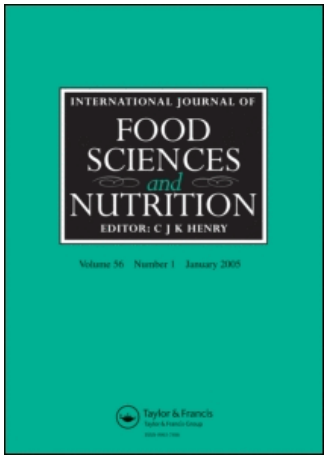

International Journal of Food Sciences and Nutrition
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713425816

Validation of a questionnaire assessing food frequency and nutritional intake in Greek adolescents

Sousana K. Papadopoulou [ab]; Vassilis Barboukis [a]; Anastasios Dalkiranis [a]; Maria Hassapidou [b]; Anatoli Petridou [a]; Vassilis Mougios [a]
[a] Department of Physical Education and Sport Science, Aristotle University of Thessaloniki, Greece
[b] Department of Nutrition and Dietetics, Technological Educational Institution of Thessaloniki, Thessaloniki, Greece

First Published on: 30 November 2007
To cite this Article: Papadopoulou, Sousana K., Barboukis, Vassilis, Dalkiranis, Anastasios, Hassapidou, Maria, Petridou, Anatoli and Mougios, Vassilis (2007) 'Validation of a questionnaire assessing food frequency and nutritional intake in Greek adolescents', International Journal of Food Sciences and Nutrition, 59:2, 148 - 154
To link to this article: DOI: 10.1080/09637480701530004
URL: http://dx.doi.org/10.1080/09637480701530004

International Journal of Food Sciences and Nutrition,
March 2008; 59(2): 148–154

informa
healthcare

Validation of a questionnaire assessing food frequency and nutritional intake in Greek adolescents

SOUSANA K. PAPADOPOULOU[1,2], VASSILIS BARBOUKIS[1], ANASTASIOS DALKIRANIS[1], MARIA HASSAPIDOU[2], ANATOLI PETRIDOU[1] & VASSILIS MOUGIOS[1]

[1]*Department of Physical Education and Sport Science, Aristotle University of Thessaloniki, Greece and* [2]*Department of Nutrition and Dietetics, Technological Educational Institution of Thessaloniki, Thessaloniki, Greece*

Abstract
The aim of the study was to develop and validate a specific semi-quantitative food frequency questionnaire to assess nutritional intake of Greek adolescents. The sample of the study consisted of 250 pupils (15.3 ± 0.7 years), who completed the Youth Adolescent Food Frequency Questionnaire enriched with 22 Greek foods and recipes to include ethnic and racial diversity. A 3-day weighed food recall was used as the criterion to test the validity of the questionnaire. The analysis of correlation revealed significant correlations between the two methods for almost all variables. The Pearson's coefficients ranged from 0.83 for energy intake to 0.34 for folate intake. Non-significant correlations were found for selenium and vitamin D intakes. The findings of the study provide evidence for the validity of the scale and its utility in assessing nutritional intake of Greek adolescents.

Keywords: *Food frequency, nutritional intake, adolescence*

Introduction

The development and application of assessment tools is of high priority for research on health promotion and the development of intervention strategies. Improper nutrition has been categorized among the behaviors that lead to severe health disturbances (Rimm et al. 1993; Thorogood et al. 1994). Healthy nutrition habits are essential to be established during the first two decades of life in order to avoid the development of many chronic diseases (cardiovascular disease, diabetes mellitus, certain forms of cancer, osteoporosis) (Splett and Story 1991).

Measurement of nutrient intake seems to be one of the most controversial issues in nutritional epidemiology. Food frequency questionnaires and 24-h dietary recalls are practical tools for habitual alimentary investigation (Schroder et al. 2001). Food frequency questionnaires estimate the usual food consumption while 24-h dietary recalls cannot assess precisely the day-to-day variation in food choices (Briefel et al. 1992).

Correspondence: Maria Hassapidou, Department of Nutrition and Dietetics, Technological Educational Institution of Thessaloniki, PO Box 14561, Thessaloniki 54101, Greece. Tel: 30 2310791386. Fax: 30 2310791386. Email: mhas@nutr.teithe.gr

ISSN 0963-7486 print/ISSN 1465-3478 online
DOI: 10.1080/09637480701530004

Teufel (1997) argued that food frequency questionnaires could record eating behaviors that may influence long-term health outcomes. In order to be appropriate for epidemiological studies, a food frequency questionnaire should contain a complete list of the foods that are consumed by the population under study (Mayer-Davis et al. 1998). This is extremely important as differences in food choices exist due to different ethnicity and age (Borrud et al. 1989; Rockett et al. 1995; Teufel 1997).

Only limited data are so far available regarding the nutritional habits of adolescents (Rockett et al. 1997; Teufel 1997; Jonsson et al. 1998) and, to the best of our knowledge, there is no food frequency questionnaire regarding Greek adolescents. Thus, the objective of this study was the development and validation of a specific semi-quantitative food frequency questionnaire, the Greek Adolescent's Food Frequency Questionnaire (GAFFQ), to assess and evaluate nutritional intake of Greek adolescents.

Materials and methods

Subjects

The sample consisted of 250 pupils (120 males and 130 females) with a mean age of 15.3 years (standard deviation, ± 0.7). The students were recruited from two high schools (12 classes of 20–25 students each) in a city of Northern Greece. Permission was granted from the Ministry of Education. The school directors were informed about the purposes of the study and permitted the administration of the questionnaires.

Instruments

Greek Adolescent's Food Frequency Questionnaire. The GAFFQ consisted of 108 food items. The questionnaire included the foods listed in the Youth Adolescent Food Frequency Questionnaire (Rockett and Colditz 1995, 1997; Rockett et al. 1997) enriched with 22 Greek foods and recipes. The Questionnaire contained 12 food categories (cereal and cereal products; milk and milk products; eggs; fats and oils; meat and meat products; fish and fish products; vegetables; fruits; nuts; sugar and snacks; refreshments; and alcohol drinks). The Greek foods and dishes added were: Greek yogurt (yogurt made up with sheep and cow's milk and fat), rysogalo (made up with boiled cow's milk and rice), feta (white cheese made up with sheep and cow's milk), feta light (feta with reduced fat), cheese pie, spinach pie, fried mussels, baked mussels with pepper and tomatoes, baked octopus, scrapples (fried rolls made up with minced meat), Greek bread roll (bread roll with sesame), lentil soup, baked beans, boiled peas, pastitsio (spaghetti with minced meat, cheese and white sauce), briam (baked eggplants and zucchinis), fried eggplants and zucchinis, gemista (green peppers filled with rice), spinach rice (boiled spinach and rice with onions), okras, Greek pastries (baklava, etc.) and Greek coffee (ground coffee boiled with water). Each food was accompanied by the appropriate, according to the Greek Ministry of Health, serving portion. The pupils of the sample were asked to report how many times they had consumed these foods during the previous week. The responses were given on a one to seven times per week scale, while the students had the possibility to indicate more frequent consumption (>7 times per week) in a blank column.

Table I. Weekly food intakes (serving-size units) of Greek adolescents.

Food	Mean	Standard deviation	Food	Mean	Standard deviation
Whole milk	8.10	6.76	Boiled rice	1.40	1.69
Skimmed milk	0.926	2.75	Fried chips	2.52	1.91
Flavored milk	2.20	3.27	Baked chips	1.34	1.27
Whole milk yogurt	1.60	2.33	Boiled potatoes	0.81	1.23
Low-fat yogurt	0.582	1.49	Pastitsio	0.95	1.04
Greek yogurt	0.557	1.33	Briam	0.49	0.89
Yogurt with fruits	1.11	2.10	Fried eggplants and zucchinis	0.56	0.98
Rysogalo	0.90	1.53	Gemista	0.90	1.16
Milk pudding	0.52	1.22	Spinach-rice	0.76	.99
Chocolate pudding	0.56	1.36	Boiled okras	0.51	1.07
Feta	5.35	4.60	Boiled chicory (salad)	1.32	1.84
Feta light	0.45	1.53	Boiled beetroots (salad)	0.75	1.29
Cheese cheddar	3.03	3.14	Boiled cabbage (salad)	0.57	1.09
Cheese cheddar light	0.41	1.73	Raw cabbage (salad)	1.32	1.74
Cheese gouda	1.74	3.02	Tomatoes and cucumbers (salad)	3.27	2.56
Cheese pie	1.97	2.43	Pears	2.08	2.58
Spinach pie	0.99	1.40	Apples	3.04	2.48
Pizza	1.77	1.71	Oranges	3.40	4.25
Boiled eggs	1.55	1.68	Bananas	2.52	2.49
Fried eggs	1.33	1.49	Compote	0.98	1.74
Roasted beef	1.60	1.32	Fruit juices	3.74	3.60
Roasted lamb	0.58	0.98	Sweetened fruit juices	1.87	2.54
Roasted pork	1.31	1.38	Sugar	3.41	4.71
Fried liver	0.71	1.10	Honey	2.10	3.08
Roasted chicken	1.57	1.28	Marmalade	1.53	2.37
Baked fish	1.25	1.24	Marmalade light	0.39	1.28
Fried fish	0.94	1.11	Chocolate nut spread	2.34	4.32
Fried mussels	0.40	0.87	Cake mix	1.52	1.76
Baked mussels	0.42	0.95	Croissants	1.62	1.89
Baked octopus	0.55	0.94	Biscuits	1.53	2.48
Scrapples	1.39	2.21	Greek pasties	1.72	2.40
Hamburger	0.99	1.12	Ice cream (cream and chocolate)	3.81	3.64
Minced meat	0.68	1.02	Light ice cream	1.05	2.55
Sausage	1.20	1.54	Corn snacks	1.20	1.84
Ham	1.66	2.38	Potato crisps	1.46	1.85
Salami	1.64	2.53	Chocolate plain	1.96	2.00
Bacon	1.05	1.77	Chocolate confectionery	1.55	2.14
Smoked turkey fillet	0.76	1.53	Cola beverages	3.33	4.51
Vegetable soup	1.31	1.40	Cola light	1.04	2.34
Butter	2.23	2.94	Orange drink carbonated	1.65	2.29

Table I (*Continued*)

Food	Mean	Standard deviation	Food	Mean	Standard deviation
Soft margarine	1.25	2.25	Orange drink non-carbonated	1.89	2.75
Olive oil	4.80	5.55	Lemonade	1.09	1.91
Vegetable oil	1.34	2.46	Sprite	1.01	2.01
Mayonnaise	1.03	1.72	Soda	0.75	1.73
Mayonnaise light	0.50	1.91	Cocoa powder	2.53	4.27
Nuts	2.18	3.11	Greek coffee	0.53	1.47
White bread	7.95	7.56	Coffee instant	1.49	2.67
Wholemeal bread	1.19	2.63	Coffee infusion	0.61	1.33
Greek bread roll	1.47	1.81	Tea	1.22	1.98
Breakfast cereals	2.05	2.74	Beer	0.91	1.64
Lentil soup	1.10	1.22	Wine	0.53	1.15
Baked beans	0.96	0.99	Spirits (40% alcohol)	0.46	1.20
Boiled peas	0.82	1.11	Snaps	0.43	1.90
Spaghetti	1.92	1.54	Water	22.71	15.48

Three-day weighed food recall. The students were asked to weigh the foods they were going to consume on three specific days of the week (two weekdays and one weekend-day) and then describe them in detail. The 3-day weighed food recall is considered the golden standards in evaluating the nutrient scores of food frequency questionnaires (Willet 1990). Hence, it was used to test the construct validity of the GAFFQ.

Procedure

Written consent was obtained from the pupils to participate in the study. The pupils of the sample were first given the 3-day weighed food recalls and instructed on how to complete them, using analog kitchen scales. One week later the 3-day weighed food recalls were collected. At the same time, the GAFFQ was distributed to the students. The questionnaires were completed during regular class hours. The first author supervised the administration of the questionnaire. Both oral and written instructions were given to the pupils to avoid misconceptions and secure confidentiality. Dietary records were analyzed for energy, macronutrients, and micronutrients in Microsoft Access by the use of a food database developed in our laboratory on the basis of McCance and Widdowson's food tables (Holland et al. 1995) and Trichopoulou's (1992) food tables.

Results

Weekly food intakes expressed as serving-size units of the foods included in the GAFFQ are presented in Table I. Nutrient intakes based on the 3-day recall and the GAFFQ are presented in Table II.

The validity of the GAFFQ was assessed by examining its correlation with the 3-day weighted food records. We found significant correlations between the two questionnaires for almost all variables (Table III). Non-significant correlations were found

Table II. Daily nutrient intakes based on the 3-day recall and the GAFFQ.

	3-day recall		GAFFQ	
	Mean	Standard deviation	Mean	Standard deviation
Energy (kcal)	2,516.36	807.96	2,661.98	958.35
Protein (g)	101.02	33.59	105.16	36.65
Fat (g)	123.63	51.60	131.57	49.34
Carbohydrate (g)	257.45	62.61	275.09	107.56
Saturated fat (g)	42.66	12.94	45.65	16.27
Monounsaturated fat (g)	49.85	13.97	53.99	20.54
Polyunsaturated fat (g)	12.74	4.05	13.78	5.02
Cholesterol (mg)	402.71	123.21	449.48	203.04
Vitamin E (mg)	7.41	1.44	8.68	5.39
Vitamin C (mg)	137.15	49.38	152.61	79.64
Iron (mg)	13.94	4.38	15.13	6.79
Vitamin A (μg)	4,150.16	2,259.67	5,865.25	6,827.92
Vitamin D (μg)	1.08	0.45	1.40	1.11
Vitamin B_1 (mg)	3.66	0.49	4.67	3.85
Vitamin B_2 (mg)	2.46	0.83	2.87	1.29
Vitamin B_6 (mg)	1.96	0.71	2.13	0.95
Niacin (mg)	20.65	6.84	22.71	10.55
Vitamin B_{12} (μg)	12.96	8.02	16.85	16.83
Folate (μg)	249.54	138.88	292.80	135.16
Sodium (mg)	2,775.83	1,494.75	3,013.68	1,444.06
Potassium (mg)	3,740.67	1,000.09	3,985.38	1,574.31
Calcium (mg)	1,412.60	485.10	1,520.50	637.68
Magnesium (mg)	333.96	71.98	362.53	145.20
Phosphorus (mg)	1,740.62	494.19	1,865.52	725.09
Zinc (mg)	17.43	4.64	21.22	15.37
Selenium (μg)	28.82	17.62	34.25	15.47
Iodine (μg)	144.39	36.76	164.00	82.29
Fiber (g)	17.70	7.85	19.76	9.05

for selenium and vitamin D. The Pearson's coefficients ranged from 0.83 for energy intake to 0.34 for folate intake.

The effect size was calculated in order to examine the effect of the sample size. The effect size scores were calculated according to Cohen (1988). Scores lower than 0.40 indicate low effects of sample size, scores between 0.41 and 0.70 medium effects, and scores above 0.70 high effects. The results of the analysis indicated that, with the exception of vitamin A, sodium, potassium, calcium, and phosphorus that exhibited high scores, the effect size scores were below 0.40 for the variables of the study.

Discussion

The aim of the present study was to examine the validity of the GAFFQ, a questionnaire developed to assess the frequency of food consumption, and the energy and macronutrient and micronutrient intake of Greek adolescents. The 3-day dietary record was used as the criterion of the validity of the questionnaire. The analysis of correlation was used to test the consistency between the two methods. The Pearson's coefficients indicated moderate to high correlation between the nutrient intakes of the two questionnaires. Similar correlations have been reported in the literature describing

Table III. Pearson correlation coefficients between the 3-day recall and the GAFFQ.

Variable	*r*	Variable	*r*
Energy	0.83	Vitamin B_2	0.64
Protein	0.77	Vitamin B_6	0.72
Fat	0.78	Niacin	0.69
Carbohydrate	0.76	Vitamin B_{12}	0.49
Saturated fat	0.70	Folate	0.34
Monounsaturated fat	0.64	Sodium	0.72
Polyunsaturated fat	0.66	Potassium	0.75
Cholesterol	0.43	Calcium	0.76
Vitamin E	0.52	Magnesium	0.74
Vitamin C	0.66	Phosphorus	0.77
Iron	0.71	Zinc	0.53
Vitamin A	0.45	Selenium	Not significant
Vitamin D	Not significant	Iodine	0.42
Vitamin B_1	43	Fiber	0.61

Note: $P < 0.01$ for all *r* values reported.

the development of food frequency questionnaires in the same age group (Rockett et al. 1997).

According to the results of the present study, the GAFFQ provides valid information about food intake, useful especially in epidemiological studies. Furthermore, our findings support the proposal of Rockett et al. (1997) that food frequency questionnaires can sufficiently measure nutrient intakes of adolescents. Clearly, more studies with larger samples examining adolescents from different parts of Greece are needed to verify the validity of the questionnaire and support its use for the assessment of Greek adolescents' dietary intakes.

References

Borrud LG, McPherson RS, Nichaman MZ, Pillow PC, Newell GR. 1989. Development of a food frequency instrument: Ethnic differences in food sources. Nutr Cancer 12:201–211.

Briefel RR, Flegal KM, Winn DM, Loria CM, Johnson CL, Tempos CT. 1992. Assessing the nation's diet: Limitations of the food frequency questionnaire. J Am Diet Assoc 92:959–962.

Cohen J. 1988. Statistical power analysis for the behavioral sciences. 2nd edn. Hillsdale, NJ: Erlbaum.

Holland B, Welch AA, Unwin ID, Buss DH, Paul AA, Southgate DAT. 1995. McCance and Widdowson's 'The Composition of Foods'. Cambridge: Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Food.

Jonsson I, Gummeson L, Conner M, Svensson E. 1998. Assessing food choice in school children: Reliability and construct validity of a method stacking food photographs. Appetite 30:25–37.

Mayer-Davis EJ, Vitolins MZ, Carmichael SL, Hemphill S, Tsaroucha G, Rushing J, Levin S. 1998. Validity and reproducibility of a food frequency interview in a multi-cultural epidemiologicic study. Ann Epidemiol 9:314–324.

Rimm EB, Stampfer MJ, Ascherio A, Giovannucci E, Colditz GA, Willet WC. 1993. Vitamin E consumption and the risk of coronary heart disease in men. N Engl J Med 328:1445–1456.

Rockett HR, Colditz GA. 1997. New developments in assessing diets of children and adolescents. Am J Clin Nutr 65:1116S–1122S.

Rockett HR, Wolf AM, Colditz GA. 1995. Development and reproducibility of a food frequency questionnaire to assess diets of older children and adolescents. J Am Diet Assoc 95:336–340.

Rockett HR, Breitenbach M, Frazier L, Witschi J, Wolf AM, Field AE, Colditz GA. 1997. Validation of a youth/adolescent food frequency questionnaire. Prev Med 26:808–816.

Schroder H, Covas MI, Marrugat J, Vila J, Pena A, Alcantara M, Masia R. 2001. Use of a three-day estimated food record, a 72-hour recall and a food frequency questionnaire for dietary assessment in a Mediterranean Spanish population. Clin Nutr 20:429–437.

Splett P, Story M. 1991. Child nutrition: Objectives for the decade. J Am Diet Assoc 91:665–668.
Teufel NI. 1997. Development of culturally competent food-frequency questionnaires. Am J Clin Nutr 65:1173S–1178S.
Thorogood M, Mann J, Appleby P, McPherson K. 1994. Risk of death from cancer and ischaemic heart disease in meat and non-meat eaters. BMJ 308:1667–1671.
Trichopoulou A. 1992. Tables of food composition and Greek plates. Athens: Trichopoulou.
Willet WC. 1990. Nutritional epidemiology. New York: Oxford University Press.

This paper was first published online on iFirst on 30 November 2007.