

Anthropometrics' Growth and Development Patterns of Elementary School Children in Bandung

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Abstract—The purpose of this study was to evaluate the status and pattern of physical growth and development of elementary school students in Indonesia, by measuring students' anthropometric dimension. Participants in this study were elementary students from partner schools consisting of 5 schools, involving students from grade 1 to grade 6, both boys and girls. The research method to be employed is cross-sectional survey. The instrument is an anthropometric measuring instruments consisting of a meter, calliper, and stopwatch and scales. The collected data is used to assess the status and pattern of growth and development of elementary students. The results of the study are expected to be used as recommendations for improving the quality of physical education lessons and the consideration of the local government to improve the quality of school policies in terms of physical and health activities of school students.

Keywords—anthropometric measurement; status and pattern; growth and development

I. INTRODUCTION

One aspect of child growth and development that is most noticeable is the growth and development of the anthropometric aspects [1], which are represented by changes in the physical size of the child, starting from the size of body stature and weight [2]. Unfortunately, there is a common tendency of most people to see the element of change of the physical only from body stature and weight. It's commonly misunderstood that within the height and weight dimension there are many other parts that can also be used as a measure of growth and child development. For example, the size of the smaller parts of body such as head circumference, shoulder width, pelvic width, sitting height, leg length, upper arm circumference, thigh circumference, calf circumference, length and width palms and soles of the feet, even the thickness of the skin which also takes into account the fat content in the skin folds [3,4].

As many experts put it, anthropometric measures of children or elementary school students contain many meanings. The implicit meaning, to name a few, is to measure and diagnosis and prognosis the child's health history, which can intersect with cultural problems, parental attention problems, nutritional problems, parents' social background problems, as well as a history of movement experiences in the past, as well as parenting patterns during their childhood rearing in the

family milieu [5] and social environment [6]. Last but not least, all aspects the children experienced in school, including such services and programs as physical education lessons and other school policy like recess time and extracurricular activities [7].

In many developed countries, this anthropometric measurement program has become part of the scientific discipline in the field of growth and development. As the consequence, the practice of anthropometric measurement has been extensively applied as their responsibility to develop their formal study that support the birth of government policies in health programs for the community and school [8]. Unfortunately, the practice of anthropometrics studies still rarely conducted in Indonesia, if not considered be neglected. Its practice has never been put as a government policy, mingling with very low attention of the scientists and health practitioners. The Ministry of Health of the Republic of Indonesia, has never been even interested in integrating this practice into the policy of national public health, including those that utilize both public and private schools [9,10].

This research was driven by the facts that the practice of anthropometric dimension of children in Indonesia was considered uncommon. Through discussion with colleagues, there was an idea to influence PE teachers at some partner elementary schools in the city to initiate the practice of anthropometric measurement program through the helps of PETE students, conducting their internship in their schools. This program was expected to become one embryonic step in supporting the studies in the field of child growth and development, by linking it to physical activity and physical education program in school.

This study aims to reveal the pattern and speed of physical growth of children at elementary schools by collecting data on the anthropometric aspects of students from partner schools in Bandung city. By obtaining the anthropometric data, researchers can assess the physical growth rate of students in Bandung by comparing it with the anthropometric size of elementary school children in other cities or comparing it with international parameters.

The output of this study was collected data on the development of anthropometric children, so that the pattern of student growth can be systematically mapped out to complements the data on children development that usually

still favour the cognitive, mental, and psychological growth aspects.

For the purpose of conceptualizing macro policy improvement, the collected data from this research can be used as the basis of arguments to revise and revitalize the PE program in elementary school. Admittedly or not, there has been an over-orientation of sports components in PE lesson, led to the false orientation of the aims and the essence the lesson. As a result, many elementary school children dropped out from the lesson felt less meaningful [11].

II. RESEARCH METHOD

A. Research Approaches and Methods

Research on these physical characteristics uses a survey and field measurement research model, involving many trained surveyors to conduct anthropometric measurement with cross-sectional studies. Anthropometry is a set of standardized techniques for systematically taking measurement of the body and its parts. It is thus a means of quantifying the size, proportions, and shape of the body [12]. Each measurement should provide a specific bit of information that aids in understanding growth.

B. Research Instrument

This study measured the physical characteristics of elementary school children, which academically already termed as anthropometric characteristics. To measure this anthropometric characteristic, a meter-scale instrument as well as a number of related measuring instruments to measure height, weight, head circumference, shoulder width, pelvic width, sitting height, leg length, upper arm circumference, forearm circumference, thigh circumference, and calf circumference. In addition, simultaneously, also measured body fat composition (skinfold measurement) with a device called a calliper meter.

C. Research Participants

Participants in this study were elementary school students from partner schools totalling 5 elementary schools in Bandung, from grades 1 to 6. The total number of students is 916, consisting of 456 male students and 460 female students. Those children in this study are taken and measured anthropometrically by teachers and PETE students who were previously involved in the anthropometric measurement training program by the research team, which lasted about 2 days of training. The equipment used includes equipment already owned by the PETE for Elementary School student study program.

III. RESULT AND DISCUSSION

A. Results

The result of this study was classified into four categories as main indicators of anthropometric such as stature, weight, breadth, and circumferences, as the followings:

B. Stature Dimension

In terms of height, the growth and development can be seen increasing unevenly between grades 1 to grade 6 of elementary school.

The distance that separates between the average of stature at grade 1 and grade 2 students is around 2.9 cm. While the distance of average stature from grade 2 to grade 3 is around 7.02 cm. From grade 3 to grade 4 it is around 7.06 cm, and from grade 4 to grade 5 is 1.51 cm, and from grade 5 to grade 6 it is around 6.1 cm. Thus, there was rapid growth from grade 2 to grade 3, and from grade 3 to grade 4, and experienced a slowdown from grade 4 to grade 5, and inclined again in the average from grade 5 to grade 6.

From the comparison in growth and development between male and female students in terms of stature, it also needs to be carefully noticed by the teachers. That is, the development and growth of male and female children is different, and these differences show a real reversal. The average size of male students in grade 1 to grade 2 is still ahead from their female colleagues. This tendency seemed to shift from grade 2 to grade 3, in which girls begin to align themselves, with minor difference that are not noticeable or almost the same. Afterwards, the girls caught up and even passed the growth of the boys, especially in grade 4, in grade 5 and in grade 6, with the differences gradually becoming steeper.

C. Weight Dimension

In terms of weight, growth and development increases relatively more lately than increasing height. From the period of six years in elementary school, students only increase by no more than 16 kg, which developed almost identical between boys and girls in each class. Both the overall average for male and female students were also relatively comparable, noting that in female students, there was an unnoticeable increase in grades 4, 5 and 6, leaving male students behind.

D. Leg Length Dimension

In the length of the legs, the growth and development that occurs indicated equality that is relatively evenly identical in the overall growth rate as well as between male students and female students. The difference between them is almost imperceptible, considering that the rate of developments relatively does not significantly differ between grades. In terms of overall development, the difference between grade 1 to grade 2 was between 2.12, from grade 2 to grade 3 is 4.69, from grade 3 to grade 4 is -0.28, from grade 4 to grade 5 is 4.69, and from grade 5 to grade 6 is 3.78. In the development rate, the differences between boys and girls were relatively not obviously different, although in the upper class, the development of the girls remained higher than the boys.

E. Shoulder Breadth Dimension

On the shoulder width (biacromial breadth), the rate of growth and development also indicates equality that is relatively not much different in the overall. Likewise, in the difference of growth rate between male and female students. In grade one to grade 4, the growth and development of biacromial female students was relatively below that of male

students. But when for those who are in grades 5 and 6, the development of female students was relatively slightly higher than that of male students.

F. Pelvic Breadth Dimension

A striking feature difference occurred in the growth and development of the pelvic breadth (bicristal), although in the early grades boys still showed higher changes, but then all relatively decreased when they were in grade 3, rising again in grade 4 and class 5, then the girls caught up and went ahead far enough from the development of male students. The difference is quite steep so that it differed from above 1 cm, and most likely, this is the beginning of growth spurt of female students' hip breadth that is relatively high until they are adults, especially when approaching the maturity of their secondary sexual characteristics.

G. Head Circumference Dimension

In terms of head circumference, the growth and development of elementary school students is characterized by relatively same size between boys and girls when they are in grade 1. Then in the second grade, boys went ahead quite high while female students went in relatively fixed lines, but made equal position as the male students in grade 3 and surpassed them in grade 4. There was another turmoil move from the boys in grade 5, but then they have to give the way for the girls speeding up maneuver on the head circumference in grade 6.

H. Thigh Circumference

In the thigh circumference, growth and development that occur both in boys and girls indicates an almost equal changes in the overall growth rate. It also happens in the difference between male and female students. The difference between them is almost unnoticed, considering that the developments that occur relatively do not differ significantly between different classes. In terms of overall development, the difference between grade 1 to grade 2, from grade 2 to grade 3, from grade 3 to grade 4, from grade 4 to grade 5, and from grade 5 to grade 6 is in a constant average, which is 1.53 cm. Likewise in the difference between boys and girls.

I. Calf Circumference Dimension

Similar to the development of shoulder width (biacromial breadth), the growth and development that occurs in the calf circumference indicates equality that is relatively not much different from the overall growth rate and between male and female students. In grade 1 to grade 5, the growth and development of female students' calf circumference is relatively below that of male students' calf. But in grade 6, the development of female students was relatively slightly higher than that of male students.

IV. DISCUSSION

The general pattern of the anthropometric growth and development of elementary school age children can be depicted from the above measures, which in essence described a pattern that was relatively in accordance with the theory of children growth and development. These measurements essentially

describe one important chapter in human life, which is often referred to by some experts as the golden age [13]. A more carefully search still need to be done, especially by including more participant and by involving more trained human resources, as well as more standardized equipment.

In general, the results of the above calculations still indicate the existence of conformity with the prevailing theory, that prior to adolescence, in which the growth spurt has not occurred, female students will exceed the speed of growth and development of male students. Still according to the theory, the growth rate of female students occurs about two years earlier than a male student. It also indicates that the end of the female's growth process will be happening earlier than male students, in almost all aspects of growth and development [14].

For the purpose of practical use, stature and body weight are the most widely used measurement in growth studies. Child's height and weight are often measured for wider purposes, such as at school, in hospitals, at sports clubs, to monitor the status and progress of growth. Therefore, growth patterns in these two sizes often receive more attention. The pattern shows a specific average of age and sex for both male and female and does not capture the magnitude of the normal distance of individual variability in each group of children. The pattern of change that occurs is usually the same for all children. Measures achieved at each age and timing of growth spurts, however, differ from child to child [15].

From birth to early adulthood, both height and weight follow four phases of growth phase, namely: fast in infancy and early childhood, relatively settled during middle childhood, accelerates again during juvenile growth spurt, and slowing down and finally stop with reaching high adults. While body weight usually continues until adulthood later.

Both sexes follow the same growth path. The gender difference before the adolescent was deemed to be consistent although minor. Boys tend to be slightly taller and heavier than girls. During the early part of the teenage explosion, girls were temporarily taller and heavier than boys due to an earlier explosion of growth. But soon it will disappear or no longer appear when boys also enter an explosion of growth spurt in adolescence [16]. Boys catch up and eventually pass the body size of girls, on average.

V. CONCLUSION

The status and pattern of physical growth and development of elementary school students in Indonesia show the growth rate of female students occurs about two years earlier than a male student. It also indicates that the end of the female's growth process will be happening earlier than male students, in almost all aspects of growth and development.

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