

Disparities in food habits across Europe

Antonia Trichopoulou*, Androniki Naska and Tina Costacou, on behalf of the
DAFNE III Group†

Department of Hygiene and Epidemiology, Medical School, University of Athens, 75 Mikras
Asias Str, Athens 115 27, Greece

Socially-and culturally-patterned differences in food habits exist both between and within European populations. Daily individual food availability data, collected through the national household budget surveys (HBS) and harmonized in the context of the Data Food Networking (DAFNE) project, were used to assess disparities in food habits of seven European populations and to evaluate dietary changes within a 10-year interval. The availability of selected food items was further estimated according to the educational level of the household head and, based only on the Greek HBS data, according to quintiles of the household's food purchasing capacity. Results for overall food availability support the north–south differentiation in food habits. Generally, the availability of most food items, including foods such as vegetable fats, animal lipids and sugar products, has decreased over the 10 years. Households in which the head was in the higher education categories reported lower availability for most food items, with the exception of low-fat milk, fresh fruit, animal lipids and soft drinks; the latter showing a sharp increase even within southern European households. The household's food purchasing capacity can be used as an indicator of socio-economic status, with higher values being associated with lower status. Greek households of lower social class follow a healthier diet in terms of greater availability of vegetable oils, fresh vegetables, legumes, fish and seafood. Data from the DAFNE databank may serve as a tool for identifying and quantifying variation in food habits in Europe, as well as for providing information on the socio-economic determinants of food preferences.

Diet: Socio-economic food disparities: European household budget surveys: DAFNE

There are disparities in dietary habits between and within European populations, resulting mostly from their different cultural norms. The dietary choices of the population subgroups may also be related to socio-economic differences (Hulshof *et al.* 1991; Smith & Baghurst, 1992; Roos *et al.* 1996; Johansson *et al.* 1999; Dowler, 2001; Roos *et al.* 2001; Irala-Estevez *et al.* 2000), which have been reported to be implicated in the clustered patterns of disease observed among the less privileged of the European societies (Davey Smith & Brunner, 1997). The inadequate diet of the low socio-economic groups, in combination with other poor lifestyle choices (e.g. smoking, limited physical activity), is listed among the risk factors that may partially explain the observed outcome. Individuals in lower social classes have been reported to consume more lipids (with a higher intake of saturated fatty acids), potatoes, cereals, refined sugar and preserves, milk (with a lower consumption of semi-skimmed and skimmed milk), meat

and meat products. Individuals in higher social classes, on the other hand, have been reported to consume more vegetables, fruit and cheese, but less milk, bread and butter, and they also appear to have a higher alcohol intake, when compared with their lower social class counterparts (Hulshof *et al.* 1991; Smith & Baghurst, 1992; Roos *et al.* 1996; Johansson *et al.* 1999; Roos *et al.* 2001; Irala-Estevez *et al.* 2000).

Socio-economic differences in eating practices are often studied in terms of the level of education achieved. Education has been reported to be the strongest and most consistent indicator in assessing socio-economic differentials (Liberatos *et al.* 1988). Education expresses not only the individual's attainment and years of schooling, but it might also reflect occupation, income and, even more importantly when it comes to healthy dietary practice, the way an individual perceives and applies current nutritional information (Johansson *et al.* 1999).

Abbreviations: DAFNE, Data Food Networking; HBS, household budget survey.

***Corresponding author:** Professor Antonia Trichopoulou, fax +30 10 746 2079, email antonia@nut.uoa.gr

†The Data Food Networking (DAFNE) III Group: Greece (University of Athens; coordinating center): A. Trichopoulou, A. Naska, A. Antoniou, H. Economou; Belgium (University of Ghent): A. M. Remaut, A. P. Cueto Eulert; Italy (National Research Institute for Food and Nutrition): A. Turrini, S. Barcherini, S. Martines; Norway (University of Oslo): K. Trygg, E. Mork, K. Lund-Iversen; Portugal (University of Porto): M. D. Vaz de Almeida, S. Rodrigues; Republic of Ireland (University College, Galway): S. Friel, J. Dalton; UK (King's College, London): M. Nelson, D. Rimmer, S. Burr.

Another indicator commonly used as a proxy for the household's income is the food purchasing capacity of the household, often expressed as the proportion of the household's expenses that refer to food purchases. High values of this proportion have been shown to indicate low socio-economic class or small income (James *et al.* 1997). The household's food purchasing capacity has also been recognized as a measure of food security within households, since those households with a high proportion of food expenses are more vulnerable when an unexpected event (e.g. job loss, natural disaster) limits the financial capacity (Maxwell & Frankenberger, 1992).

The aim of the present paper is to present disparities in the food habits of nationally-representative samples of seven European populations, covering northern, central and southern European regions, and to assess changes in their dietary choices within a 10-year interval. To evaluate inequalities in nutrition within European populations, the availability of selected food items at a household level is presented according to the educational level of the head of the household. Complementary to the level of education, the paper aims to appraise the information on dietary disparities according to socio-economic status, by examining food availability in relation to the household's food purchasing capacity.

Materials and methods

Daily individual food availability was estimated using data collected in the context of the national household budget surveys (HBS). These surveys are periodically undertaken, using nationally-representative samples of households, with the intention of collecting data that includes food availability, taking into consideration the households' purchases together with contributions from own production and food items received as gifts (Trichopoulou, 1992). The information also includes socio-economic characteristics of the households, thus allowing cross-links between food availability and socio-economic and demographic data.

The harmonization of the food and related HBS data from fourteen European countries has been undertaken in the context of the EU-funded Data Food Networking (DAFNE) project (Trichopoulou & Naska, 2001). The process of harmonization included the establishment of operational criteria for the classification of foods and socio-economic variables, iterative cross-coding, as well as several working group meetings and bilateral visits to address specific problems. The DAFNE databank currently comprises forty-nine datasets from fourteen European countries, covering different European regions and time periods. From the information available in the DAFNE databank, food availability data collected within approximately a 10-year interval in seven European countries (Belgium, Greece, Italy, Norway, Portugal, the Republic of Ireland and the UK) are presented. Data, harmonized between countries, are presented for fourteen food items and groups previously reported to disclose information on socio-economic disparities (Hulshof *et al.* 1991; Smith & Baghurst, 1992; Roos *et al.* 1996; Johansson *et al.* 1999; Irala-Estevéz *et al.* 2000). Individual availability was estimated without making allowances for the proportion that was edible, and under the

assumption that there was equal distribution of food within the household and during the survey period.

To allow comparisons between countries, level of education was classified as: illiterate or elementary education incomplete; elementary education completed; secondary education incomplete; secondary education completed; college or university). However, information about education was not routinely collected in the Republic of Ireland and the UK, and the coding system used in the recent Belgian survey did not allow classification into the five groups. Furthermore, only ten Norwegian households were classified as 'illiterate or elementary education incomplete', and were thus not considered in the analysis.

The household's food purchasing capacity was expressed as the household's expenditure for food: the total household expenses, without deducting standard housing costs. This ratio was shown to be inversely related to household income (data not shown). To understand how the food expenditure ratio is related to the household's dietary behaviour, data from the Greek 1998–9 HBS were studied and presented for the fourteen food items mentioned earlier.

Statistical analysis

Analyses were conducted separately for each of the participating European countries. Descriptive analyses were performed to describe the study populations, and means with their standard errors and other basic descriptive statistics were calculated to depict the nutritional habits of European households for each country. Univariate ANOVA was employed to relate the availability of selected food items within the household to the educational level of the head of the household for each country, and to quintiles of the food expenditure ratio only for Greece.

Results

Table 1 presents mean availability for selected food items according to European region and year of survey. Focusing on comparisons across countries, it is clear that southern European populations generally consumed greater amounts of cereals, fish and seafood (although Norwegian households also reported high fish and seafood consumption), fresh fruit and vegetables, legumes and vegetable oils, with olive oil being the lipid of preference (data not shown), compared with the rest of Europe. However, the availability of vegetable fats (mainly margarine), animal lipids and soft drinks was higher in northern and central European regions. Although Irish households reported high milk availability, the consumption of low-fat milk was less prevalent when the Republic of Ireland was compared with the other northern and central European countries.

Meat availability showed a decline across most European countries, with the exception of the Republic of Ireland, Portugal and Norway (with only a small increase in Norway). In general, milk availability also seemed to be declining, whereas intake of low-fat milk was on the rise among northern and central European regions. Consumption of sugar products appeared to be either stable or on the decline, whereas an increase in intake of soft drinks was noted across all populations studied.

Table 1. Mean availability (g or ml/person per d) of selected food items by country and year (data from the Data Food Networking (DAFNE) database*)

Foods	BE		GR		IRL		IT		NW†		PT		UK	
	1988	1999	1988	1999	1987	1999	1990	1996	1986, 1987, 1996, 1997, 1988	1998	1990	1995	1989	1999
Cereals (g)	220	238	315	253	289	289	359	335	211	201	291	257	207	199
Meat and meat products (g)	166	127	162	149	133	166	160	136	121	126	143	163	146	130
Fish and seafood (g)	21	21	40	45	11	13	41	38	54	50	74	85	21	20
Milk (total; ml)	153	112	226	219	436	400	190	199	384	278	236	233	296	260
Low-fat milk (ml)	71	67	N/A	33	6.7	20	N/A	N/A	183	200	N/A	N/A	89	162
Fresh fruit (g)	151	117	341	305	81	94	259	232	125	129	210	173	87	99
Fresh vegetables (g)	116	127	252	248	96	110	153	128	75	85	145	140	111	103
Potatoes (g)	187	97	154	137	226	186	91	76	151	114	323	230	165	128
Legumes (g)	0.5	0.0	16	14	1.3	1.1	4.6	4.1	1.6	0.8	14	11	1.3	1.0
Vegetable oils (ml)	8	9.4	82	86	4.7	9.7	76	62	1	2	59	53	5.6	6.7
Vegetable fats (g)	22	13	7	5.8	12	3.9	2.2	1.5	27	24	7.1	6	18	11
Animal lipids (g)	14	8	1.4	0.8	27	8.9	6.8	5.6	12	6.4	2.3	2.4	14	10
Sugar products (g)	55	56	79	N/A	70	61	51	49	84	79	43	34	36	31
Soft drinks (ml)	129	191	60	65	70	122	32	42	109	177	19	39	N/A	202

BE, Belgium; GR, Greece; IRL, Republic of Ireland; IT, Italy; NW, Norway; PT, Portugal; UK, United Kingdom; N/A, data not available.

*www.nut.uoa.gr

†Values are means for the three survey years.

Table 2. Mean availability (g or ml/person per d) by country (for the survey year indicated) and educational attainment* (data from the Data Food Networking (DAFNE) database†)

Foods	GR (1998–9)					IT (1996)					NW (1996, 1997, 1998)‡					PT (1995)				
	EI	EC	SI	SC	C/U	EI	EC	SI	SC	C/U	EI	EC	SI	SC	C/U	EI	EC	SI	SC	C/U
Cereals (g)	327	285	234	220	206	408	358	326	311	289	212	209	189	199	310	260	202	209	187	
Meat and meat products (g)	154	155	144	144	144	146	149	133	126	118	139	139	123	114	153	167	162	155	161	
Fish and seafood (g)	53	48	40	41	45	41	38	37	38	38	58	58	45	47	82	86	91	77	90	
Milk (total; ml)	188	198	202	239	259	207	205	195	197	190	324	286	265	268	202	227	278	272	294	
Low-fat milk (ml)	21	26	34	38	47	N/A	N/A	N/A	N/A	N/A	200	202	195	208	N/A	N/A	N/A	N/A	N/A	
Fresh fruit (g)	297	289	274	309	357	235	242	221	232	230	127	132	118	143	140	172	198	199	239	
Fresh vegetables (g)	287	258	230	234	234	140	134	119	128	138	84	86	77	91	159	139	126	112	139	
Potatoes (g)	156	143	136	134	117	84	86	71	71	69	179	127	101	90	296	232	172	159	142	
Legumes (g)	22	17	12	11	10	4.8	4.3	3.9	4.1	3.7	1.3	0.7	0.8	0.6	16	12	5.7	5.5	3.7	
Vegetable oils (ml)	97	98	69	77	81	78	69	60	55	50	1.1	1.7	1.9	2.8	61	54	44	42	47	
Vegetable fats (g)	4.8	5.8	5.8	6.1	6.1	1.3	1.6	1.5	1.4	1.2	31	27	22	19	5.5	5.9	7.3	5.0	6.6	
Animal lipids (g)	0.8	0.6	0.7	0.9	1.2	5.1	6.5	5.2	5.2	5.0	8.0	7.1	5.6	6.1	1.6	2.0	3.5	4.2	5.5	
Sugar products (g)	N/A	N/A	N/A	N/A	N/A	58	55	46	45	38	89	82	76	76	42	34	27	30	30	
Soft drinks (ml)	56	61	66	70	72	31	41	44	45	39	153	195	191	163	28	38	49	48	56	

GR, Greece; IT, Italy; NW, Norway; PT, Portugal; EI, elementary education incomplete; EC, elementary education completed; SI, secondary education incomplete; SC, secondary education completed; C/U, college or university.

For overall *F* tests: **P* ≤ 0.05.

†www.nut.uoa.gr

‡Values are means for the three survey years.

Mean availability of selected food items based on the educational attainment of the head of the household and the country is shown in Table 2. Greek households whose head reached a higher level of education exhibited a lower availability of cereals, meat and meat products, fish and seafood, fresh vegetables, potatoes, legumes and vegetable oils; whereas there was higher availability of milk (total and low-fat), fresh fruit, vegetable fats, animal lipids and soft drinks. It should be noted that although the ANOVA *F* tests

always provided significant results, there were greater differences between households in which the head is in the elementary-education (incomplete or completed) group and households in which the head reached a higher level of education. In Italy, higher educational attainment was related to lower availability of all food items studied, with the exception of soft drinks.

Similar to Greece, Norwegian households in the higher education groups reported lower availability for cereals,

meat and meat products, fish and seafood, fresh vegetables, potatoes and legumes. On the other hand, educational level was positively associated with milk (total and low fat), fresh fruit, vegetable oils and animal lipids. Norway was the only one of the countries studied where soft drink availability declined as the educational level of the household improved. Only in Portugal did meat availability show a general increase with educational level. Portuguese households in which the head reached a high level of education also reported elevated availability of fish and seafood, milk, fresh fruit, vegetable fats, animal lipids and soft drinks.

Table 3 shows the average food availability (g or ml/person per d) according to quintiles of the food expenditure ratio for the Greek HBS 1998–9. Generally, increased food availability was observed with increasing values for the food expenditure ratio, with the exception of low-fat milk availability. Fig. 1 shows the spending efficiency of the lowest compared with the highest quintile of the food expenditure ratio.

Discussion

Multipurpose HBS are conducted in most European countries, collecting information on the food commodities

Table 3. Average food availability (g or ml/person per d) by quintiles of the food expenditure ratio* (data from the Greek household budget survey 1998–9)
(Mean values with their standard errors)

Quintile. . .	Food expenditure ratio									
	1st		2nd		3rd		4th		5th	
Foods	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Mean (%)	13		20		25		31		46	
Cereals (g)	231 ^a	4.41	257 ^b	4.41	268 ^b	4.41	289 ^{cd}	4.41	291 ^d	4.41
Meat and meat products (g)	136 ^a	3.66	150 ^a	3.66	165 ^b	3.66	172 ^b	3.66	165 ^b	3.66
Fish and seafood (g)	44 ^a	1.67	48 ^{ab}	1.67	51 ^{bc}	1.67	55 ^c	1.67	50 ^{abc}	1.67
Milk (total) (ml)	224 ^a	5.32	230 ^a	5.32	232 ^a	5.32	225 ^a	5.32	199 ^b	5.32
Low-fat milk (ml)	47 ^a	2.74	41 ^{ab}	2.74	35 ^{bc}	2.74	33 ^{bcd}	2.74	23 ^d	2.74
Fresh fruits (g)	335 ^a	8.81	332 ^a	8.80	348 ^a	8.80	347 ^a	8.81	317 ^b	8.80
Fresh vegetables (g)	247 ^{ac}	6.10	272 ^{ac}	6.10	281 ^{bc}	6.10	293 ^b	6.10	266 ^c	6.10
Potatoes (g)	120 ^a	4.18	139 ^b	4.18	152 ^b	4.18	153 ^b	4.18	153 ^b	4.18
Legumes (g)	12 ^a	0.84	14 ^{ab}	0.84	16 ^b	0.84	17 ^b	0.84	17 ^b	0.84
Vegetable oils (ml)	66 ^a	5.71	81 ^{ab}	5.71	98 ^{bc}	5.71	106 ^c	5.71	116 ^c	5.71
Vegetable fats (g)	5.8 ^{ac}	0.33	6.9 ^{abc}	0.33	6.9 ^{abc}	0.33	5.7 ^{abcd}	0.33	5.2 ^{ad}	0.33
Animal lipids (g)	0.95	0.14	0.79	0.14	0.93	0.14	0.88	0.14	0.93	0.14
Soft drinks (ml)	60 ^a	2.99	61 ^{ab}	2.99	66 ^{abc}	2.99	75 ^{cd}	2.99	82 ^d	2.99

a,b,c,d Mean values with unlike superscript letters were significantly different ($P < 0.005$).

*Household expenditures for food:total household expenditures.

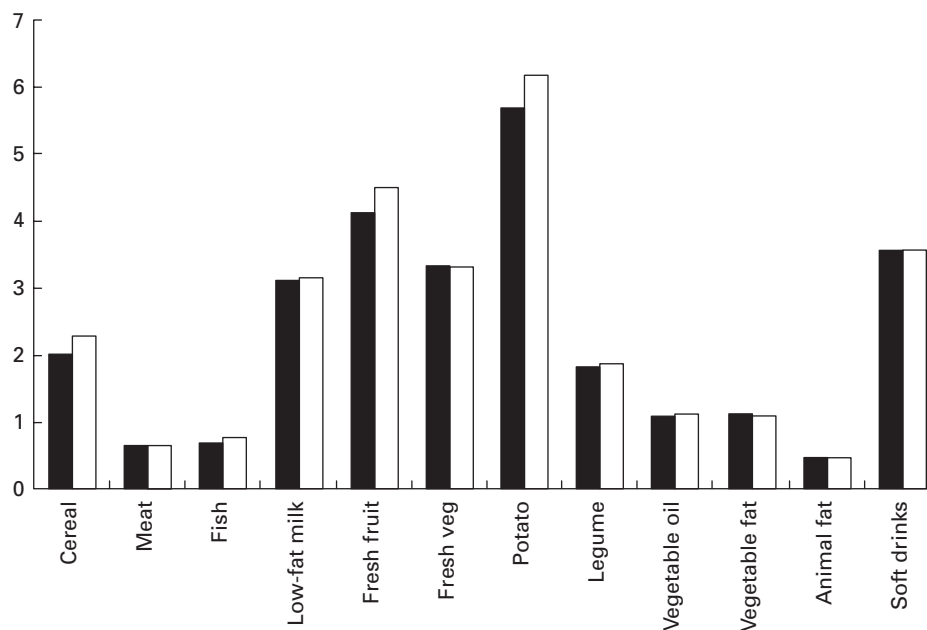


Fig. 1. Spending efficiency (g/Greek drachma) of lowest (■) and highest (□) quintiles of the food expenditure ratio. (Data from the Greek household budget survey 1998–9.)

available at household level, and on the demographic and socio-economic characteristics of nationally-representative samples of European populations. The DAFNE initiative has for the last 15 years worked on the post-harmonization of the HBS food and related information (Lagiou & Trichopoulou, 2001). The subsequently developed DAFNE databank could provide a useful tool in monitoring webs of causation operating from distal socio-economic factors to proximal eating behaviours. Although data refer to availability at the household level and information on the quantities of meals taken outside the household is lacking, the undertaking of comparisons by time, country and population subgroups may place them among the datasets of choice when it comes to ecological studies (Lagiou *et al.* 1999; Trichopoulou *et al.* 1999).

Our results for the overall daily food availability support previous findings of a north-south differentiation in food habits (Rumm-Kreuter, 2001). However, the availability of fresh fruit and vegetables generally showed a decline in southern Europe and a small increase in northern and central Europe, although mean availability per person still remained much higher among southern Europeans. In most countries food availability, including foods such as vegetable fats, animal lipids and sugar products, seemed to decrease with time. These findings may fail to support the reported increasing prevalence of overweight and obesity in Europe and worldwide (World Health Organization, 2000), and may point towards limited physical activity. Increased availability, on the other hand, was noted only for low-fat milk, vegetable oils and soft drinks. Taking a closer look at the availability of food items by time and region, it is notable that in northern and central European countries the increase also included fresh fruit and vegetables, probably reflecting the recent turn towards a healthier diet.

Information on the educational level of the household head was available only for four of the seven countries studied. Of these four, three are southern European countries (Greece, Italy and Portugal) and the fourth is Scandinavian (Norway). Our findings on how education affects food availability show good agreement with other recent observations that low educational level, and by extension low socio-economic status, is generally associated with lower consumption of fresh fruit and increased consumption of sugar products, potatoes, cereals (including bread), meat and meat products (Hulshof *et al.* 1991; Smith & Baghurst, 1992; Roos *et al.* 1996; Johansson *et al.* 1999; Irala-Estevez *et al.* 2000). Interestingly, we observed that lower educational level was associated with higher availability of fresh vegetables in southern European countries, but not in Norway. The observation that fresh fruit availability increased with the educational level of the household, whereas the opposite trend was observed with regard to fresh vegetable and legume availability may reflect the adherence of less-educated southern European households to traditional dietary choices.

In general, the availability of most food items decreased with higher educational attainment of the head of the household, with the exception of low-fat milk, fresh fruit, animal lipids and soft drinks. The increasing preference for low-fat milk and fresh fruit is consistent with current

recommendations to adopt healthier food choices. However, the sharp increase in soft drink availability, even within southern European households, may reflect the globalization of current dietary choices.

The food expenditure ratio has been often used as an indicator of the household's socio-economic status, or as a proxy for the household's income, with high values suggesting low socio-economic status, or low income (James *et al.* 1997). The relationship between the food expenditure ratio and household characteristics was also evaluated using data from the Greek HBS undertaken in 1998-9. Analysis of covariance was used to test differences in mean values for the food expenditure ratio in relation to household characteristics such as the educational attainment of the head of the household, the composition of the household and quintiles of the household's income. Mean values for the food expenditure ratio decreased with higher educational attainment of the head of the household (overall F 30.33, $P < 0.0001$) and quintiles of income (overall F 8.27, $P < 0.0001$), but increased with increasing number of household members (overall F 12.54, $P < 0.0001$). These findings confirm that the food expenditure ratio can be used as an indicator of socio-economic status, with higher values of the ratio being associated with lower socio-economic status, and are in agreement with results reported by James *et al.* (1997).

Contrary to previous reports from northern Europe (Hulshof *et al.* 1991; Roos *et al.* 1996; James *et al.* 1997; Johansson *et al.* 1999), Greek households of lower socio-economic status, as expressed both by the educational level of the head of the household and the food expenditure ratio of the household, followed a healthier diet with greater availability of vegetable oils and other foods rich in protective nutrients (i.e. fresh vegetables, legumes and fish). However, households with a lower socio-economic status also reported a higher consumption of energy-dense foods (such as cereals, potatoes and vegetable fats), as well as meat and meat products, possibly reflecting manual occupation.

The spending efficiency of the lowest *v.* the highest quintiles of the food expenditure ratio shown in Fig. 1 compares favourably with the findings of James *et al.* (1997). Based on Greek HBS data of 1998-9, low socio-economic groups appeared to purchase food items more efficiently than higher socio-economic groups. For the same amount of money spent on food, the upper one-fifth (lower socio-economic status) purchased greater quantities of cereals, fresh fruit and potatoes. Marginal differences were also apparent for fish, low-fat milk, and legumes.

Study findings indicate a need for a well-formulated nutrition policy and nutrition education across Europe, with the focus on all socio-economic levels. For such a policy to be effective, a wide range of conceptions, misconceptions and perceptions related to nutrition must be addressed. Moreover, it is clear that databases that are comparable across Europe and regularly updated can prove useful for multi-level monitoring and targeting. Thus, data from the DAFNE databank may serve as a tool for identifying and quantifying variation in food habits in Europe and for providing information on the socio-economic determinants of food preferences.

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