results support the findings that RAE influences young Japanese children’s physical size, motor ability, and physical activity evaluated by kindergarten teachers. However, $\chi^2$ values were significant, indicating insufficiency of a fundamental measure of fit. This is because this statistic method is sensitive to a sample size and covariance of the observed variables. Children’s measured values varied widely.

Second, children’s birth month had a significant effect on physical size. This reflected differences in physical according to relative age. That is, children with a high relative age have better physical sizes.

Third, physical size significantly affected motor ability. These results explain why RAE influences motor ability. Because relatively-older-age children show a benefit in physical development according to relative age, they have better motor ability. However, in 5-year-old children, the effects of physical size on physical activity evaluation are negative, indicating that children with a better physical size may receive low physical activity evaluation. This is because weight varies with physical size. Some children from the 5-year-old class may have been overweight and may not have had good motor ability. Thus, it is important to understand how difference in physical size affects motor ability during sport or exercise.

Finally, children’s motor ability significantly affected physical activity evaluation, suggesting that kindergarten teachers evaluated children’s attitudes based on motor ability. As stated earlier, there are large differences in physical sizes between children, reflecting differences in physical development according to relative age. Thus, it is important to reduce the possibility of underestimation of physical activity by devising a method of implementation of sport or exercise.

Conclusions

We conclude that birth months affects children’s physical activity through physical size and motor ability. Thus, we propose that teachers in kindergartens should pay attention to differences in physical development according to relative age during evaluation.

References

1) Science Council of Japan: The basic guidelines for the proper implementation of exercise and sports making children lively, 2011. (in Japanese)