

Original Article

Academic performance of Korean children is associated with dietary behaviours and physical status*

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The purpose of this study was to obtain a fuller understanding of the association of dietary behaviours, physical status and socio-economic status with academic performance in Korean teenagers. The subjects in this study were 6,463 boys and girls, in grade 5, 8, and 11 in Korea. A self-administered questionnaire and the food-frequency form were used. Grade point average (GPA), height, weight, and physical fitness score for the year were recorded from the school record. The academic performance of students was strongly associated with dietary behaviours, especially with regularity of three meals even after control for parent's education level. Regular breakfast and lunch were more important in grades 5 and 8, while regular dinner was more related with academic performance in grade 11. Small, positive associations of height and physical fitness to academic performance were also found. The relative importance of regularity of meals was greater than that of socio-economic status and physical status in older teenagers. The results of this study suggest that accommodation of better dietary environment and nutrition education for three regular meals is recommended.

Key Words: dietary behaviour, academic performance, meal regularity, children, physical fitness, height, food security

Introduction

Good academic performance of students is always a concern for both students and parents, in part because academic performance is directly related to university entrance and job opportunities. It is well recognized that socio-economic conditions such as parent's education, job, and economic status influence how well students do in school.¹⁻⁴

The relationship between dietary behaviour and academic performance of students has not been widely investigated. There is some evidence that food insufficiency and dietary behaviours are associated with school performance beyond socio-economic status. Children from families that report experiences of food insufficiency and hunger are more likely to show academic problems.⁵ It has also been suggested that participation in the school breakfast program significantly improves school performance and reduces absenteeism and tardiness.⁶ Whether or not a child eats breakfast may have an effect on nutrient intake and nutritional status, which in turn could affect cognition.⁷⁻⁹

Several other dietary behaviours of students that might affect academic performance have not been studied. For example, even though the importance of breakfast was mentioned in several papers,⁷⁻¹² few studies looked at the importance of lunch or dinner. The eating frequency of meals and snacks per day may also have an effect on students' academic performance. How students eat during examination periods may also have an association with academic performance of students, as might taking nutrient supplements. Physical status has also been reported to be associated with school performance. Height and weight are not only affected by genetics, but also by environmental factors, such

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as long-term and short-term food intakes. Wilson and his coworkers⁴ studied NHES II (age 6-11 y) and III (age 12-17 y) data and found that height Z-score was significantly correlated with the Wechsler Intelligence Scale for Children (WISC) and the Wide Range Achievement Test (WRAT) scores of the children. Height has been shown to be associated with academic performance in several papers, but when socio-economic status is controlled, the association of height with academic performance is reduced.^{1,4} In the case of body weight, overweight seems to be negatively associated with the academic achievement of students.^{13,14} Another factor that may be associated with academic performance of students is their physical fitness. Because physical fitness is related with health of students,¹⁵⁻¹⁷ better physical fitness may be related with academic performance.

The purpose of this study was to obtain a fuller understanding of the association of multiple factors with academic performance in Korean teenagers. Specifically, we examined how dietary behaviours, physical status, physical fitness, and socio-economic status are jointly related to academic performance. The findings add to our understanding of why some children may perform academically better than others, and may be useful in developing nutrition promotion efforts for the dietary problems.

Methods

Data collection

Subjects were sampled from eight cities of South Korea, selected to achieve geographical balance. Sixteen elementary schools, 14 middle schools and 14 high schools were randomly selected with a probability proportional to the population size of the city. One to six intact classes were randomly selected at each school to participate in the study. Students were sampled from six grade (5th, 8th, and 11th) and gender (boys and girls) groups. A total of 7,207 students were surveyed that was approximately 0.35 % of the total Korean students in those grades. The final sample consisted of 6,463 students who answered both the questionnaire and the food frequency form, 1,935 from grade 5 (age 10-11 y), 2,194 from grade 8 (age 13-14 y), and 2,334 from grade 11 (age 16-17 y). The study was approved by the Institutional Review Board of Ewha Womans University.

A pilot survey was performed to test the questionnaire and develop the food frequency questionnaire. Eighty-six food items, which were used most frequently by students in the pilot study, were chosen to be included in the food frequency questionnaire. This revised version was compared to student's 24-hour recall to confirm its validity. Each food item was listed with a choice of three portion-sizes and the frequency of intakes per month. The categories of frequency ranged from none, 1, 2, 3 times/month, 1, 2, 3, 4, 5, 6 times/week, or 1 to 2 times/day. For rice, a choice of five portion sizes was given, and students were asked to write the frequency of intake per week. The nutrient intakes were estimated using the Korean food composition table.¹⁸

Information on socio-demographic status, dietary behaviour and food frequency was collected by distribution of

questionnaires to the students in the classroom. As an index of academic achievement of students, grade point average (GPA) was recorded from the school record of the last semester. The subjects included Korean, mathematics, social studies, natural science, physical education, music, art, ethics, and practical course. English was also included in grades 8 and 11. The range of GPA was between 1 and 5.

Height and weight of the students were recorded from the annual physical examination record of the school. Physical fitness score was recorded from the annual physical fitness test of the school. Short (100 m) and long (600-1000 m) distance race, standing broad jump, back up exercise, throwing, and chin-ups for boys or hanging on the bar for girls were included in the test. For a long-distance race, the 600, 800, or 1000 meter dash was used for grades 5, 8 or 11, respectively.

Conceptual model and variables

A conceptual model of the factors affecting school-age children's academic performance was made using variables available from the survey data. We postulated that academic performance of the students is associated with socio-economic status, diet quantity and quality, dietary behaviours, and physical status and fitness.

Father and mother's education level was used to represent the socio-economic status. It was our limitation that we did not have other objective indicators of socio-economic status. For dietary behaviours, regularity of breakfast, lunch and dinner, number of daily meals eaten, number of daily snacks eaten, snack money spent by students, changes in meal size during examination period, and nutrient supplement use were available variables. Among these variables, regularity of breakfast, lunch, and dinner had the strongest relationship with academic performance. Therefore, those variables were chosen to represent dietary behaviour. The regularity of meals implies eating a meal at a regular time. Eating staples, such as rice, noodle or bread with side dishes, are recognized as meals in Korean contexts. Students who skip meals or eat sometimes were considered as irregular meal eaters.

For diet quantity and quality, energy intake (MJ), protein density (g protein/10MJ) and standardized micronutrient density were used. To calculate standardized micronutrient density, first the micronutrient density (nutrient intake/MJ) was obtained separately for calcium, iron, phosphorus, vitamin A, vitamin B₁, vitamin B₂, niacin, vitamin C, and vitamin B₆. Second, a standardized value was obtained for each micronutrient density by subtracting the mean and dividing by the standard deviation. Then, a mean standardized density was calculated by the mean of these nine standardized values. For physical status and fitness, height, weight and physical fitness score were used as representative variables.

Statistical analysis

Analyses were performed separately for the six grade and sex groups. For prevalence estimates and means, missing data were excluded from the analysis for a given variable.

Multiple linear regressions were applied to investigate the associations between academic performance and socio-economic, dietary behaviour, and physical status variables. Cities were controlled in the multiple linear regressions. For the regression analyses, all observations were included, even if some variables had missing data. A total of 304 grade-5 boys, 241 grade-5 girls, 357 grade-8 boys, 264 grade-8 girls, 250 grade-11 boys, and 177 grade-11 girls had at least one missing value. Parent's education variables had the largest number of missing values. The number of missing values in parent's education ranged from 232 (23.2%) in grade 5 boys to 75 (7.2%) in grade 11 girls for mother's education. The number of missing values in fitness score ranged from 84 (7.6%) in grade 8 boys to 28 (3.0%) in grade 5 girls. All the other variables had less than 3% of the missing values. The AMOS statistical package¹⁹ was used to estimate the regression coefficients from all observations. AMOS uses a maximum likelihood procedure for estimation under the assumption that the missing data were missing at random.²⁰ This procedure does not require a separate step for imputation of missing values.

Results

Descriptive statistics

Frequencies for parent's education years and regularity of meals are shown in Table 1. In grade 5, 54% of fathers had more than 12 years of education and 39% had 10-12 years of education. The proportion of fathers with longer education length decreased with increase in student's grade. A similar trend was found for mother's education. Within the same grade, fathers had more education than mothers. Parent's education level was similar between boys and girls in grades 5 and 8. However, more girls had higher educated parents than boys in grade 11 ($P < 0.05$).

Lunch was the most regularly eaten meal, probably corresponding to the time schedule of the school, followed by breakfast and dinner, in all grades. For grade 5, 83.5% of the students ate lunch regularly, 63.6% ate breakfast regularly, and 55.2% ate dinner at a regular time. For grade 8, 79.0%, 56.6% and 40.2% of the students ate lunch, breakfast, and dinner at a regular time, respectively. Grade 11 showed a similar tendency, 60.1% for lunch, 58.6% for breakfast, and 45.6% for dinner. Boys ate breakfast and dinner more regularly than girls in all grades, whereas girls had more regular lunch than boys in grades 5 and 8 ($P < 0.05$).

Grade point average, physical status, and energy intake of the students are given in Table 2. Average academic performance score was higher in girls than in boys at the same grade. Average height of boys was slightly shorter than that of the girls at grade 5, but boys were taller than girls at grades 8 and 11. Body weight of boys was heavier than that of girls at all grades. Physical fitness score was not different by sex within the same grade.

Mean energy intake was highest at grade 8, both in boys and girls. Boys had higher average energy intake than girls at the same grade. Protein density of the student's diet was similar among different grades and sex.

Association of factors with academic performance

Results of the multiple regression analysis for academic performance of the students are given in Tables 3 to 5. Parent's education level was strongly associated with student's academic performance in grade 5 and 8. Higher parental education was related with higher GPA, with the largest magnitude being about one-half of a point. The association between parent's education and student's performance was weak in grade 11 boys, and no association was found in grade 11 girls.

Table 1. Frequency and percentage of parent's education and regularity of meals

		Grade 5		Grade 8		Grade 11	
		Boy	Girl	Boy	Girl	Boy	Girl
Father's education	<9 yrs	58 (7.4)†	46 (6.0)	103 (11.8)	86 (9.5)	169 (14.9)	74 (7.8)
	10-12 yrs	287 (36.7)	312 (40.9)	362 (41.3)	409 (44.9)	552 (48.6)	426 (45.1)
	>12 yrs	436 (55.8)	404 (53.0)	411 (46.9)	415 (45.6)	414 (36.5)	444 (47.0)
Mother's education	<9 yrs	74 (9.7)	86 (11.3)	166 (18.9)	160 (17.4)	336 (29.0)	169 (17.5)
	10-12 yrs	370 (48.5)	381 (49.9)	438 (50.0)	486 (52.8)	634 (54.8)	583 (60.3)
	>12 yrs	319 (41.8)	296 (38.8)	272 (31.1)	275 (29.9)	187 (16.2)	215 (22.2)
Regularity of breakfast	No	333 (34.3)	357 (38.7)	428 (39.0)	511 (48.0)	463 (36.0)	498 (47.9)
	Yes	638 (65.7)	566 (61.3)	669 (61.0)	554 (52.0)	822 (64.0)	541 (52.1)
Regularity of lunch	No	200 (20.1)	114 (12.2)	278 (25.2)	178 (16.6)	503 (39.1)	426 (40.9)
	Yes	776 (77.9)	817 (87.8)	825 (74.8)	895 (83.4)	783 (60.9)	615 (59.1)
Regularity of dinner	No	414 (42.5)	437 (47.3)	592 (53.7)	708 (66.1)	620 (48.3)	640 (61.9)
	Yes	560 (57.5)	487 (52.7)	510 (46.3)	363 (33.9)	664 (51.7)	394 (38.1)

† frequency (%)

Regularity of breakfast and lunch was associated with academic performance in most groups. Regularity was related to higher GPA, with the largest magnitude being about one-quarter of a point. Weak association of having a regular dinner was seen in grade 5 or grade 8 boys, but having a regular dinner had the strongest association with academic performance among the three meals in grade 11, with the magnitude being about one-third of a point. Daily energy intake had small, but consistently negative associations with student's performance. Protein density was associated with student's performance only in grade 11 boys ($P < 0.1$).

Micronutrient density was positively associated with performance only in grades 8 boys and girls. A weak but positive association between height and academic performance was found in grade 5 girls and grade 8 boys. A difference of 10 cm was related to a difference in performance of about 0.15 points. Body weight of the students had no relationship with academic performance. In five of the six groups, physical fitness score was positively associated with performance. A difference of one standard deviation of the mean was related to a 0.1 point difference in performance.

Table 2. Grade point average, energy intake, nutrient density, height, weight, and fitness score of students†

	Grade 5		Grade 8		Grade 11	
	Boy	Girl	Boy	Girl	Boy	Girl
GPA	3.93 ± 0.70	4.18 ± 0.64	3.06 ± 1.11	3.37 ± 1.00	2.96 ± 0.83	3.17 ± 0.81
Height (cm)	141.9 ± 6.2	142.7 ± 6.7	160.8 ± 8.0	156.4 ± 5.5	171.8 ± 5.7	160.4 ± 5.0
Weight (kg)	37.6 ± 8.5	36.4 ± 7.9	52.0 ± 11.0	49.1 ± 7.8	63.2 ± 10.3	53.4 ± 7.4
Fitness score	43.6 ± 17.3	45.3 ± 16.1	55.6 ± 21.6	55.5 ± 18.2	57.5 ± 21.1	58.6 ± 18.0
Energy (MJ)	10.76 ± 5.14	9.56 ± 4.54	11.45 ± 4.86	9.83 ± 4.01	10.56 ± 3.62	8.81 ± 3.37
Protein (g/MJ)	8.16 ± 1.61	8.17 ± 1.49	8.21 ± 1.47	8.27 ± 1.41	7.99 ± 1.20	8.23 ± 1.29
Ca (mg/MJ)	75.8 ± 27.5	78.6 ± 25.7	71.9 ± 25.4	76.3 ± 24.1	71.2 ± 21.4	78.0 ± 23.9
P (mg/MJ)	125.4 ± 24.6	127.0 ± 23.4	123.9 ± 22.9	126.2 ± 22.1	122.6 ± 19.4	127.3 ± 21.6
Fe (mg/MJ)	1.39 ± 0.44	1.41 ± 0.42	1.39 ± 0.40	1.46 ± 0.36	1.31 ± 0.34	1.45 ± 0.34
Vit. A (RE/MJ)	49.3 ± 33.9	51.3 ± 28.5	44.3 ± 26.5	48.7 ± 25.3	42.8 ± 21.6	50.2 ± 29.8
Vit. B1 (mg/MJ)	0.15 ± 0.03	0.15 ± 0.03	0.15 ± 0.03	0.15 ± 0.03	0.14 ± 0.03	0.16 ± 0.03
Vit. B2 (mg/MJ)	0.17 ± 0.05	0.17 ± 0.04	0.16 ± 0.04	0.17 ± 0.04	0.16 ± 0.03	0.16 ± 0.04
Niacin (mg/MJ)	1.74 ± 0.44	1.76 ± 0.38	1.70 ± 0.37	1.76 ± 0.36	1.61 ± 0.33	1.79 ± 0.34
Vit. C (mg/MJ)	14.4 ± 9.6	15.9 ± 10.9	13.3 ± 8.6	16.2 ± 9.6	12.1 ± 6.5	16.2 ± 7.2
Vit. B6 (mg/MJ)	0.04 ± 0.02	0.04 ± 0.02	0.04 ± 0.02	0.04 ± 0.02	0.03 ± 0.02	0.04 ± 0.02

† Mean ±SD

Table 3. Regression coefficients and P -values from multiple regression models for GPA, Grade 5†

	Boys (N=996)		Girls (N=939)	
	Coefficient	P value	Coefficient	P value
Constant	2.519	0.000	1.811	0.001
<i>Socioeconomic status</i>				
Father education (<9 yrs = 0, 10-12 yrs = 1)	0.115	0.255	0.193	0.064
Father education (<9 yrs = 0, >12 yrs = 1)	0.208	0.069	0.351	0.002
Mother education (<9 yrs = 0, 10-12 yrs = 1)	0.118	0.192	0.114	0.160
Mother education (<9 yrs = 0, >12 yrs = 1)	0.275	0.010	0.285	0.003
<i>Dietary behavior</i>				
Regular breakfast (No = 0, Yes = 1)	0.177	0.000	0.064	0.143
Regular lunch (No = 0, Yes = 1)	0.110	0.043	0.259	0.000
Regular dinner (No = 0, Yes = 1)	-0.059	0.207	-0.089	0.036
Energy intake (/MJ)	-0.017	0.000	-0.018	0.000
Protein density (g protein/10MJ)	0.000	0.783	-0.001	0.771
Standardized micronutrient density	0.062	0.106	0.025	0.486
<i>Physical status & fitness</i>				
Height (cm)	0.006	0.207	0.014	0.001
Weight (kg)	0.003	0.453	-0.004	0.272
Standardized fitness score	0.101	0.000	0.050	0.017

† The models included indicator variables to control for cities.

To understand the relative contribution of socio-economic status, dietary behaviour, and physical status and fitness variables on student's academic performance, the pattern of squared multiple correlation (R^2) is presented in Table 6. The multiple variables used in this study explained 11.7-23.3 % of the academic performance of the students. Socio-economic status and physical status were less related with academic performance in older children. Meanwhile, dietary behaviours of the students were constantly related with academic performance, regardless of the age of students. Socio-economic status and dietary behaviour together accounted for most of the variability explained.

Discussion

The results of this study demonstrate that academic performance of Korean teenagers is associated with regularity of three meals. Regular breakfast and lunch were more important in grades 5 and 8, while regular dinner was more related with academic performance in grade 11. The results also show weak, but positive associations of height and physical fitness with academic performance. These results are the first to demonstrate an association between regularity of all three meals and academic performance. This study shows that not only regular breakfast, but also regular lunch and dinner are associated with academic functioning of teenagers. It has been previously reported that short-term breakfast omission diminishes short-term memory in children.^{12,21,22} In the long-term, school breakfast consumption was shown to improve school attendance and scholastic achievement of children.^{6,10} Powell and his coworkers¹⁰ reported that undernourished children from rural Jamaica had an improved arithmetic score of the WRAT (Wide Range

Achievement Test) test after 2-3 months of school breakfast consumption.

Meyers and coworkers⁶ also reported that participation in the breakfast program for 3 months increased the total scale score of the Comprehensive Test of Basic Skills among low-income elementary school children in Massachusetts. In our cross-sectional study, it was also shown that regular breakfast had a positive association with GPA of the students except girls in grade 5. Students who ate breakfast regularly had a GPA 0.15-0.28 points higher than students who did not eat breakfast regularly. The relation of regularity of meals to academic performance is extended to regular lunch and dinner. The reason why regular meals are related to academic performance is not clear. Eating staples such as rice, noodle, or bread with side dishes are recognized as meals in Korean contexts. Therefore, eating meals at a regular time may be a reflection of food security.²³ In addition, meal regularity also may reflect family care.

It is known that chronic undernutrition has adverse effects on subsequent cognitive development and school performance of children.²⁴ In studies using data from the Community Childhood Hunger Identification Project Surveys (CCHIP) in the United States,^{25,26} investigators found that school-age children identified as hungry and/or at risk of hunger were more likely to have impaired psychosocial function and academic outcome. Using data from NHANES III, Alaimo and her coworkers⁵ also found that family food insufficiency was associated with school-age children's academic and psychosocial development. These investigators also found that family food insufficiency was associated with depression and suicide attempts in teenagers.²⁷ Alaimo *et al.*⁵ outlined several possible mechanisms for their results that

Table 4. Regression coefficients and p-values from multiple regression models for GPA, Grade 8[†]

	Boys (N=1113)		Girls (N=1081)	
	Coefficient	P value	Coefficient	P value
Constant	-0.269	0.748	1.908	0.032
<i>Socioeconomic status</i>				
Father education (<9 yrs = 0, 10-12 yrs = 1)	0.219	0.079	0.141	0.286
Father education (<9 yrs = 0, >12 yrs = 1)	0.584	0.000	0.500	0.001
Mother education (<9 yrs = 0, 10-12 yrs = 1)	0.268	0.012	-0.052	0.619
Mother education (<9 yrs = 0, >12 yrs = 1)	0.471	0.001	0.214	0.110
<i>Dietary behaviour</i>				
Regular breakfast (No = 0, Yes = 1)	0.270	0.000	0.278	0.000
Regular lunch (No = 0, Yes = 1)	0.256	0.001	0.176	0.024
Regular dinner (No = 0, Yes = 1)	0.020	0.754	0.160	0.012
Energy intake (/MJ)	-0.031	0.000	-0.072	0.000
Protein density (g protein/10MJ)	-0.004	0.198	0.001	0.707
Standardized micronutrient density	0.168	0.004	0.097	0.066
<i>Physical status & fitness</i>				
Height (cm)	0.017	0.004	0.008	0.198
Weight (kg)	0.005	0.188	-0.004	0.359
Standardized fitness score	0.130	0.000	0.090	0.003

[†] The models included indicator variables to control for cities.

Table 5. Regression coefficients and *P* values from multiple regression models for GPA, Grade 11[†]

	Boys (N=1292)		Girls (N=1042)	
	Coefficient	<i>P</i> value	Coefficient	<i>P</i> value
Constant	1.218	0.096	2.572	0.002
<i>Socioeconomic status</i>				
Father education (<9 yrs = 0, 10-12 yrs = 1)	0.036	0.640	-0.129	0.259
Father education (<9 yrs = 0, >12 yrs = 1)	0.230	0.014	-0.052	0.688
Mother education (<9 yrs = 0, 10-12 yrs = 1)	-0.057	0.368	-0.092	0.280
Mother education (<9 yrs = 0, >12 yrs = 1)	0.306	0.001	0.056	0.605
<i>Dietary behaviours</i>				
Regular breakfast (No = 0, Yes = 1)	0.156	0.001	0.142	0.004
Regular lunch (No = 0, Yes = 1)	0.240	0.000	0.215	0.000
Regular dinner (No = 0, Yes = 1)	0.314	0.000	0.294	0.000
Energy intake (/MJ)	-0.023	0.000	-0.022	0.003
Protein density (g protein/10MJ)	0.004	0.081	0.002	0.376
Standardized micronutrient density	0.002	0.960	0.049	0.269
<i>Physical status & fitness</i>				
Height (cm)	0.007	0.111	0.005	0.349
Weight (kg)	-0.002	0.419	-0.005	0.164
Standardized fitness score	0.021	0.367	0.095	0.000

Table 6. Squared multiple correlation ($R^2 \times 100$) for the GPA of Korean students

Variables included in model*	Grade 5		Grade 8		Grade 11	
	Boy	Girl	Boy	Girl	Boy	Girl
Socioeconomic Status (SES)	11.9	13.9	13.8	10.0	6.3	2.3
Dietary Behaviors	10.7	9.3	8.9	9.2	11.6	9.0
Physical Status	9.3	6.8	6.2	3.5	1.3	2.5
SES and Dietary Behaviors	15.5	17.3	19.0	16.4	16.1	10.1
SES and Physical Status	14.6	16.0	17.7	11.7	6.4	4.0
SES, Dietary Behavior, and Physical Status	18.1	19.4	23.3	17.4	16.4	11.7

* Each model included indicator variables to control for cities.

could also be relevant to explaining the relation between meal irregularity and poorer school performance: 1) poorer health status, 2) irritability, distractibility, and emotional changes, 3) anxiety resulting from feelings of deprivation, 4) parental stress, anxiety, and behavior, and 5) family functioning.

Child height is affected by both genetics and environmental factors.^{28,29} There are also concerns that it may partially reflect parental care of the children.³⁰ The association between height and academic achievement has been the subject of a number of interesting observations.³¹⁻³³ Wilson and his colleagues⁴ have found that wide range achievement test (WRAT) scores were significantly correlated with height in National Health Examination Survey (NHES) samples of 14,000 US youths aged 6-17 years old. In Wessex growth study comparing short-normal children with controls,¹ investigators found that height had effects on intelligent quotient (IQ), reading attainment and basic number

skills at age 11-13 after controlling for social class. From multiple regression analysis, they reported that social class explained 14% of the variance in IQ scores while height explained a further 2%. In our study, the association of height with academic performance was bigger at younger ages. Physical activity and fitness has been shown to provide health benefits to children.¹⁵⁻¹⁷ However, the implication of physical fitness for their academic performance is not well understood. Dwyer *et al.*¹⁶ showed that participation in physical fitness programs emphasizing endurance in 10-year-old school children improved physical work capacity and decreased body fat without loss of their academic performance. In our study, physical fitness score of the students was introduced to see whether the physical fitness was associated with academic performance of the children. We found that physical fitness was positively but weakly associated with academic performance of the students.

In conclusion, academic performance of Korean teenagers was strongly associated with regular meal eating. The relative importance of regularity of meals is greater than that of socio-economic status and physical status in older teenagers. The results of this study suggest that accommodation of better dietary environment and nutrition education for eating three regular meals is recommended. Further studies are necessary to see whether the regularity of meals is directly related with food security and/or family care of the Korean students.

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