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The Effectiveness of Applying Score System in Growth Chart to Predict Stunting and Improve Nutritional Knowledge of Pre-Schoolers' Mother in Indonesia.

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ABSTRACT

Background: A growth chart is widely used to monitor child growth, but not to predict stunting. Therefore, there is a high need to create a more simple growth chart. The study aimed to find out the effectiveness of the application score system in growth chart in predicting stunting and improving mothers knowledge.

Materials and Method: This study was a quasi experimental study. A total of 533 pre-schoolers aged 4-5 years old and 110 mothers were selected from forty kindergarten schools in Deli Serdang and Aceh Besar Distric. Twelve field workers were trained to conduct height measurements using the score growth chart and teaching mothers on nutrition. Data on height status was presented in six classifications. Chi-Square test was performed to test the difference of mother's knowledge before and after intervention.

Findings: Of the total 533 pre-schoolers, 22.5% were stunted and 33.1% children had been predicted to be stunted. After intervention, mothers in the intervention group were three and half times more likely to have better knowledge than mothers in the control group (85.2% vs 56.6%) and Relative Risk : 3.5 (1.5-6.5)

Conclusions: Application of the score system in growth chart was practicable in predicting stunting and improving maternal knowledge. It needs to consider applying the wall score growth chart in nutritional survey. Children under-five year old need to involve in further studies.

Keywords: Score system, Growth Chart, Stunting, Pre-schooler, Nutritional Knowledge

BACKGROUND

Stunting is defined low-length-or height-for-age below two of standard deviation of the World Health Organization standard .^[1] Globally, the prevalence of stunting prevalence is improving. It has resulted in being an identified as a major global health priority.^[2] In sub-Saharan countries have the higher prevalence than Southeast Asian countries, 40% and <30%.^[3] WHO reported that since 1996-2010 there was not meaningful decreasing of stunted children all over the developing countries.^[4] In Indonesia, since 2007 until 2013 the stunting prevalence has remained stagnant at 35.0% to 37.0%. It is because children with height for age between <-2 to -1 standard deviation were not targeted in the nutrition intervention program. Meanwhile, WHO

stated that stunting prevalence has to decrease < 20.0%.^[5,6]

A growth chart is widely used as a nutrition education tool for parents to monitor their child growth including to detect stunting. However, most mothers found it difficult to interpret the child growth on the chart. Roberfroid found that 40%-70% mothers in Asia, Africa and Latin America had low understanding in interpreting their child growth.^[7,8] In Indonesia, not more than 34.0% mothers understood the function growth chart.^[9] Therefore, there is a high need to create a more simple and communicative growth chart to be easily understood by parents.^[10] Recently, more than 200 kinds of modifying growth charts created in eighty countries^[11,12] to allow parents have a better understanding of

early growth patterns. Several studies had found that good understanding of growth chart was effectively decreasing stunting.^[13,14]

In this study, we used score growth chart as the main media to detect and predict stunting and in teaching mothers on child nutrition. Scores 5, 6, 7, 8, 9 and 10 were applied in interpreting the nutritional status of children. This modified growth chart had been tested and resulted high sensitivity (91.0%) and specificity (92.0%).^[15]

The ideas of applying numbers emerged from several public health studies that applied percents and scores in motivating clients to do positive activities.^[16-18] This study aimed to find out the effectiveness of score growth chart to predict stunting and improve mothers nutritional knowledge.

MATERIAL AND METHOD

Study Design

This study was a quasi experimental study conducted in twenty kindergarten schools in urban areas of two districts that purposefully selected from two provinces; ten schools in Deli Serdang of North Sumatera Province as intervention location and ten schools in Aceh Besar of Aceh Province as control study. The prevalence of stunting in Deli Serdang and Aceh Besar was comparable, 24.4% and 26.4%, respectively.^[19,20]

Participants

a. Preschoolers

A total of 533 pre-schoolers aged 4-5 years old were selected from forty kindergarten schools; 265 children in Deli Serdang and 268 students in Aceh Besar. Selection of schools based on the number of students, school performance, the ratio of teacher and student and school health program.

b. Mothers

The number of mothers were determined by sample size calculation. We calculated the sample size keeping in view, there would be a 30% improvement of nutritional knowledge after intervention and adding 10% for drop-out possibility, using this formula;^[21]

Materials

Score Wall Growth Chart

Score growth chart is a modified growth chart. It is made from a thick plastic material with the size 150 cm x 200 cm. The horizontal lines show the height in cm (0-130 cm) and vertical lines show the child's age in months. Score 5, 6, 7, 8, 9 and 10 are placed on the left side.

These scores imply six classifications of height status: 1) Score 5 (HAZ <-3SD) = Severely Stunting, 2) Score 6 (HAZ ≤-3 to -2SD) = Stunting, 3) Score 7 (HAZ ≤-2 to -1 SD) = Tend to be Stunting, 4) Score 8 = Normal (HAZ 0 to +1SD), 5) Score 9 (HAZ +1 to +2SD) = Tall and 6) Score 10 (HAZ +2 to +3SD) = Very Tall.

Taking height measurement

The measurements were taken individually and collectively. See fig.1 and 2. Prior to taking the measurement, child's age had to put into groups. Measurement was started by positioning the child in front of the wall chart, calculated the height and determine nutritional status. The mother was asked to observe and to record child height and status.

Data collection

There were four steps data collection implemented in this study. Step one was collecting data on the height measurement of 533 pre-schoolers in forty kindergarten schools. Three field workers were responsible to take the measurements. Data on child height, scores and nutritional status of each child were recorded by enumerators. Step two was collecting data on respondents' economic characteristics and nutritional knowledge. A pretested structured questionnaire was administered to obtain information on socioeconomic profile, child age, weight, length and sex, parents education and occupation. Step three was conducting a nutrition education class. Mothers in the intervention group were taught on child growth and healthy food. Mothers were presented with five topics; 1) Function of the growth chart 2) Function of scores 3) Normal height gain 4) Interpreting growth scores 5) nutrition status. While in mothers control group were encouraged to weigh their children regularly and providing healthy breakfast and step four was re-collecting data on mother's knowledge.

Data Analysis

Data on height status of 533 pre-schoolers was presented was presented in distribution frequency table. Based on the mean scores of twenty questions used to categorize the level of knowledge. It was divided into two categories; high knowledge and low knowledge. Statistical calculation used was T-test and Chi-Square test. The significance level was determined by the *p*-values.

RESULTS

Table 1. Socioeconomic characteristics of respondents, by location of study

Socio-economic characteristics	Deli Serdang, n=265		Aceh Besar, n=268		<i>p</i> -value
	n(%)	Mean±SD	n(%)	Mean±SD	
Children characteristics					
Sexual types	121(45.7)		129(48.3)		> 0.05
Boy	144(54.3)	3.2±0.38	139(51.7)	3.2±0.45	> 0.05
Girl		48.2±1.9		48.0±1.6	> 0.05
Birth weight (kg)	95(35.9)		105 (39.3)		
Birth length (cm)	170(64.1)		163 (60.7)		
Current age (months)					
48-54 months					
55-60 months					
Parent's characteristics					
Mother's age (years)		26.8±4.44		28.9±4.59	0.73
Father's age (years)		152.3±3.44		151.6±4.44	0.78
Mother's education					
Grade 1-6	25(9.4)		30(11.2)		
Grade 7-9	75(28.3)		63(23.8)		
Grade 10-12	137(51.4)		140(52.9)		0.79
Grade >12	28(10.9)		35(13.1)		
Mother's occupation					
Household workers	197(74.3)		179(66.8)		0.37
Government workers	32(12.0)		43(16.0)		
Agricultural/skill labour	24(9.1)		28(10.4)		
Private sector	12(4.6)		18(6.7)		
Father's education					
Grade 1-6	13(4.6)		8(2.8)		0.47
Grade 7-9	53(20.0)		44(16.3)		
Grade 10-12	162(61.4)		170(64.0)		
Grade > 12	37(14.0)		46(16.9)		
Father's occupation					
Government workers	16(6.0)		13(4.9)		0.38
Agricultural/skill labour	40(15.1)		37(13.8)		
Private sector	200(75.5)		204(76.1)		
Others	9(3.4)		14(5.2)		

Table 2. Scores and Height Status of Preschoolers, by Location of Study

Score and Height Status	Location of study				TOTAL N=533	
	Deli Serdang, n= 265		Aceh Besar, n=268		n	%
	n	%	n	%		
5 = Severely stunting	10	3.8	18	6.7	28	5.2
6 = Stunting	33	12.4	59	22.0	92	17.3
7= Tend to be stunting	77	29.0	90	33.6	167	31.3
8 = Normal	119	45.0	83	31.0	202	37.8
9 = Tall	20	7.5	14	5.2	34	6.7
10= Very Tall	6	2.3	4	1.5	10	1.9

Table 1 shows the four characteristic variables of pre-schoolers and six characteristic variables of parents. Sexual types, birth weight, birth length and current age of children in the two locations of the study were comparable ($p>0.00$). The mean of birth weight and length of children in two locations of the study was normal; 3.2 ± 0.38 vs 3.2 ± 0.45 and 48.2 ± 1.9 vs 48.0 ± 1.6 respectively. None of the characteristics of parents were significantly different ($p>0.00$), even though mothers age in Deli Serdang was relatively younger than in Aceh

(26.8 ± 4.44 vs 28.9 ± 4.59) and more high education parents in Aceh than Deli Serdang (80.9% vs 74.5%).

As presented in Table 2. Of 533 pre-schoolers, 22.5% were stunted. Almost one third (31.3%) of children tended to be stunted. In terms of location, number of stunting children in Aceh Besar was almost double than in Deli Serdang (28.7% vs 16.2%), while the number of tall children were more in Deli Serdang than in Aceh Besar (9.8% vs 6.7%).

Table 3. Level of Mother's Knowledge Before and After Intervention

Level of knowledge	Before				p-value	After				Relative risk	
	Intervention group, n=54		Control group, n=53			Intervention group, n=50		Control group, n=50			p-value
	n	%	n	%		n	%	n	%		
High knowledge	30	55.5	28	52.8	0.58	42	85.2	30	56.6	0.00	3.5(1.5-6.5)
Low knowledge	24	44.5	25	47.2		8	14.8	20	43.4		

Before intervention, the nutritional knowledge in both groups were comparable. However, after intervention there was significantly changing. Table 3 shows, before intervention the proportion of high knowledge between intervention and control group was comparable (55.5% vs 44.5%; $p = 0.58$). After intervention, the high knowledge improved by 29.7% in intervention group and 3.8% in control group. Mothers in the intervention group were three and half times more likely to have better knowledge (RR = 3.5 (1.5-6.5) and $p = .00$)

FINDINGS

The present study proved that using score growth chart detected 22.5% stunted children and predicted 31.3% “tend to be stunted” children with HAZ >-1 to -2SD.

Assuming that half of those “tend to be stunted” children (15.7%) will be really stunted, therefore in the next round survey the prevalence of stunting could be in the range of 22.5% to 38.0%. The underlying reasons were because in most of nutritional surveys, parents were never well-informed on their child’s nutritional status. Most parents overestimated to their child nutritional status.^[22-24] and restricted to get food make the children to have a risk to be malnutrition.^[25] The consequences the prevalence of stunting to be stagnated. This condition had happened in Indonesia. Since 2010 till 2016 prevalence of stunting stagnated at 35.0-37.0%.^[5,6] and the coverage of food supplementary, exclusive breastfeeding and growth chart belonging was very low, 36.8%, 29.5% and 34.0%, respectively.^[26]

These findings in line with the situation in other developing countries. de Onis et.al, found than by the year 2005-2010 stunting among pre-school children in Africa regions had stagnated at 38.8-38.2% and slightly decrease from 37.6% to 37.1%.^[4] In sub-Saharan and Southeast Asia countries, the prevalence of stunting stagnated at 30%-40%, in Eastern Ethiopia 45.8%.^[3,27] Lutter CK., et al (2011) also reported that only 36% of children in developing countries had exclusive breastfeeding and around half (~50%) poor meal practices.^[28]

This study found that wall score growth chart was efficient as nutrition education media. Scoring system made it easier for mothers to interpret child growth. Involving mothers in taking child height measurements

and to do plotting in the chart were potential parts in nutrition education session. This results in a line with several studies who used a modified growth chart to improve maternal knowledge.^[12,16], and the application of scores in health activities.^[17,18] However, the economic and education level of participants might have played important role in these achievements.

The implication of this finding was in the next anthropometry survey, it needs to presents specifically the prevalence of children with HAZ >-1 to -2SD status and targeting them into nutritional intervention.

The primary strength of this study was the ability to prove the causes of stagnated stunting prevalence. The main limitation of the study was the sample. This study focused only the pre-schooler age and low number of mothers. Further study needs to cover the under-five year children and to include fathers in nutrition education session.



Figure 1. Taking height measurement individually



Figure 2. Taking height measurement collectively

CONCLUSION

The tracking of an individual child height-for-age z-scores on growth curve is an important indicator for

assessing stunting. This study found that the HAZ-1 to -2SD status is a useful indicator for predicting stunting children. Application of the score system in growth chart was effectively detecting and predicting stunting and improving mothers' knowledge of child growth.

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Conflicts of Interest: We declare that there are no conflicts of interest in this study

Ethical Clearance: The ethical clearance was taken from the Ethics Board, Polytechnic of Health Medan

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