Effect of diet quality on academic achievement among female college students

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Summary. *Aim:* The study was conducted in order to determine whether diet quality had an effect on academic achievement (CGPA) of female undergraduate students. *Materials and Methods:* A sample of 222 students aged 19 to 24 years was drawn from Kinnaird College for Women, Lahore. Data was collected using a questionnaire that took into account student's demographics, academic profile, as well as a food frequency questionnaire (FFQ). The USDA National Nutrient Database was then used to calculate the usual dietary intake of macronutrients and micronutrients for each student. The Diet Quality Index-International (DQI-I) was utilized to determine a diet quality score for them. *Findings:* The mean DQI-I score for the students was 57.27 (±9.86). Linear regression established the existence of a positive relationship between diet quality score and CGPA (p<.05). There was a significant effect of the variety component (p<.05) and the moderation component (p<.05) on academic achievement but not of adequacy and overall balance components. *Conclusions:* The students had an overall diet quality score that was considered poor. When diet quality scores were compared with CGPA using linear regression analysis a positive association was found, meaning as diet quality improved so did the student's CGPA and vice versa. Reasons as to why their diet quality was low and how to improve it should be further investigated. This study will be valuable in providing the base line dietary data of the students for this purpose.

Key words: diet quality, academic achievement, CGPA, DQI-I, students

Introduction

Diet is a factor that continuously plays a significant role in sustaining the health of individuals (1). A well-functioning body results from the foods we consume (2). A healthy diet is one that will provide our bodies with both appropriate amounts of energy along with essential vitamins and minerals (2). Food influences body and mind function at every stage of life (2). Thus, diet quality is an important aspect to focus on especially during one's educational years; because food supplies fuel to the brain, diet has an impact on cognition and behavior in various ways (1). Diet affects mental functions such as recollection, thinking, contemplation, and psychomotor coordination (1). These cognitive capacities are relevant determinants of how well a student can perform scholastically. Encouraging the consumption of a assorted diet which includes plentiful foods of sound nutritional value seems to be the ideal method to make sure that youngsters will have optimum physiological and cognitive functioning (1). Very few dietary studies have been done on university students in Lahore and none have correlated intake with academics, but a study on 18 year old females revealed an average caloric intake of 1878 kcals, from which 264.14 grams were of carbohydrates, 65.43 grams from protein and 74.07 grams from fat. The study also showed minimal intake of fruits and vegetables among them and a high consumption of sweets and oils (3).

A correlation exists between academic achievements and prosperity in professional careers (4). Thus, college students are at a period in their lives when how well they perform academically can become the basis of their future job opportunities. Therefore, it is a vital

time in which they will strive to achieve their maximum potential. There are several factors that influence how successful one is academically but the diet of an individual may have a greater impact than is known. Most commonly diet is studied by looking at roles of particular nutrients or the effects of certain meals like breakfast. However, people consume whole foods rather than single nutrients or meals. In acknowledgment of this fact and the need to fulfill the research gap regarding dietary intake of undergraduate students, the following study was undertaken to look at the effect of overall diet quality and its effect on academic achievement.

Materials and methods

Subject selection

The subjects were 222 female undergraduate students between the ages of 19 and 24 years studying at Kinnaird College for Women in the Fall term of 2013. They were chosen randomly through the selection of ten classrooms out of all the undergraduate classrooms available and including all the students currently sitting inside to partake in the study after informed consent. Students enrolled in semester I and/or a post graduate program in the university were excluded.

Nutritional habits and life style data

All participants were asked to complete a questionnaire composed of three parts. The first one was about the socio-demographic data (age, living area, CGPA, parental education levels and household income). The second part was about lifestyle and medical information. Height was taken by the researcher using a stadiometer, weight by using a weighing machine, and the values were then used to calculate body mass index (BMI). The third part was about dietary intake on daily basis. A semi quantitative food frequency questionnaire (FFQ) was developed for this purpose.

Development of FFQ

It consisted of all of the 90 food items mentioned by 40 undergraduate students randomly interviewed to obtain their 24 hr. recall previously. The portion sizes used for the foods in the FFQ was the amount typically mentioned by the participants in the interview. The foods were then divided into 7 groups including a grains group, vegetable group, fruit group, meat and meat alternatives group, milk and dairy products, fats, oils & sweets group, and a miscellaneous group. The FFQ were asked the participants how many times they consumed a particular food on a weekly basis (1-7 times).

Interpretation of dietary intake

The usual daily dietary intake of the students included all those foods selected more than four times a week on the FFQ. Food composition tables by the United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference were then used to determine the exact amount of calories, protein, fat, fiber, calcium, iron, sodium, vitamin C, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids, and cholesterol that one took daily according to the specific foods they ate.

Diet Quality Index–International

A DQI-I score for each student was then suggested to sum up overall diet quality which would tell us whether the students were consuming foods that were fulfilling their dietary requirements or not (5). The DQI-I index looks at four dietary components including variety, adequacy, moderation, and balance and allows us to measure diet quality through the scores (0-100), with 100 representing very good diet quality. The following is the breakdown of the DQI-I (Appendix)

The energy requirement for each student was checked using the Harris Benedict Equation to see whether it was in between 1700-2200, 2200-2700, or greater 2700 kcal. The recommended servings of fruits range from 2-4 servings, vegetables from 3-5 servings, grains from 6-11 servings, and fiber from 20-30 grams. Thus, if someone required calories in the range of 1700-2200 daily, their recommended (100%) would be the lower number of each range. For example, fruits intake would be two servings, vegetables intake would be three servings, grains intake would be six servings, and fiber intake would be 20 grams. Intake for protein would be considered adequate if one was taking more than 10% of their total calories from it. Recommended intakes of calcium is 1000 mg, for iron it is 18 mg, and 75 mg for vitamin C according to the samples age and gender.

Table 1. Variety Component of Diet Quality Index-International (5)

Component	Full Score	Points	Scoring Criteria
Variety	**0 – 20**		
Overall food group variety (meat/poultry/fish/eggs; dairy/beans; grain; fruit; vegetable)	0 – 15	15	≥ 1 serving from each food group/d
		12	Any 1 food group missing/d
		9	Any 2 food groups missing/d
		6	Any 3 food groups missing/d
		3	≥ 4 food groups missing/d
		0	None from any food group
Within-group variety from protein source (meat, poultry, fish, dairy, beans, eggs)	0 – 5	5	≥ 3 different sources/d
		3	2 different sources/d
		1	From 1 source/d
		0	None

Table 2. Adequacy Component of Diet Quality Index-International (5)

Component	Full Score	Points	Scoring Criteria
Adequacy	**0 – 40**		
Vegetable group	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Fruit group	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Grain Group	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Fiber	0 – 5	5	≥ 20 – 30 g/day > 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Protein	0 – 5	5	≥ 10 % of energy/day > 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Iron	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Calcium	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations
Vitamin C	0 – 5	5	> 100 % recommendations
		3	50–100 % recommendations
		1	< 50 % recommendations
		0	0 % recommendations

Ethical Compliance

The participants of the study were informed about the purpose of the study and their voluntary consent was taken prior to administration of the questionnaire.

Statistics Evaluation of Data: Data analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 19. Discrete variables were displayed in tables in frequency and percent while continuous variables were represented as mean ± standard deviation (SD). Effect of diet quality on academic achievement was checked through linear regression and results were considered significant if $p < 0.05$.

Results

The study carried was focused on a total of two objectives which included the assessment of overall diet quality of students and determination of the effect of diet quality on academic achievement. The sample consisted of undergraduate students of Kinnaird College for Women and the following results were seen. Demographic data of the respondents revealed that the majority (59.5%) were either 20 or 21 years old, from an urban residence (91.9%) and had married parents (90.1%). Respondent's mother educational

Table 3. Moderation Component of Diet Quality Index-International (5)

Component	Full Score	Points	Scoring Criteria
Moderation	**0 – 30**		
Total Fat	0 – 6	6	≤ 20 % of total energy/d
		3	> 20–30 % of total energy/d
		0	> 30 % of total energy/d
Saturated Fat	0 – 6	6	≤ 7 % of total energy/d
		3	> 7–10 % of total energy/d
		0	> 10 % of total energy/d
Cholesterol	0 – 6	6	≤ 300 mg/d
		3	> 300–400 mg/d
		0	> 400 mg/d
Sodium	0 – 6	6	≤ 2400 mg/d
		3	> 2400–3400 mg/d
		0	> 3400 mg/d
Empty calorie food	0 – 6	6	≤ 3 % total energy/d
		3	> 3–10 % total energy/d
		0	> 10 % total energy/d

Table 4. Balance Component of Diet Quality Index-International (5)

Component	Full Score	Points	Scoring Criteria
Overall Balance	**0 – 10**		
Macronutrient ratio (carbohydrate–protein–fat)	0 – 6	6	55–65:10–15:15–25
		4	52–68:9–16:13–27
		2	50–70:8–17:12–30
		0	Otherwise
Fatty Acid Ratio	0 – 4	4	P/S = 1–1·5; M/S = 1–1·5
		2	P/S = 0·8–1·7; M/S = 0·8–1·7

level was relatively high with the majority (45%) having completed high school and/or a bachelor's degree. Father's educational level was high with the majority (48.2%) having completed their education at a level greater than a bachelor's degree. Furthermore, most of the students were from high socioeconomic status that is their monthly household income was greater than US $500 (Tab. 5).

The results of the food frequency portion of the questionnaire revealed that the roti was the most eaten grain with a mean intake of 5.46 (±2.25) and least eaten grain was pita bread with a mean intake of 1.19 (±1.84) times per week under the bread, cereal, rice, and pasta group. Under the vegetable group, the most frequently eaten vegetables were tomatoes with a mean intake of 4.14 (±2.61) and least eaten vegetable was taro with the mean intake of .94 (±1.56) times per week. Weekly fruit choices included apple as the most consumed fruit with a mean intake of 4.16 (±2.62) and the least eaten fruit was dried plums with a mean intake of 1.40 (±2.16) times per week. Under meat, poultry, fish, dry beans, eggs, and nuts group, most commonly eaten items was chicken with a mean intake of 4.77 (±4.70) and the least eaten protein was canned tuna with a mean intake of .98 (±1.93) times per week. Within the milk, yogurt, and cheese a mean intake of 4.18 (±2.75) and the least consumed dairy product group, plain milk was consumed the most with was cheddar cheese with a mean intake of 1.77 (±2.08) times per week. It was also shown that the top four weekly choices under the fats, oils and sweets group were oil with a mean intake of 4.98 (±2.51) and the least common item was margarine with a mean intake of 1.71 (±2.36) times per week. Under the miscellaneous food options, the most frequently eaten items within a week were salt with a mean intake of 4.94 (±2.53) and the least used food item was egg roll with a mean intake of 1.44 (±2.12) times per week (Table 6).

Discussion

Researchers worldwide use GPA to measure student's academic performance (6), and this study used CGPA for the same purpose. It was found that the majority of the students had a CGPA which lied in between 3.00 and 3.33. The mean diet qual-

Table 5. Socio-Demographic Statistics of Students

Variable	Frequency	Percent
Age		
< 20 years	44	19.8
≥ 20 − ≤ 21	132	59.5
≥ 22 − ≤ 23	36	16.2
≥ 24 years	10	4.5
Place of Residence		
Rural	18	8.1
Urban	204	91.9
Parent's Marital Status		
Married	200	90.1
Single or Widowed	17	7.7
Divorced	0	0
I prefer not to answer	5	2.3
Mother's Educational Level		
≤ 10th grade	13	5.9
> 10th grade & ≤ High School	38	17.1
> High School & ≤ Bachelors	100	45.0
> Bachelors	71	32.0
Father's Educational Level		
≤ 10th grade	8	3.6
> 10th grade & ≤ High School	25	11.3
> High School & ≤ Bachelors	82	36.9
> Bachelors	107	48.2
Monthly Household Income (US Dollars)		
≤ $250	12	5.4
> $250 & ≤ $500	36	16.2
> $500	174	78.4
CGPA		
A+ (4.00)	1	.5
A (≥ 3.89 - < 4.00)	4	1.8
A- (≥ 3.67 - < 3.89)	25	11.3
B+ (≥ 3.33 - < 3.67)	63	28.4
B (≥ 3.00 - < 3.33)	82	36.9
B- (≥ 2.67 - < 3.00)	36	16.2
C+ (≥ 2.33 - < 2.67)	7	3.2
C (≥ 2.00 - < 2.33)	2	.9
C- (≥ 1.67 - < 2.00)	1	.5
D (≥ 1.33)	1	.5
BMI		
Underweight (<18.5)	46	20.7
Normal (18.5 -24.9)	156	70.3
Overweight (25-29.9)	16	7.2
Obese (>30)	4	1.8

ity index (DQI-I) score for the students was 57.27 (±9.86) out of the range 0-100. This was higher than a study of Spain which found its population to have a mean score of 56.31 (7). However both indicate a poor diet as they are below 60 (4). The variety component saw the students having a mean of 16.66 (±4.30) out of the possible range of 0-20. Under the component of adequacy in which scores can range from 0-40, the students had a mean score of 30.07 (±8.14). Scores in the next subcategory of moderation can range from 0-30 and the students had a mean of 9.55 (±8.46) here. Lastly, the mean score of .95 (±1.65) was seen under the balance subcategory out of the possible score range of 0-10 (Tab. 7). Thus, the highest percentage out of the possible total was seen in the variety component, followed by adequacy and moderation. According to the standards of DQI-I, it was balance that was the weakest area of their diets. Similar results that concluded the poorest scores in balance subcategory were found on a study done on a Mediterranean population as well (8).

The effect of diet quality on academic achievement (CGPA) was found then by linear regression. There was a significant effect (p<.05) of diet on academic achievement and the value of regression coefficient (b=.006) showed that there is a positive effect on academic achievement (Tab. 8). Linear regression also was used to determine the effect of different components of diet quality on CGPA. The results of that test showed that there is significant effect (p<.05) of the variety component diet on academic achievement and the value of regression coefficient (b=.026) shows that there is positive effect (Table 8). Previous research has also highlighted variety as one the components showing the most significant association with academic performance (9).

The results also demonstrated that there is significant effect (p<.05) of the moderation component diet on academic achievement and the value of regression coefficient (b=.012) shows that there is a positive effect (Tab. 8). The term moderation is used to restrict intake of some nutrients which would be harmful in excess in the diet (8). Specifically, the moderation component of the DQI-I restricted the percentage of total calories from fat and saturated fat, cholesterol and sodium, as well as consumption of empty calorie foods like cakes, sodas, and ice-cream. Results of the study showed that

Table 6. Mean weekly intake of all food groups

Variable	Mean	Standard Deviation
n=222		
Cereal and Grain Group		
Bread (1 slice)	4.69	2.44
Breakfast Cereal (1 cup)	1.77	2.19
Naan (1 whole)	1.91	2.01
Oats (½ cup)	1.19	2.00
Paratha (1 whole)	2.28	2.48
Pasta (½ cup)	2.01	1.84
Pita Bread (1 whole)	1.19	1.84
Roti (1 whole)	5.46	2.25
Saltine Crackers (7 small)	1.53	2.12
White Rice (1 cup)	3.91	2.35
Whole Wheat Crackers (5small)	1.45	2.18
Vegetable Group		
Bell Peppers (1cup raw or ½ cup cooked)	1.26	1.64
Bitter Gourd (½ cup cooked)	.95	1.56
Cabbage (1 cup raw or ½ cup cooked)	2.32	2.12
Carrots (1 cup raw or ½ cup cooked)	2.71	2.26
Cauliflower (½ cup cooked)	1.81	1.95
Corn (1 ear)	2.34	2.37
Cucumbers (1 cup)	3.05	2.47
Egg Plant (½ cup cooked)	1.29	1.84
Mushrooms (½ cup cooked)	1.25	1.97
Okra (½ cup cooked)	1.14	1.79
Onions (½ cup cooked)	4.05	2.57
Peas (½ cup cooked)	2.26	2.04
Potatoes (½ cup cooked)	3.19	2.21
Spinach (½ cup cooked)	1.99	2.02
Squash (½ cup cooked)	1.23	1.85
Sweet Potatoes (½ cup)	1.63	2.17
Taro (½ cup cooked)	.94	1.56
Tomatoes (1 cup raw or ½ cup cooked)	4.14	2.61
Fruit Group		
Apple (1 medium)	4.16	2.62
Banana (1 small)	3.79	2.64
Grapes (17 whole)	2.59	2.35
Guava (1 medium)	2.69	2.47
Orange (1 medium)	3.64	2.66
Pear (1 medium)	2.05	2.30
Pomegranate (½ cup)	3.12	2.51
Apple Juice (1 cup)	2.56	5.60
Grape Juice (1 cup)	1.49	2.11
Mango Juice (1 cup)	2.23	2.53
Orange Juice (1 cup)	2.91	2.67
Apricots, Dried (¼ cup)	1.65	2.31
Dates (3 whole)	2.14	2.32
Plums, Dried (3 whole)	1.40	2.16
Raisins (¼ cup)	1.41	2.15

(Continued)

Table 6 *(continued)*. Mean weekly intake of all food groups

Meat, Poultry, Fish, Dry Beans, Eggs & Nuts Group

Beef (1 piece / 3 oz.)	1.61	2.03
Beef Sausage (1 piece)	1.07	2.01
Canned Tuna (3 oz.)	.98	1.93
Chicken (1 piece / 3 oz.)	4.77	4.70
Chicken Frankfurter (1 piece)	2.00	2.50
Egg (1 whole)	4.05	2.50
Fish (3 oz.)	2.35	2.09
Ground Beef (3 oz.)	1.28	2.10
Mutton (1 piece / 3 oz.)	2.50	2.29
Chickpeas (½ cup cooked)	1.54	1.85
Kidney Beans (½ cup cooked)	1.36	1.98
Lentils (½ cup cooked)	1.94	2.03
Almonds (6 whole)	3.22	2.65
Cashews (1 oz.)	2.32	2.51
Peanuts (10 whole)	2.83	2.35
Walnuts (1 oz.)	2.36	2.38

Milk, Yogurt, & Cheese Group

Buttermilk (1 cup)	1.85	2.61
Cheddar Cheese (1½ oz.)	1.77	2.08
Chocolate Milk (1 cup)	2.46	2.70
Frozen Yogurt (1 cup)	2.17	2.40
Ice Cream Vanilla (1 cup)	2.36	2.38
Mozzarella Cheese (1½ oz.)	1.89	2.30
Plain Milk (1 cup)	4.18	2.75
Yogurt (1 cup)	3.64	2.64

Fats, Oils & Sweets Group

Butter (1 tbsp.)	2.47	2.45
Jam (1 tbsp.)	2.03	2.52
Margarine (1 tbsp.)	1.71	2.36
Mayonnaise (1 tbsp.)	2.80	2.50
Oil (1 tbsp.)	4.98	2.51
Salad dressing (1 tbsp.)	3.00	2.93
Sugar (1 tsp.)	4.78	2.57

Miscellaneous Group

Brownie (2" square)	1.79	1.93
Chocolate (1 bar.)	3.02	2.58
Chocolate Cake Piece (1/8 of 18 oz. cake)	2.28	2.32
Cola (12 fl. oz.)	3.09	2.73
Custard (½ cup)	1.73	2.12
Egg Roll (1)	1.44	2.12
French Fries, Small (71 g)	3.09	2.42
Honey (1 tbsp.)	2.33	2.64
Ketchup (1 tbsp.)	3.31	2.48
Pizza (1 Slice)	2.26	2.09
Popcorn (1 cup)	1.95	2.25
Potato Chips (1 bag)	3.45	2.60
Salt (1 tsp.)	4.94	2.53
Soy Sauce (1 tbsp.)	2.44	2.45
Sprite (12 fl. oz.)	2.65	2.56

Table 7. Diet Quality Index-International (DQI-I) scores and Components

Component	Score Range	Mean	SD
n=222			
DQI-I, total	0-100	57.27	9.86
Variety	0-20	16.66	4.30
Overall food group variety	0-15	12.84	2.91
Within-group variety for protein sources	0-5	3.82	1.76
Adequacy	0-40	30.07	8.14
Vegetable group	0-5	3.52	1.97
Fruit group	0-5	4.01	1.72
Grain group	0-5	2.83	1.37
Fiber	0-5	4.01	1.40
Protein	0-5	4.73	.80
Iron	0-5	3.45	1.64
Calcium	0-5	3.45	1.67
Vitamin C	0-5	4.06	1.54
Moderation	0-30	9.55	8.46
Total fat	0-6	1.14	1.89
Saturated fat	0-6	2.11	2.44
Cholesterol	0-6	3.08	2.79
Sodium	0-6	1.92	2.53
Empty calorie foods	0-6	1.31	2.32
Overall Balance	0-10	.95	1.65
Macronutrient ratio	0-6	.48	1.19
Fatty acid ratio	0-4	.47	1.12

There are 4 components of DQI-I3

1. Variety means that all food groups were being taken and there were several protein sources.

2. Adequacy means that appropriate servings of the fruit, vegetable, grains were being consumed and fiber intake was greater than 20 grams. Intake for protein would be considered adequate if one was taking more than 10% of their total calories from it. Recommended intakes of calcium is 1000 mg, for iron it is 18 mg, and 75 mg for vitamin C according to the samples age and gender.

3. Moderation means that fat intake was below 30% of total energy, saturated fat was less than 10%, cholesterol was less than 300 mg, sodium less than 3400 mg, and empty calorie food comprised less than 10% of total kcals.

4. Overall Balance means that the macronutrient ratio (carbohydrate-protein-fat) and fatty acid ration (poly-saturated, mono-saturated and saturated) was appropriate.

Table 8. Effect of Total Diet Quality and DQI-I Components on Academic Achievement (CGPA)

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Diet Quality Score	.006	.003	.140	2.099	.037*
Variety Score	.026	.010	.282	2.621	.009*
Adequacy Score	-.002	.005	-.046	-.454	.650
Moderation Score	.012	.004	.266	3.000	.003*
Balance Score	-.014	.016	-.057	-.831	.407

*$p < .05$

the variety and moderation component score had a significant effect on academic achievement (CGPAs).

Conclusions

Students should take appropriate diets which fulfill all their nutrient requirements. They should consume a variety of foods and meet minimum servings from all of the food groups. Students should also follow the guideline of moderation when it comes to fat intake. Such changes in their diet may improve their academic results.

References

1. Bellisle F. Effects of diet on behaviour and cognition in children. Br J Nutr 2004;92:227-232.
2. Erikson, J. Brain food: the real dish on nutrition and brain function. WisKids Journal 2006;25(5).
3. Aziz S, Umm-e-Rubab NW, Majid R, Hosain K, Siddiqui IA, Manzoor S. Dietary pattern, height, weight centile and BMI of affluent school children and adolescents from three major cities of Pakistan. J Coll Physicians Surg Pak. 2010 Jan 1;20(1):10-6.
4. Saeed Y, Shoaib M, Ashfaq K. Youth's Future and Prospects: Examining Awareness about Professional Field among Educated Youth of Gujrat, Pakistan. Middle East J Sci Res 2012;11:833–839.
5. Kim S, Haines PS, Siega-Riz AM, Popkin BM. The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. J Nutr 2003;133:3476-3484.
6. Chapell MS, Blanding ZB, Silverstein ME, Takahashi M, Newman B, Gubi A, McCann N. Test anxiety and academic performance in undergraduate and graduate students. J Educ Psychol 2005;97:268-274.
7. Mariscal-Arcas M, Romaguera D, Rivas A, Feriche B, Pons A, Tur JA, Olea-Serrano F. Diet quality of young people in southern Spain evaluated by a Mediterranean adaptation of the Diet Quality Index-International (DQI-I). Br J Nutr 2007;98:1267-1273.
8. Tur JA, Romaguera D, Pons A. The Diet Quality Index-International (DQI-I): is it a useful tool to evaluate the quality of the Mediterranean diet?. Br J Nutr 2005;93:369-376.
9. Florence MD, Asbridge M, Veugelers PJ. Diet quality and academic performance. J Sch Health 2008;78:209-215.

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