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Research Article
Stunted Children Has Higher Risk of Overweight: A Study on Children Aged 6-12 Years in Eight Provinces in Indonesia

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Abstract

Background and Objective: A higher risk of overweight has been widely described in other populations but very limited information was available on Indonesian school-aged children (ISC). The aim of this study was to analyze the association between stunting and overweight ISC. **Materials and Methods:** This study used electronic data of Basic Health Research (BHR) 2010 which was designed as a cross sectional survey. A total of 8,599 ISC aged 6-12 years from eight provinces in Indonesia were selected for the analysis. Overweight and obese were defined as body mass index (BMI) for age Z-score (BAZ) of ≥+1 and ≥+2 standard deviation (SD), while stunting was defined as a height-for-age Z-score (HAZ) of <-2 SD based on WHO cut-off point. **Results:** The prevalence of overweight, obesity and stunting in ISC were 19.5, 7.9 and 28.0%, respectively. There were 7.5% of ISC categorized as having concurrent stunting and overweight. Most of them were boys and at younger age. They also had low economic status, low parents education and lived in rural areas ($p<0.05$). In multivariate logistic regression analyses adjusted for all factors, stunting was associated with overweight (OR = 2.33, 95% CI: 2.06-2.61). **Conclusion:** It is apparent that there is a significant association between stunting and overweight in ISC. This association implies that the double-burden of malnutrition (DBM) does exist in Indonesia and comprehensive planning is needed to overcome the problem.

Key words: Double-burden of malnutrition, overweight, parents education, school-aged children, stunting

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Indonesia is currently facing the double burden of malnutrition, in which undernutrition and overnutrition occur at the same time[1]. It is related to nutrition transition, the changes in nutritional status profile among population determined by economic, demographic, environmental and cultural changes[2]. During the period of 1993-2007, the prevalence of obesity in Indonesia increased significantly in all population groups, including rural population, low-income groups and school-aged children[3]. Some nutrition disorders at school age are undernutrition (i.e. stunting and wasting) and overnutrition (i.e. overweight and obesity).

Based on the results of Basic Health Research (BHR)[4], 12.2% of children aged 6-12 years were wasted and 9.2% of them were overweight. The most prominent nutrition disorder was stunting because 35.6% or more than one third of children aged 6-12 years were stunted, in which 15.1% were categorized as severe stunted and 20.5% as moderate stunted[4]. The latest results of BHR[5] showed that 30.7 and 18.8% of children aged 5-12 years were stunted and overweight, respectively.

There are only limited researches in Indonesia that showed a significant association between undernutrition and overnutrition, particularly stunting and overweight. Therefore, this study aimed to identify risk factors for overweight and analyze the association between stunting and overweight of Indonesian school-aged children (ISC) in eight provinces of Indonesia. Specific objectives of this study were to analyze characteristics of the children and their families, analyze nutritional status of the children, analyze the relation of characteristics of the children and their families with their nutritional status; and analyze risk factors for overweight among children.

MATERIALS AND METHODS

Data, design, time and location: This was a descriptive national-scale cross-sectional study. Electronic files (secondary data) was used from BHR[4] conducted in 2010 by National Institute of Health Research and Development (NIHRD), Ministry of Health. The research sites consisted of eight provinces based on the category of stunting prevalence[6], i.e. very high (≥40%) in East Nusa Tenggara and North Sumatra; high (30-39%) in West Nusa Tenggara and West Java; moderate (20-29%) in Bangka Belitung, Special Capital Region of Jakarta and Special Region of Yogyakarta and low (<20%) in Bali. Data collection in several regions conducted by BHR's data collection team was started from May to August 2010. Data was processed, analyzed and interpreted in November 2013 in Bogor, West Java.

Total sample and sampling method: Population, according to Basic Health Research[4] by Ministry of Health, were all households representing all provinces in Indonesia. The household sample was selected based on 2010 Citizen Census listing. Household selection was conducted by Central Bureau of Statistics with two-stage sampling.

The children in this study were boys and girls aged 6-12 years from eight provinces found in 2010 BHR's electronic data[4]. There were 11,335 children contained in the electronic files. The total number of children that was processed and analyzed became 8,599.

Children' inclusion criteria in this analysis were as follows: aged 6-12 years with a body mass index (BMI) for age Z-score (BAZ) of -5 SD ≤Z-score ≤+5 SD, energy adequacy level of 40-300% and had complete data[7]. The exclusion criteria were the ones with BAZ of < -5 SD and > +5 SD; energy adequacy level of <40 and >300%, were having a diet, fasting or celebration day; and had incomplete data.

Data types and collection method: All data in this study were secondary data taken from BHR[4] 2010, obtained in the form of electronic files. The data we used included children characteristics (age and sex), family characteristics (parents age, parents education level, parents BMI, family size and household expenditure), children' food consumption (type of food and amount of food consumed in grams), children' body weights and heights.

The data were collected by BHR team from NIHRD, Ministry of Health which was conducted from May to August 2010. Socioeconomic and demographic data were obtained by interviewing the children directly using structured questionnaires equipped with manual instructions on filling out the questionnaire. Food consumption data were collected by a 24 h recall method. Anthropometric data were collected by direct measurement.

Nutritional status: Anthropometric data that were analyzed included height-for-age index (HAZ) and BAZ, using WHO AnthroPlus v1.0.4[7]. Based on HAZ, the children were classified into two groups, i.e. normal nutritional status group and stunting (<-2SD) group. Overweight and obese were defined as BAZ of ≥+1 and ≥+2 SD[8].

Data processing and analysis: The data were processed and analyzed by using Statistical Package for the Social Science

(SPSS 17.0) for Windows (IBM Corporation, www.ibm.com/us-en/marketplace/spss-statistics). The processing stage included selecting variables that would be analyzed, cleaning and recoding them into categorical data. Data analyses performed in our study were univariate, bivariate and multivariate analyses. Comparative test was also conducted to observe the differences in variable values based on normal and overweight categories. Bivariate analysis was used to determine the association between two variables, i.e. dependent and one of independent variables by using chi-square test (χ^2) for categorical data. Multivariate analysis was performed to determine the values of risk factors or odds ratio (OR) by using multiple logistic regression with Backward Wald method, results were considered statistically significant at $p<0.05$ and at 95% confidence interval (CI).

RESULTS

Characteristics of children and their families: Results showed that there were 19.5% overweight children and 7.9% obese children. On the other hand, the analysis also showed that 28% of the children were stunted. The analysis was also performed to determine the children with concurrent stunting and overweight and the results showed that there were 7.5% of children with concurrent stunting and overweight. Children' mean age was 8.9 years and percentage proportion of boys and girls was almost the same, i.e. 49.2% (girls) and 50.2% (boys) (Table 1 and 2).

Most of the children were from lower middle class in which their household expenditures were in 3rd-5th quintiles (53.9%) and living in urban areas (55.4%). Most of them (54.3%) had large family (≥8 people). Mean mother age and father age were 36 and 41 years, respectively. Most of the parents had low education level. Only less than 10% of children' parents were highly educated. Mean BMI of parents nutritional status was relatively normal, i.e. 22.5 kg/m^2 for the fathers and 23.9 kg/m^2 for the mothers. However, most of the children' parents were underweight or BMI <18.5 kg/m^2 (Table 1 and 2).

Children' food consumption was also analyzed. The results indicated that mean energy and protein adequacy levels were still categorized as adequate. The values of all food consumption variables were significantly higher in overweight children than children with normal nutritional status ($p<0.05$). However, Healthy Eating Index (HEI) score were not significantly different in both groups ($p>0.05$). Mean HEI score showed that most of the children had poor diet quality (Table 1 and 2).

Nutritional status: Nutritional status of the children was determined based on indicator of BAZ and HAZ. The BAZ z-score of the stunted children (-0.01±1.70 SD) were significantly higher ($p = 0.000$) than the normal children (-0.36±1.49 SD), although their mean Z-scores were considered normal. HAZ z-score of the overweight children (-1.39±2.11 SD) were significantly lower ($p = 0.000$) than the normal children (-1.13±1.43 SD) (Table 1). These results were also supported by mean BMI. Mean BMI of the stunted children was 16.98±3.63 kg/m^2 which were significantly higher ($p = 0.000$) than children with normal nutritional status (16.08±2.86 kg/m^2).

Relationship between children' characteristics, family characteristics and nutritional status: The relationship between children' characteristics, family characteristics and

Table 1: Characteristics of children and their families based on nutritional status (normal and overweight)

Characteristics	Normal (Mean±SD)	Overweight (Mean±SD)	Total (Mean±SD)	p-value*
Participant's age (years)	8.95±1.98	8.84±1.90	8.92±1.96	0.042
HAZ	-1.13±1.43	-1.39±2.11	-1.18±1.58	0.000
BAZ	-0.80±1.15	1.99±0.85	-0.26±1.56	0.000
Father age (years)	41.32±7.87	41.42±7.46	41.34±7.80	0.645
Mother age (years)	36.71±6.77	36.97±6.55	36.76±6.73	0.152
Father BMI (kg/m^2)	22.34±3.24	23.24±3.36	22.52±3.29	0.000
Mother BMI (kg/m^2)	23.71±4.01	24.60±4.30	23.88±4.08	0.000
Energy intake (kcal)	1435.00±543	1530.00±521	1454.00±541	0.000
Protein intake (g)	39.90±19.0	44.90±20.2	40.90±19.4	0.000
Fat intake (g)	32.70±24.1	37.22±24.7	33.60±24.3	0.000
Carbohydrate intake (g)	237.30±102.1	244.50±96.8	238.70±101.1	0.007
Energy adequacy level (%)	77.35±29.92	82.65±29.06	78.38±29.83	0.000
Protein adequacy level (%)	86.89±41.99	97.79±44.73	89.01±42.75	0.000
Percentage of energy intake from carbohydrates (%)	51.11±22.21	52.82±21.42	51.44±22.07	0.005
Percentage of energy intake from fat (%)	15.91±11.91	18.10±12.06	16.33±11.97	0.000
Percentage of energy intake from protein (%)	8.62±4.18	9.70±4.46	8.83±4.26	0.000
HEI score	48.71±11.58	49.04±11.14	48.77±11.49	0.275

*t-test, significant at $p<0.05$

Table 2: Participant distribution by nutritional status (normal and overweight)

	Nutritional status						
	Normal		Overweight		Total		
Variables	No.	Percentage	No.	Percentage	No.	Percentage	p-value*
Participant's age							
6-9 years	4016	79.9	1010	20.1	5026	58.4	0.081
10-12 years	2909	81.4	664	18.6	3573	41.6	
Sex							
Girl	3433	81.2	795	18.8	4228	49.2	0.126
Boy	3492	79.9	879	20.1	4371	50.8	
HAZ							
Normal	5168	83.4	1025	16.6	6193	72.0	0.000
Stunting	1757	73.0	649	27.0	2406	28.0	
Household expenditure							
1st-2nd quintiles	3286	82.9	678	17.1	3964	46.1	0.020
3rd-5th quintiles	3639	78.5	996	21.5	4635	53.9	
Area type							
Rural	3204	83.5	635	16.5	3839	44.6	0.000
Urban	3721	78.2	1039	21.8	4760	55.4	
Family size							
Small (≤4 people)	22	78.6	6	21.4	28	0.3	0.000
Medium (5-7 people)	3127	80.2	771	19.8	3898	45.3	
Large (≥8 people)	3776	80.8	897	19.2	4673	54.3	
Father education level							
≤Elementary-school graduate	3406	83.0	700	17.0	4106	47.7	0.000
Junior-/senior high-school graduate	3001	80.5	726	19.5	3727	43.3	
Diploma/university graduate	518	67.6	248	32.4	766	8.9	
Mother education level							
≤Elementary-school graduate	3769	83.4	750	16.6	4519	52.6	0.000
Junior-/senior high-school graduate	2769	79.4	717	20.6	3486	40.5	
Diploma/university graduate	387	65.2	207	34.8	594	6.9	
Father BMI							
18.5-24.9 kg/m^2	645	89.6	75	10.4	720	8.4	0.000
<18.5 kg/m^2	4941	80.5	1194	19.5	6135	71.3	
≥25 kg/m^2	1311	76.5	403	23.5	1714	19.9	
Mother BMI							
18.5-24.9 kg/m^2	471	87.5	67	12.5	538	6.3	0.000
<18.5 kg/m^2	4186	81.6	942	18.4	5128	59.6	
≥25 kg/m^2	2268	77.3	665	22.7	2933	34.1	
Father age							
<40 years	3147	81.4	721	18.6	3868	45.0	0.080
≥40 years	3778	79.9	953	20.1	4731	55.0	
Mother age							
<40 years	4685	80.5	1133	19.5	5818	67.7	0.982
≥40 years	2240	80.5	541	19.5	2781	32.3	
Energy adequacy level							
Inadequate/adequate: <110%	6031	81.0	1419	19.0	7450	86.6	0.012
Excessive: ≥110%	894	77.8	255	22.2	1149	13.4	
Protein adequacy level							
Inadequate/adequate: <110%	5361	82.5	1138	17.5	6499	75.6	0.000
Excessive: ≥110%	1564	74.5	536	25.5	2100	24.4	
Energy intake from carbohydrates (%)							
Inadequate: <55%	4528	81.3	1040	18.7	5568	64.8	0.012
Adequate: ≥55%	2397	79.1	634	20.9	3031	35.2	
Energy intake from protein (%)							
Inadequate: <10% (6-9 years) and <15% (10-12 years)	5441	82.4	1160	17.6	6601	76.8	0.000
Adequate: ≥10% (6-9 years) and ≥15% (10-12 years)	1484	74.3	514	25.7	1998	23.2	
Energy intake from fat (%)							
Inadequate: <35% (6-9 years) and <30% (10-12 years)	6357	81.0	1490	19.0	7847	91.3	0.000
Adequate: ≥35% (6-9 years) and ≥30% (10-12 years)	568	75.5	184	24.5	752	8.7	

Table 2: Continue

Variables	Nutritional status: Normal No.	Normal Percentage	Overweight No.	Overweight Percentage	Total No.	Total Percentage	p-value*
HEI score							
Good diet (>80)	2947	78.8	795	21.2	3742	43.5	0.767
A diet needs improvement (51-80)	3451	81.6	778	18.4	4229	49.2	
Poor diet (<50)	527	83.9	101	16.1	628	7.3	
Total	6925	80.5	1674	19.5	8599	100.0	

*chi-square test; significant at p<0.05

BAZ was analyzed. Children' characteristics (i.e. age and sex) had no significant relationship with overweight (p>0.05). The number of overweight children in the stunted group was also significantly higher than in the normal group. Most of the overweight children were from higher-class family (household expenditure was in 3rd-5th quintiles), living in urban areas and having medium-sized family (5-7 people) (Table 2).

Most of the overweight children had highly educated and overweight (BMI ≥25 kg/m^2) parents. However, parents age was not significantly associated with overweight among the children (Table 2).

Results also showed that food consumption had a significant association with BAZ. Energy and protein adequacy levels, as well as percentage of energy intake from carbohydrates, fat and protein were significantly associated with overweight in the children (p<0.05). However, HEI score had no significant relationship with overweight. There were more overweight children who had good HEI scores (Table 2).

Table 3 showed the association between social-economic characteristics and the concurrent stunting and overweight among children. The analysis showed that concurrent stunting and overweight cases were more likely found among boys and in younger age (6-9 years). Most of the stunted-with-overweight children were from lower class family (household expenditure was in 1st-2nd quintiles) and living in rural areas. However, family size had no significant association with concurrent stunting and overweight.

Among all parents characteristics, only father education level and nutritional status that had significant association with the nutritional status of their children. Most of the children with concurrent stunting and overweight significantly had low-educated and underweight (<18.5 kg/m^2) fathers. Mother's education level and nutritional status were not significantly related to the concurrent stunting and overweight in the children. Parents age also had no significant association with concurrent stunting and overweight found among the children (Table 3).

Energy adequacy level had a significant relationship with concurrent stunting and overweight in the children. Table 3 showed that most of the stunted-with-overweight children were categorized as having energy intake <110%. HEI score also had no significant association with the concurrent stunting and overweight cases. The majority of stunted-with-overweight children had good HEI scores.

Risk factors for overweight: Based on the bivariate analysis which indicated a significant association between stunting and overweight, we assumed that stunting had an effect on overweight. Therefore, it was used as one the risk factors in the analysis of children' overweight-related risk factors. The results were presented in Table 4.

The results of multiple logistic regression indicated that stunting was a risk factor for overweight with the highest OR value (2.33) among other variables analyzed. It meant that stunted children were 2.33 times at higher risk of being overweight than the ones with normal height.

DISCUSSION

Results of the present study showed that there were 19.5% overweight children and 7.9% obese children. These results were slightly higher than the latest BHR's data in 2013[5]; i.e. 18.8% of children aged 5-12 years were classified as overweight. The results of multiple logistic regression indicated that stunting was a risk factor for overweight with the highest OR value (2.33) among other variables analyzed.

A previous study showed that there was a significant association between stunting and overweight status (weight-for-height index) in children aged 3-9 years in four countries (Russia, Brazil, South Africa and China)[9]. Stunted children had 1.7-7.8 times higher risk to be overweight than the normal ones. Similar result was also found in another study which indicated that stunted babies had nearly three times higher risk of being overweight (OR = 2.7, 95% CI: 1.8-4.1)[10]. Previous researchers also showed that there were 19% of 120

Table 3: Participant distribution based on stunted-with-overweight and non-stunted-with-overweight nutritional statu

	Nutritional status						
	Non-stunted with overweight*		Stunted with overweight		Total		
Variables	No.	Percentage	No.	Percentage	No.	Percentage	p-value**
Children' age							
6-9 years	4620	91.9	406	8.1	5026	58.4	0.027
10-12 years	3330	93.2	243	6.8	3573	41.6	
Sex							
Girl	3945	93.3	283	6.7	4228	49.2	0.003
Boy	4005	91.6	366	8.4	4371	50.8	
Household expenditure							
1st-2nd quintiles	3590	90.6	374	9.4	3964	46.1	0.000
3rd-5th quintiles	4360	94.1	275	5.9	4635	53.9	
Area type							
Rural	3518	91.6	321	8.4	3839	44.6	0.010
Urban	4432	93.1	328	6.9	4760	55.4	
Family size							
Small (≤4 people)	3461	92.5	281	7.5	3742	43.5	0.483
Medium (5-7 people)	3916	92.6	313	7.4	4229	49.2	
Large (≥8 people)	573	91.2	55	8.8	628	7.3	
Father education level							
≤Elementary-school graduate	3766	91.7	340	8.3	4106	47.7	0.048
Junior-/senior high-school graduate	3471	93.1	256	6.9	3727	43.3	
Diploma/university graduate	713	93.1	53	6.9	766	8.9	
Mother education level							
≤Elementary-school graduate	4159	92.0	360	8.0	4519	52.6	0.149
Junior-/senior high-school graduate	3232	92.7	254	7.3	3486	40.5	
Diploma/university graduate	559	94.1	35	5.9	594	6.9	
Father BMI							
18.5-24.9 kg/m^2	687	95.4	33	4.6	720	8.4	0.000
<18.5 kg/m^2	5609	91.4	526	8.6	6135	71.3	
≥25 kg/m^2	1625	94.8	89	5.2	1714	19.9	
Mother BMI							
18.5-24.9 kg/m^2	506	94.1	32	5.9	538	6.3	0.081
<18.5 kg/m^2	4716	92.0	412	8.0	5128	59.6	
≥25 kg/m^2	2728	93.0	205	7.0	2933	34.1	
Father age							
<40 years	3565	92.2	303	7.8	3868	45.0	0.364
≥40 years	4385	92.7	346	7.3	4731	55.0	
Mother age							
<40 years	5360	92.1	458	7.9	5818	67.7	0.099
≥40 years	2590	93.1	191	6.9	2781	32.3	
Energy adequacy level							
Inadequate/adequate: <110%	6866	92.2	584	7.8	7450	86.6	0.009
Excessive: ≥110%	1084	94.3	65	5.7	1149	13.4	
Protein adequacy level							
Inadequate/adequate: <110%	6015	92.6	484	7.4	6499	75.6	0.536
Excessive: ≥110%	1935	92.1	165	7.9	2100	24.4	
Energy intake from carbohydrates (%)							
Inadequate: <55%	5130	92.1	438	7.9	5568	64.8	0.129
Adequate: ≥ 55%	2820	93.0	211	7.0	3031	35.2	
Energy intake from protein (%)							
Inadequate: <10% (6-9 years) and <15% (10-12 years)	6116	92.7	485	7.3	6601	76.8	0.202
Adequate: ≥10% (6-9 years) and ≥15% (10-12 years)	1834	91.8	164	8.2	1998	23.2	

Table 3: Continue

Variables	Nutritional status: Non-stunted with overweight* No.	Non-stunted with overweight* Percentage	Stunted with overweight No.	Stunted with overweight Percentage	Total No.	Total Percentage	p-value**
Energy intake from fat (%)							
Inadequate: <35% (6-9 years) and <30% (10-12 years)	7248	92.4	599	7.6	7847	91.3	0.329
Adequate: ≥35% (6-9 years) and ≥30% (10-12 years)	702	93.4	50	6.6	752	8.7	
HEI score							
Good diet (>80)	24	85.7	4	14.3	28	0.3	0.280
A diet needs improvement (51-80)	3615	92.7	283	7.3	3898	45.3	
Poor diet(<50)	4311	92.3	362	7.7	4673	54.3	
Total	7950	92.5	649	7.5	8599	100.0	

*This category included normal, overweight only and stunted only children, **Chi-square test, significant at p<0.0

Table 4: Significant risk factors for overweight based on logistic regression analysis

Variables	β	OR (95% CI)	p-value[1]
HAZ-based nutritional status (normal = 0)			
Stunting	0.85	2.33(2.06-2.64)	0.000
Mother education level (≤elementary-school graduate =0)			
Junior/senior high-school graduate	0.16	1.17(1.04-1.33)	0.012
Diploma/university graduate	0.84	2.31(1.88-2.84)	0.000
Protein adequacy level (inadequate/adequate, <110% = 0)			
Excessive (≥110%)	0.39	1.48(1.30-1.70)	0.000
Mother BMI (18.5-24.9 kg/m² = 0)			
<18.5 kg/m²	-0.42	0.66(0.50-0.86)	0.002
≥25.0 kg/m²	0.24	1.27(1.13-1.42)	0.000
Area type (rural = 0)			
Urban	0.23	1.25(1.11-1.42)	0.000
Family size (≤4 people = 0)			
5-7 people	-0.19	0.83(0.74-0.93)	0.001
≥8 people	-0.31	0.74(0.58-0.93)	0.012
Father BMI (18.5-24.9 kg/m² = 0)			
≥25.0 kg/m²	-0.66	0.52(0.40-0.66)	0.000
Constant	-2.05		0.000

[1]logistic regression; significant at p<0.05

under-three children with concurrent stunting and overweight in South Africa[2]. However, result from this analysis was different from a study conducted in South Africa by different researchers who observed children aged 8-11 years and found there was no significant association between stunting and overweight (p>0.05)[11].

The relationship between stunting and overweight/obesity can be explained by mechanism of growth retardation and changes in hormonal response combined with unhealthy food consumption. Stunted children have less lean body mass, resulting in decreased basal metabolic rate and physical activity. If energy intake is adequate, there is a difference between linear growth potential and adipose tissue deposition. It may happen for several reasons; i.e. the food consumed does not contain sufficient essential nutrients for linear growth but had adequate nutrients to increase adipose tissue deposition. Moreover, early nutrition programming is likely to produce some hormonal effects on limited linear growth but the potential for weight gain is not deprived of hormonal effects[9]. Stunting leads to a series of important changes such as lower energy expenditure, more vulnerable to the effects of high fat intake, lower fat oxidation, disruption of food consumption adjustment and impaired fat metabolism[12-13]. A 36-month longitudinal study on 30 girls aged 7-11 years in Brazil indicated that stunted group had lower resting metabolic rate during follow-up period with significant differences between 24-month and 36-month periods. It was related to the

increased weight gain and decreased lean body mass if compared to the normal group. These conditions indicated risk of obesity in stunted group[14].

Concurrent stunting and overweight in school-aged children can describe nutrition transition aspect[11]. In the past, stunting and limited access to food were closely related. However, the association is not as clear as in the present, especially in countries that undergo nutrition transition such as Indonesia. The transitions are, for instance, the changes in dietary pattern from traditional diet into Western-type diet (energy-dense, high-fat and low-fiber) or high-carbohydrate but low-protein diets; thus, the children who were originally stunted and underweight will become overweight but still stunted[2].

CONCLUSION AND RECOMMENDATION

There were 7.5% of school-aged children with concurrent stunting and overweight in eight provinces that we observed. Bivariate and multivariate analyses also indicated the effect of stunting on overweight. The stunted children were 2.33 times at higher risk of being overweight than the normal children. Thus, it was clear that there was a significant association between stunting and overweight in school-aged children. This finding proves that nutrition transition and double burden of malnutrition occur in Indonesia. It implies the need for comprehensive planning to overcome the problems.

Comprehensive planning should be immediately designed and its implementation should be followed up. Nutrition programs -especially on adolescent girls, women of childbearing age, pregnant women and nursing mothers-need to be a top priority. The review is needed to determine the most appropriate window of opportunity among all life cycle aspects to break the chain of nutrition problems.

SIGNIFICANCE STATEMENT

This study discovered that there were 7.5% of school-aged children with concurrent stunting and overweight. Most of them were boys and at younger age. They also had low economic status, low father education and lived in rural areas. Stunted children were 2.33 times at higher risk of being overweight than the normal ones. This finding proves that nutrition transition and double burden of malnutrition occur in Indonesia. This study will help the researcher to uncover the critical areas of relationship of stunting and overweight that many researchers in Indonesia have not able to explore. Thus a new theory on relationship of stunting and overweight may be arrived at.

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