

Nutritional Status, Physical Activity, and Sedentary Activity of School Children in Urban area, West Java, Indonesia

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ABSTRACT

The purpose of this research was to analyse nutritional status, physical activity, and sedentary activity in school children in West Java, Indonesia. The study used a cross-sectional design and was conducted from October to December 2016. Samples were taken using simple random sampling technique with a total sample of 300 subjects taken among fifth-grade students in seven elementary schools located in Bandung city, West Java. The data collected in this research were anthropometric data such as physical activity and sedentary activity. Data analysis was carried out using descriptive statistics, analysis of variance (ANOVA) and Pearson test. The results showed that 21.7% of school children were overweight, while 19.7% were obese. The results of the subject activity, based on nutritional status category, were not significantly different. All subjects with underweight nutritional status were having light activity (100%), the percentage of subjects with normal nutritional status, overweight, and obese were 71.6%, 75.4%, and 74.6%, respectively. The average duration of underweight subjects performing sedentary activities on holidays was 4.2±3.0 hours, 5.4±2.7 hours for normal subjects, 5.8±2.7 hours for overweight, and 5.4±2.5 hours for obese subjects. The proportion of sedentary activity time on holiday among underweight, normal, overweight, and obese subjects were 17.6±12.4%; 22.3±11%; 24.1±11.3%; and 22.3±10.5%. The sedentary activity of children on holiday was not significantly different, but there was a significant difference between the proportion of sedentary time in a day between groups of nutritional status ($p<0.05$), i.e., normal children and overweight children. The correlation test results indicated a negative correlation between physical activity and sedentary activity, meaning that higher sedentary activity of subjects both in school time and holiday resulted in lower physical activity ($p<0.01$). The nutritional status, physical activity, and subject sedentary activity based on nutritional status were not significantly different.

Keywords: nutritional status, physical activity, school children, sedentary activity

INTRODUCTION

Currently, overweight and obesity in school children are a nutritional problem requiring special attention. Increased cases of overweight and obesity in school children not only occurred in developed countries, but its prevalence has also begun to increase. The prevalence of overweight and obesity in children have been rising since 1990. This prevalence was higher in Africa compared to Asia. However, when seen from the number of children, Asia has a higher prevalence (De Onis 2010). According to WHO (2014), children aged 5-19 years who are obese in developed countries reach 340 million. The

trend of this increase was also visible in Indonesia. Since 2010, the prevalence of school children who are overweight and obese continues to increase, from 9.2% in 2010 to 18.8% in 2013 (MoH 2013).

Obesity is the result of unbalanced energy intake derived from food and drink, with energy expended for metabolic processes and physical activity. The excess of energy is then stored in the body in the form of fat. The effects of excess body fat may cause a variety of health, social and psychological problems (Gill 2015). Children's activities on holidays tend to be watching television or going to the mall. In addition to low physical activity, the level of snack consumption,

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which is thought to be quite high, causes obesity in children (Deni & Dwiriani 2009). Also, Butte *et al.* (2015) added that obese children are known to be associated with several risk factors (disease risk factors, genetic, and environmental factors). Environmental factors have an impact on the behavior and physical activity in obese children.

A person's behavior in physical activity has an impact on weight gain, which is not only applicable in adults, but also in children and adolescents. People who tend to be inactive with more leisure activities are at risk of obesity. Physical activity is a body movement produced by skeletal muscle contraction that will continuously increase energy expenditure (Bouchard 2010). According to WHO (2014), a lack of physical activity is one of ten risk factors for death. Physical activity done regularly can reduce the risk of heart disease, stroke, diabetes, breast cancer, and colon cancer. It is recommended that children should do moderate to vigorous physical activity for at least an hour a day to maintain and improve heart, lung, bone, muscle and cardiovascular systems.

Overweight and obese children generally have lower physical activity compared to children with normal nutritional status. The study of Page *et al.* (2005) in the UK found that physical activity as measured by accelerometer in obese children was lower than that of normal children (31,844±13,200 vs 41,844±10,430 counts/h).

Another behavior that contributes to obesity is sedentary lifestyle. According to Frekemon *et al.* (2015), sedentary behavior is characterised by low or immovable body movements or activity so that the energy released by the body is relatively small. The energy spent during sedentary behavior is less than 1.5 METs (Metabolic Equivalent Task). Tremblay *et al.* (2011) added some types of sedentary activities such as sitting, watching television, playing video games, and watching at the cinema. The least energy spent while doing these activities can create a positive energy balance and impact weight gain. If this condition lasts for a long period, then a person may become obese. Study of Mushtaq *et al.* (2011) in Pakistan revealed that one of the obesity risk factors in children was the sedentary activity. Olaya *et al.* (2015) and Kuriyan *et al.* (2007) found that watching television was associated with an increased prevalence of overweight. In addition to watching TV, playing video games

can also increase the risk of obesity. The results of Bhadoria *et al.* (2015) study proved that obese children spend longer time playing video games, computer and watching television compared to non-obese children ($p < 0.001$). The likelihood of obesity is 2.96 higher in children who spend >28 hours per week for the sedentary activity (Badhoria *et al.* 2017).

Based on the facts described above, this research aims to analyse the difference in physical and sedentary activities of elementary school children based on nutritional status in the urban school of West Java, Indonesia

METHODS

Design, location, and time

This research used a cross-sectional study conducted in elementary school in Bandung City, West Java, Indonesia from October to December 2016. The subject of the study were a fifth-grade students at elementary school determined through simple random sampling.

Sampling

Seven elementary schools were selected as research sample based on purposive sampling method and its rayon. The population of primary school children in Bandung was 228 441 which has not been categorised based on nutritional status. Thus, the number of subjects was determined based on an assumed variety of BMI/Age of elementary school children (2.92) (Sutiari *et al.* 2010), and the precision was determined with the value of 0.7. The calculation results showed a minimum subjects of 282 children with an additional 10% to avoid drop out, so the final subjects were 300 children.

Fifth-grade students were chosen because they are included in the higher grade with the assumption that they could answer the questions for guidance. The inclusion is of fifth-grade elementary school children both male and female willing to be a subject in the research by filling informed consent after getting an explanation of the research. Exclusion criteria included children who have a history of the disease and suffer from one of the chronic diseases such as diabetes, heart disease, and hypertension. Chronic history data were collected by filling questionnaires with interview method.

The research protocol has been approved by the Ethics Committee of the Faculty of Public Health, Diponegoro University, Semarang (No. 271/EC/FKM/2016).

Data collection

Data collected in this research were subject characteristics consisting of gender, age, anthropometric data, physical activity, and sedentary activity. Subject characteristics, physical activity, and sedentary activity were collected through interview with the subjects to understand their activities during school days and holidays. Physical activity data consisted of children's physical activity on school days and holidays. Data were obtained based on the interview, where the subjects were asked to remember and record their activities during school days and holidays. Physical activities at school were then recalled on the next day, as well as holiday activities. Subjects were asked to remember and record their activities from when they wake up until when they sleep. Anthropometric data consisted of weight and height. Weight was measured using a digital scale Camry® eb9003 (0.1 kg precision). The measurement of height was done using microtome with an accuracy of 0.1 cm.

Data analysis

The FAO (2001) categorised the level of physical activity into three, i.e., light (1.40-1.69), moderate (1.70-1.99), and strenuous (2.00-2.40). The physical activity ratio (PAR) value of each child activity refers to the PAR values of adolescents and adults. The sedentary activity data was obtained by using a 2x24 hour sedentary activity recall questionnaire. Data on the nutritional status of the subjects were grouped based on the BMI/Age Z-score.

The nutritional status of elementary school children is categorised based on the BMI/Age Z-score, including underweight (Z-score <-2.0), normal (Z-score \geq -2.0 to \leq 1.0), overweight (Z-score >1.0 to \leq 2.0), and obese (Z-score >2.0).

Data on subject characteristics, nutritional status, physical activity, and sedentary activities were processed and analysed using Microsoft Excel 2010 and IBM SPSS 21.0 to calculate and classify data either numerically or categorically. Data analysis was done descriptively with a 5% significance level, indicating that the limit of

rejection to the null hypothesis was $p < 0.05$. The test of analysis of variance (ANOVA) was used to see the difference between physical activity and sedentary activity of children based on nutritional status because the data was numeric. Pearson correlation test was used to test the relationship between physical activity and the sedentary activity of the subjects.

RESULTS AND DISCUSSION

Nutritional status of elementary school children

The total 5th grade students in seven selected school meeting the inclusion criteria were 934. Three-hundred students were considered as the minimum sample calculation, then randomly selected based on the appropriate randomization (without being determined based on nutritional status).

In general, the study was located in an urban area and the schools classified as middle up. This aspect was supported by the parental education distribution data showing the level of parental education. Fathers who completed primary education (elementary and junior high school) accounted for 13.6%, showing that most of the students' fathers have already had a good education. Most of the fathers had higher education (11.1% diploma; 38.0% graduate; and 5.6% postgraduate).

The educational level of the student's mother was also as good as the father's education. Mothers who only had a basic education (elementary and junior high) amounted to 14.4%. Most of them finished senior high school (37.1%) and 48.4% university. Educated parents could increasingly improve the welfare of their families. Besides, they have more opportunity to get a job and a better salary to support their family life. Similarly, in a study by Deni & Dwiriani (2009), most of the parents in urban area graduated from colleges.

In addition to the educational level, parent income data per month was also obtained. Table 1 showed the range of family income. Almost half of the families (40.3%) have an income of > IDR 5,000,000 or \$370 per month. Currently, the average income per capita of the Indonesian population is IDR 4,000,000 or \$300. The poverty line set by the Indonesian Central Bureau of Sta-

Table 1. Distribution of parent's income per month

Parent's income (IDR)	n	%
≤ 2,500,000	81	27.9
2,500,001 - 5,000,000	92	31.7
5,000,001 - 7,500,000	60	20.7
7,500,001 - 10,000,000	32	11.0
> 10,000,000	25	8.6
Total	290	100.0

tistics (BPS) in 2017 was IDR 387,160 per capita per month (BPS 2017).

The number of boys was 152 (50.7%), while girls were 148 people (49.3%). Table 2 showed a low prevalence of underweight in school children, being 2.6% in boys and 2.0% in girls. The low prevalence of underweight in this study proved that there is no public health problem related to malnutrition.

Anthropometric measurements included weight, height, percent body fat, and waist circumference. The mean weight was 37.9 kg, while the mean height was 139.3 cm. Both weight and height were higher in girls compared to boys. Table 2 demonstrated that nutrition problems in urban school children were overweight and obese. The overweight prevalence in boys (17.8%) was lower than that of girls (25.7%). In contrast, the prevalence of obesity in boys (23%) was higher compared to girls (16.2%).

The results revealed that the percentage of overweight and obese children in this study was higher when compared to the national prevalence (10.8% obese and 8.8% very obese) (MoH 2013). The high percentage of overweight and obese children in this study may have an impact on the increased risk of non-communicable diseases in the next few years in Bandung. This scheme will adversely affect the quality of life of Bandung residents in the next few years. In addition to af-

fecting the quality of life, increased percentage of overweight and obesity children will also impact on the economy of the city. Bouchard (2010) suggested that an increased in the prevalence of obesity at various levels leads to increased cost-allocation on health. An average of 1.4%-5.7% of a country's direct-cost healthcare was used to overcome obesity.

Nutritional status of school children could affect both health and cognitive function, then impact on learning achievement. The Center for Disease Control and Prevention (2015) revealed several health effects that arise from obese children such as the risk of developing cardiovascular disease including high blood pressure and high cholesterol. Based on another study, the nutritional status and knowledge of nutrition could affect a person's memory (Atina & Tanzihah 2012).

Physical activity of school children

Children's physical activities were observed to be diverse. All underweight children had light physical activity (100.0%), while 71.6% of children with normal nutritional status had light physical activity, 16.0% had moderate physical activity, and the rest (12.4%) had strenuous physical activity. Most overweight children were having light physical activity (75.4%). A total of 11 overweight children (16.9%) were categorised in the moderate activity levels, and only five children (7.7%) had strenuous activity levels. Similar to overweight children, most obese children were also having a light level of physical activity (76%) only (Table 3). The ANOVA test results demonstrated that the physical and sedentary activities of children based on the nutritional status did not significantly differ. Besides, the results of the correlation test showed that physical and sedentary activities were negatively correlated, meaning that the higher sedentary activity

Table 2. Distribution of children's nutritional status (BMI/Age) by gender

Nutritional status	Boys		Girls		Total	
	n	%	n	%	n	%
Underweight (Z-score < -2.0)	4	2.6	3	2	7	2.3
Normal (Z-score ≥ -2.0 s/d ≤ 1.0)	86	56.6	83	56.1	169	56.3
Overweight (Z-score > 1.0 s/d ≤ 2.0)	27	17.8	38	25.7	65	21.7
Obese (Z-score > 2.0)	35	23	24	16.2	59	19.7
Total	152	100	148	100	300	100
Mean±SD	0.55±1.65		0.52±1.36		0.54±1.52	

Table 3. Children's physical activity base on nutritional status

Physical activity (PAL)	Underweight (n=7)	Normal (n=169)	Overweight (n=65)	Obese (n=59)	Total (n=300)
Light (1.40-1.69)	7 (100)	121 (71.6)	49 (75.4)	44 (74.6)	221 (73.7)
Moderate (1.70-1.99)	0 (0)	27 (16)	11 (16.9)	12 (20.3)	50 (16.7)
High (2.00-2.40)	0 (0)	21 (12.4)	5 (7.7)	3 (5.1)	29 (9.7)
Total	7 (100)	169 (100)	65 (100)	59 (100)	300 (100)

of the children (both during school days and holidays), the lower their physical activity will be ($p < 0.01$).

Children's physical activity, moderate and strenuous, based on the nutritional status showed that some were having an activity such as climbing the stairs and cycling during the school days. More than half of the study subject was included in the category of light physical activity levels, such as sitting activity which was longer than the required physical activity through body movement. This fact is evidenced by the average sedentary activity over 5 hours/day.

The results showed that the level of physical activity in underweight, normal, overweight, and obese children was not significantly different, which was in line with the results of other research conducted in Bogor, showing that the activity of elementary school children with normal nutritional status and obesity were classified in the light category (Karimah 2014). Children tend to move less during light physical activity such as sitting for studying over 6 hours during classroom lessons or other sedentary activities. The results showed that there was no difference in physical activity level between normal, overweight and obese children. But the results was not in line with Purslow *et al.* (2008) who found that the total time of light physical activity was higher in overweight and obese children compared to normal and underweight children in London.

The level of children physical activity is related to the parent's behavior. Research conducted in Bangalore, India, found that diet, physical activity, and childhood BMI in adolescence and early adulthood in India were associated with parental behavior (Swaminthan *et al.* 2013). The WHO recommends that children aged 5-17 perform moderate to vigorous intensity physical activity (MVPA) for 60 minutes per day to maintain and improve the nutritional status and children's health.

The sedentary activity of school children

Sedentary activities in this research are defined as activities that release a little energy, for example, watching television, playing games on laptop or mobile phone. The sedentary activity was divided into school days and holidays. The average of duration of underweight children perform sedentary activities on holidays was 4.2 ± 3.0 hours; while it was 5.4 ± 2.7 hours in normal children; 5.8 ± 2.7 hours in overweight children; and 5.4 ± 2.5 hours in obese children. The proportion of time for sedentary activity on holiday in underweight, normal, overweight and obese children were $17.6 \pm 12.4\%$; $22.3 \pm 11\%$; $24.1 \pm 11.3\%$; and $22.3 \pm 10.5\%$, respectively (Table 4). The ANOVA test result revealed that there was no significant difference between the total sedentary time and the proportion of sedentary time in a day between each group on holidays.

Besides holidays, the average duration of sedentary activity on school days among underweight children was 3.6 ± 2.1 hours (3.5 ± 1.8 hours in normal children, 4.3 ± 2.3 hours in overweight children, and 3.8 ± 2.0 hours in obese children). The proportion of sedentary activity during school time in underweight, normal, overweight and obese children were $14.8 \pm 8.7\%$; $14.5 \pm 7.4\%$; $17.8 \pm 9.7\%$; and $16.2 \pm 8.1\%$.

The ANOVA test results with the LSD test showed that there was no significant difference between total sedentary time between groups on school days ($p > 0.05$), but there was a considerable difference between the proportion of sedentary time in a day ($p < 0.05$). The proportion of sedentary activity-time in day in children with normal nutritional status was lower than the overweight children (Table 4).

Another ANOVA test results showed that on holiday, there was no significant difference between total sedentary time and the proportion of sedentary time in a day between groups. The

Table 4. Average sedentary activity and the proportion of sedentary activity on school days and holidays based on nutritional status

Sedentary activity	Underweight (n=7)	Normal (n=169)	Overweight (n=65)	Obese (n=59)	Total (n=300)	p*
Holidays						
Total sedentary time (hours)	4.2±3.0	5.4±2.7	5.8±2.7	5.4±2.5	5.4±2.6	0.413
The proportion of sedentary time (%)	17.6±12.4	22.3±11	24.1±11.3	22.3±10.5	22.6±11.0	0.413
School days						
Total sedentary time (hours)	3.6±2.1	3.5±1.8	4.3±2.3	3.9±2.0	3.8±2.0	0.051
The proportion of sedentary time (%)	14.8±8.7	14.5±7.4 ^a	17.8±9.7 ^b	16.2±8.1	15.6±8.2	0.049

*ANOVA test

average sedentary time on holidays was 5.4±2.6 while it was 3.8±2.0 during school days. On the school days, there was no significant difference between the total sedentary time between groups, but there was a significant difference between the proportion of sedentary time in a day ($p<0.05$). The difference was found between the proportion of sedentary time in normal and overweight children (LSD test). Overweight children have a higher proportion of sedentary time in a day than normal children. Meanwhile, there was no significant difference among the other groups.

The results of this study are in line with those of research conducted in India. It found that the obese children spent more time in sedentary activities than the normal children (Bhadoria *et al.* 2015). Sedentary activities such as watching television and using a car to schools could increase the risk factors for obesity in childhood (Jenny *et al.* 2015). Bar-On *et al.* (2001) recommend that the total time for children to watch television, play computer and video games should be limited to a maximum of 1-2 hours per day or 7 to 14 hours per week.

CONCLUSION

This study revealed that physical activity was not significantly different between children who had different nutritional status, and the average of sedentary activity of underweight, normal, overweight, and obese children was also not significantly different. However, there was a significant difference in the proportion of seden-

tary time in a day between groups ($p<0.05$). The proportion of sedentary time in a day of children with normal nutritional status was lower than the overweight. If we look at the relationship between physical activity and sedentary activity, there was a negative relationship, meaning that the higher the sedentary activity of the subjects (both in school days and holidays), the lower the physical activity during those days will be.

Based on the research findings, the authors suggest the parents to monitor and limit the time of children's sedentary activities, because it can increase the risk of obesity. Parents should encourage children to do physical activity as a form of healthy behavior. Besides, school educators are expected to provide more physical activity opportunities during the learning process by modifying the method of learning, so that physical activities are not only related to sport's subjects.

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