EPH - International Journal of Medical and Health Science

CHILDREN WITH BETTER BREAKFAST HABIT AND FAMILY SOCIOECONOMIC STATUS TENDED TO HAVE BETTER ACADEMIC ACHIEVEMENT

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Abstract:-

Skipping breakfast affects learning performance at school. This study aimed to analyze correlation between breakfast habits, family socioeconomic status and academic achievement among elementary school children. This cross-sectional study was conducted from March to May 2016 on 150 fifth graders. Subjects' characteristics, family socioeconomic status and breakfast habits were collected by filling out questionnaire, academic achievement was estimated by average score of midterm test. Subjects with good academic achievement had better socioeconomic status than those with poor academic achievement. Most of the subjects had breakfast 5-7 times/week and it was usually done before 7 AM. Breakfast was usually served and consumed at home. Staple food and animal-based side dish were usually consumed for breakfast. Breakfast's energy and protein contributions were significantly higher (p<0.05) among subjects with higher academic achievement than those with lower academic achievement. Subjects with better breakfast habits and socioeconomic status tended to have better school achievement.

Keywords:*academic achievement, breakfast habit, family socioeconomic status, nutritional status, school-aged children*

INTRODUCTION

Early preparation and formation of habits, including breakfast habits, during childhood are required to achieve high-quality human resource conditions. Academic achievement can be one of the indicators to achieve high-quality human resources. Nutrition improvement on children during school-aged period may contribute to academic achievement and will enhance individual well-being in the long term[1]. One of the efforts to improve nutritional quality is a balanced and regular diet. Breakfast is the most important thing to do every day because it can contribute to daily nutrient intake and requirement. Breakfast consumption in children provides better learning performance at school[2], but there are still many children not accustomed to eat breakfast. According to previous study, the prevalence of children not used to eat breakfast was 22.4%[3]. Another study has reported that 69.6% of Indonesian children have not consumed breakfast in accordance with balanced diet recommendation[4]. Skipping breakfast may lead to nutrient deficiencies in the body in the morning and increase the risk of malnutrition[5]. It can cause excessive consumption at other meal times, especially dinner, thereby leading to obesity[6]. On the contrary, based on previous study, breakfast could minimize the possibility of overweight and obesity[7]. A study by Berkey *et al*.[8] has shown that skipping breakfast may have a negative effect on answering questions and thinking skills, lower attendance at school, and psychological problems[8]. The problem faced when skipping breakfast is low blood glucose levels which is caused by no energy intake. Conversely, children who consume breakfast provide better performance in arithmetic, answering questions and logical thinking ability. Those results are in line with previous study which has reported that nutritional status and breakfast habits have significant relationship with academic achievement[9]. A study on Indonesian elementary school children has shown that snack (i.e. *buras*) intervention can significantly improve the blood glucose levels[10]. Furthermore, the study has stated that blood glucose level has a positive significant effect on short-term memory improvement of elementary school children. Family socioeconomic status also related to eating habits, especially breakfast habits and indirectly related to academic achievement of children. Children whose their parents had high education will tend to eat breakfast every day. Highly educated mothers are more supportive of the availability of nutritious food at home. The higher the family income, the better the child's breakfast habits. Thus, this study aimed to analyze correlation between breakfast habits, family socioeconomic status and academic achievement among elementary school children in Bogor City.

Methods

This cross-sectional study was conducted from March to May 2016. The method used for subject selection was purposive sampling. The subjects in this study were 150 male and female students of two public schools and two private schools in Bogor City; i.e. Bantarjati 5 Public Elementary School, Sindangsari 1 Public Elementary School, Insan Kamil Elementary School and Iannatushibyan Islamic Elementary School. The specified inclusion criteria were fifth grade students, capable of filling out questionnaires, able to communicate well, and willing to be study subjects. The data regarding subjects' characteristics were obtained through questionnaires filled out by the subjects guided by the researchers and the data of family characteristics were obtained through questionnaires filled out by the subjects' parents. Breakfast frequency was classified into "rarely" (< 5 times/week) and "often" (≥ 5 times/week). Breakfast time was categorized into "before 7 AM" (before school) and "after 7 AM" (at school). The ways of obtaining breakfast were divided into "prepared at home", "bought at stalls" and "others". Type of breakfast foods was divided into: 1) staple food; 2) staple food and animal-based side dishes; 3) snacks; and 4) no breakfast. The amount of food consumed during breakfast for one week were assessed by food record in grams or household measures, which were then converted by using Food Composition Table. Data concerning energy contribution from breakfast were classified into three categories; i.e. low (energy contribution < 15% RDA for energy), moderate (energy contribution of 15-25% RDA for energy), and high (energy contribution > 25% RDA for energy)[11]. The data regarding protein contribution from breakfast were classified into two categories; i.e. insufficient (protein contribution < 25% RDA for protein) and sufficient (protein contribution ≥ 25% RDA for protein). The data about subjects' breakfast habits were collected through questionnaires filled out by the subjects guided by the researchers. Anthropometric data were obtained by taking direct measurements of body weight and height in each class of each school. Body weight was measured with digital scales with a capacity of 200 kg and 0.1 kg accuracy, while body height was measured using a stature meter with a capacity of 200 cm and 0.1 cm precision. The subjects' academic achievement was obtained from the data of midterm test scores in 2015/2016 academic year which collected by the researchers sourced from school data. The school subjects chosen were the ones tested on National Examination; i.e. Mathematics, Indonesian Language and Natural Sciences. Academic achievement were classified in two categories; i.e. good (average score >70) and poor (average score ≤ 70). The data obtained were processed and analyzed by using 2010 Microsoft Excel software and SPSS version 17.0 for Windows. Subjects' nutritional data based on body mass index (BMI)-for-age (BAZ) that were obtained from anthropometric measurements were then analyzed using 2007 WHO Anthroplus software. Statistical analyses we used were Spearman's correlation test and comparative tests (independent sample t-test, Mann-Whitney and chi-square).

Ethical Considerations

Ethics approval was not required for this study. Ethics approval was waived since the presented data are anonymized and the risk of identification is low. All interviews were conducted after obtaining the written informed consent of the subjects.

Results

Most of the subjects were 11 years old (74.7%) and more than half of them were girls (54%). More girls had good academic achievement than boys. Pocket money of the subjects with good academic achievement was significantly higher than the ones with poor academic achievement (p=0.000) (Table 1). Most of the fathers were high-school graduates (42%)

while most mothers were less than high-school graduates (40%). Paternal and maternal education levels of the subjects with good academic achievement were significantly higher than those with poor academic achievement (p=0.000). Most of the subjects with good academic achievement had university-educated fathers and mothers; 44% and 42%, respectively. Among those with poor academic achievement, most of the fathers were high-school graduates (44%) while most of the mothers were less than highschool graduates (61%). Most of the subjects' mothers were housewives (66%). The number of mothers who became housewives were significantly higher (p=0.003) among subjects with poor academic achievement (78%) than those with good academic achievement (58%). There were 88.7% of the subjects who came from non-poor families. More than 90% of subjects with good academic achievement came from non-poor families. Total per capita income of subjects with good academic achievement were significantly higher than those with low academic achievement (p=0.000). Half of the subjects (50.7%) came from small families and only two subjects who came from big families. The number of family members of subjects with poor academic achievement tended to be higher than those with good academic achievement (Table 1). The subjects with good academic achievement had better characteristics and better socioeconomic conditions than those with poor academic achievement. Subjects with good academic achievement had larger amount of pocket money, higher parental education levels and higher per capita income. Most of them came from small families and most of their mothers were working (Table 1).

Table 1. Distribution of subjects' characteristics, family socioeconomic conditions and nutritional status

Characteristics	Academic achievement				Total		p-value
	Good		Poor				
	n	%	n	%	n	%	
Sex							
Boys	42	42.4	27	52.9	69	46.0	0.221
Girls	57	57.6	24	47.1	81	54.0	
Age (years)							
10	4	4.0	3	5.9	7	4.7	0.983
11	75	75.8	37	72.5	112	74.7	
12	20	20.2	11	21.6	31	20.7	
Mean±SD	11.2±0.5		11.2±0.5		11.2±0.5		
Pocket money (IDR)							
Small amount(< 6,000)	19	19.2	19	37.3	38	25.3	**0.000**
Large amount(≥ 6,000)	80	80.8	32	62.7	112	74.7	
Mean±SD	11348.5±6121.4		8019.6±3728.2		10216.7±5640.3		
Paternal education							
< Senior high school	14	14.3	24	47.1	38	25.5	**0.000**
Senior high school graduates	45	45.9	18	35.3	63	42.3	
University	39	39.8	9	17.6	48	32.2	

Characteristics	Academic achievement				Total		p-value
	Good		Poor				
	n	%	n	%	n	%	
Maternal education							
< Senior high school	30	30.3	30	58.8	60	40.0	**0.000**
Senior high school graduates	30	30.3	15	29.4	45	30.0	
University	39	39.4	6	11.8	45	30.0	
Maternal employment status							
Employed	41	41.4	10	19.6	51	34.0	**0.003**
Housewife	58	58.6	41	80.4	99	66.0	
Income (IDR/capita/month)							
Poor	6	6.1	11	21.6	17	11.3	**0.000**
Not poor	93	93.9	40	78.4	133	88.7	
Mean±SD	1459158.3±11019 45.2		553229.7±35468 1.3		1151142.6±10130 51.4		
Family size (people)							
Small	52	52.5	24	47.1	76	50.7	0.433
Moderate	47	47.5	25	49.0	72	48.0	
Big	0	0.0	2	3.9	2	1.3	
Mean±SD	4.6±1.0		4.8±1.3		4.7±1.1		
Nutritional status							
Thin	5	5.1	3	5.9	8	5.3	0.585
Normal	82	82.8	43	84.3	125	83.3	
Overweight	12	12.1	5	9.8	17	11.3	
Mean±SD	-0.3±1.2		-0.4±1.1		-0.3±1.2		
Total	99	100.0	51	100.0	150	100.0	

Most subjects had normal nutritional status (83.3%). Mean BAZ of both subject groups were also normal and not significantly different. There were more obese subjects among those with good academic achievement (12.1%) than those with poor academic achievement (9.8%) (Table 1). Spearman's correlation test showed that there was no significant correlation between nutritional status and academic achievement (p>0.05). It also indicated that academic achievement had significant positive correlations with paternal education (p=0.000; r=0.477), maternal education (p=0.000; r=0.470) and family income (p=0.000; r=0.579). Descriptively, the subjects who had better breakfast habits tended to have better academic achievement. In terms of breakfast quality, the subjects who had good academic achievement were the ones who often ate breakfast, breakfast time before 7 AM, ate breakfast at home and their breakfast meals were prepared at home. However, the analysis results did not show any significant association between breakfast habits and academic achievement variables (p>0.05). In terms of composition of breakfast foods consumed, those with good academic achievement (77%) tended to consume more breakfast foods with the composition of staple food and animalbased side dishes than those with poor academic achievement (59%). There were more subjects in poor academic achievement group than in good academic achievement group who only consumed staple food, snacks, and even skipped breakfast (Table 2).

Table 2. Breakfast habits of the subjects

| Breakfast-related variables | Academic achievement | | | | Total | | p-value |
| | Good | | Poor | | | | |
	n	%	n	%	n	%	
Breakfast frequency							
Rarely	12	12	11	22	23	15	0.570
Often	87	88	40	78	127	85	
Mean±SD	6.0±1.7		5.7±2.0		5.9±1.8		
Breakfast time							
<7.00 AM	95	96	45	88	140	93	0.229
≥ 7.00 AM	4	4	6	12	10	7	
Place for breakfast							
Home	97	98	50	98	147	98	0.827
School	1	1	1	2	2	1	
On the way to school	1	1	0	0	1	1	
How to get breakfast							
Prepared at home	98	99	50	98	148	99	0.830
Bought at stalls	1	1	1	2	2	1	
Others	0	0	0	0	0	0	
Type of breakfast							
SF*	16	16	14	27	30	20	0.271
SF* + ASD**	76	77	30	59	106	70	
Snacks	5	5	5	10	10	7	
Skip breakfast	2	2	2	4	4	3	
Total	99	100	51	100	150	100	

*Staple food
**Animal-based side dishes

In terms of breakfast quantity, subjects who had higher breakfast energy contribution (21.6±24.4%) significantly (p<0.05) had better academic achievement than those with lower energy contribution (18.3±15.2%). In addition, subjects who had higher breakfast protein contribution (12.3±21.4%) also significantly (p<0.05) had better academic achievement than those with lower protein contribution (11.5±14.4%) (Table 3). Spearman test indicated that energy (p=0.034; r=0.173) and protein (p=0.001; r=0.275) contributions from breakfast had significant correlations with academic achievement.

Table 3. Mean value and standard deviation of the percentage of energy and protein contributions from breakfast based on the subjects' academic achievement

| Variables | Academic achievement | | p value |
	Good	Poor	
Energy contribution (%)*	21.6 ± 24.4	18.3 ± 15.2	0.037
Protein contribution (%)**	12.3 ± 21.4	11.5 ± 14.4	0.001

*Low (<15% RDA for energy), moderate (15-25% RDA for energy), high (>25% RDA for energy)
**Insufficient (<25% RDA for protein), sufficient (≥25% RDA for protein)

Discussion

The subjects with good academic achievement had better subjects' characteristics and socioeconomic conditions than those with poor academic achievement. Those with good academic achievement had larger amount of daily pocket money, higher parental education levels and higher per capita income, came from small families, and had mothers who were working. Working mother usually have better education level. Children whose their parents had high education will tend to eat breakfast every day[12]. Maternal education level will have an impact on child eating behavior and food availability at home. Highly educated mothers are more supportive of the availability of nutritious food at home[13]. Working mother also can contribute to higher family income. Non-working mothers have more time to prepare food for their children, while working mothers tend to not have enough time and usually serve fast food or buy takeaway food[14]. According to previous study, the higher the family income, the better the child's breakfast habits[15]. Low-income families tend to limit access to food at home, thereby food selection is less diverse. If there were more family members, the dietary pattern becomes more varied because each member of the household does not necessarily have the same taste[16]. Spearman's correlation test showed that there was no correlation between nutritional status and academic achievement (p>0.05). The result of this study is in line with previous study which reported that there was no association between nutritional status and academic achievement, but there was a significant positive association between family socioeconomic status and academic achievement[17]. Families with higher socioeconomic status usually tend to prioritize education and provide better learning facilities to their children so that the children have better academic achievement. In our study, Spearman's correlation test indicated that paternal education (p=0.000; r=0.477), maternal education (p=0.000; r=0.470) and family income (p=0.000; r=0.579) had significant positive correlations with academic achievement. Nutritional status (BAZ) is not a single factor affecting child's academic achievement because there are other factors that influence the academic

achievement[18]. However, our results did not correspond to previous study examining 802 fourth graders in Sri Lanka[19]. The study reported that BAZ had a positive relationship with the score of Mathematics exam. A study on 135 school children aged 9 to 11 years showed that there were no thin and stunted children who belonged to grade A+ and A categories in terms of academic achievement[20]. Correlation test also showed a strong and positive association between nutritional status and academic achievement. Our finding has not been able to prove the correlation between nutritional status (BAZ) and academic achievement (midterm test scores) due to the assumption that BAZ is not a good predictor to assess the association between the two variables. Previous study concluded that weight-to-height score had inconsistent effect on academic achievement, whereas body height was a better predictor than body weight. Height-for-age Z-score (HAZ) and weight-for-age Z-score (WAZ) showed positive associations with the scores of Tamil, Mathematics and all school subjects. Meanwhile, BAZ only showed a positive association with Math score[19]. Subjects with better breakfast habits tended to have better academic achievement. In terms of breakfast quality, the subjects who frequently ate breakfast at home, with a breakfast time before 7 AM and breakfast food prepared at home, had better academic achievement. However, analysis results showed that there was no correlation between breakfast habits and academic achievement variables (p>0.05). It was different from previous study, which reported that children who ate breakfast at home tended to consume healthier food, while those who ate breakfast other than at home tended to buy snacks outside and the foods were usually less healthy. Non-working mothers had more time to prepare food for their children. In terms of education, highly educated mothers tended to prepare breakfast for their children[21]. In terms of the composition of breakfast type consumed, the subjects with good academic achievement (77%) tended to consume more breakfast with the composition of staple food and animal-based side dishes than those with poor academic achievement (59%). There were more subjects with poor academic achievement who consumed only staple food, snacks and even skipped breakfast than those with good academic achievement. These descriptive results are in line with the finding of previous study, which concluded that breakfast composition also affected cognitive performance[2]. Mahoney et al.[2] conducted experimental study on the importance of type of breakfast consumed on cognitive performance of 30 elementary school students aged 9 to 11 years in US[2]. The results indicated that the students showed an increase in spatial and short-term memories after consuming oatmeal compared to ready-to-eat cereals. Oatmeal gives a slower and more sustainable energy source due to its protein content, fiber content, glycemic index (GI) and rate of digestion; thereby enhancing cognitive function. The benefits of oatmeal are thought to be facilitated through blood glucose response after breakfast. Increased blood glucose can improve learning and memory, possibly through acetylcholine synthesis. Breakfast composition can also affect cognition through another way, i.e. rate of digestion. High-fiber, low GI, and more slowly digested breakfast will keep the glucose released into the bloodstream and brain. Breakfast composition can also influence the synthesis of brain neurotransmitters. A high-carbohydrate breakfast increases the amount of brain tryptophan, which leads to an increase in serotonin synthesis. A high-protein breakfast increases the level of tyrosine, which results in increased synthesis of dopamine and norepinephrine. Tryptophan and tyrosine play a role in alertness that have implications on cognitive performance. Oatmeal contains more protein and fiber than ready-to-eat cereals[2]. Previous study review also indicated that breakfast with lower postprandial glycemic response had benefits to cognitive performance[22]. Spearman test showed that academic achievement had significant correlations with breakfast energy contribution (p=0.034; r=0.173) and breakfast protein contribution (p=0.001; r=0.275). These findings are in line with the previous study indicating that energy and protein contributions from breakfast had significant associations with academic achievement[23]. Breakfast as the provider of energy plays an important role in increasing blood glucose levels to supply the work of the brain, while amino acids – the smallest unit of protein – are important as brain neurotransmitters. Previous study on 605 adolescents aged 11 to 18 years in Netherlands found that the adolescents who used to skip breakfast had worse performances in school than those who always had breakfast[24]. It was partly related to adolescents' attention problem at school among those who skip breakfast. Similar result was also shown in another study on 453 Jordanian elementary school students, which indicated that there was a relationship between regular breakfast and good academic achievement[25]. A study on 800 junior high school students at Ogun State showed that academic achievement, class participation and recall ability had strong positive associations with breakfast[26]. Breakfast became one of the factors affecting good academic achievement in 600 elementary school students in Pakistan[27]. Significant differences were also seen in parameters such as memory, concentration, grades obtained and attendance between children who skipped breakfast and those who did not[28]. Children who regularly consume breakfast give better performance in arithmetic, answering questions and logical thinking ability[5]. Previous study has concluded the two strongest and most consistent pathways in terms of the breakfast mechanism affecting academic achievement; i.e. through increased attendance at school and reduced tardiness[29]. Recent development in neuroscience shows the specific nutrients that are important for cognition. It has been known that skipping breakfast has an adverse effect on various aspects of cognitive development such as alertness, attention, memory, complex visual processing, problem solving and Math. Breakfast is also related to a good mental state, thus it is assumed that breakfast can influence inter-social relationship in school with teachers and friends. It is also associated with reduced absenteeism[29].

Conclusion

The subjects with good academic achievement had better subjects' characteristics and socioeconomic conditions than those with poor academic achievement. Breakfast consumption with good quality and quantity tends to improve academic achievement, thus good provision of type and amount of breakfast becomes important. Positive role and support, especially from the family, are needed to heed children's breakfast habits. Nutrition education strategy to families with low socioeconomic levels is in the form of selection of good quality breakfast menu type with affordable prices, while the strategy for the ones with middle and upper socioeconomic levels is in the form of selection of breakfast food types in accordance with balanced diet guidelines.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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