The EU Diet – Evolution, Evaluation and Impacts of the CAP

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Abstract

There is a growing concern that increasingly unhealthy diets are causing or at least contributing to the mounting economic and social costs of cancer, diabetes and cardio-vascular disease. Concerns and costs are most pronounced in the United States but they are also rising in other developed countries, notably in the European Union. In tandem with these concerns, there is growing pressure on all stakeholders of the food system to help solve these problems and reduce related health costs. Agricultural policies are blamed as one of the main culprits. It is claimed they generate not only high costs for consumers and taxpayers when subsidies are paid to farmers, but even higher costs when consumers and taxpayers have to bear the health burden of over-consumption encouraged by these subsidies.

This paper critically examines the validity of these claims. It first reviews the evolution of the diets of EU member countries and evaluates them against the recommendations of the WHO/FAO dietary guidelines. The evaluation is based on a nutrient database where food availability data has been linked to food composition data to convert foods to nutrients. The results of this evaluation confirm the excessive consumption of saturated fats, cholesterol and sugars and the convergence of diets in individual EU countries. In a second step (i) the instruments and impacts of the EU's Common Agricultural Policy (CAP) are examined, (ii) agricultural policy distortions are set in the context of the overall size of the food economy and, (iii) CAP policies are juxtaposed with past changes in EU diets. The findings allow us to reject the notion that agricultural policies are a main cause for the deterioration of the EU diet: there is no reason to suggest that the CAP has caused higher overall consumption levels nor that it has promoted the consumption of particularly unhealthy foods. On the contrary, if the CAP had any impact on EU food consumption patterns at all, it reduced overall consumption levels and particularly those of "unhealthy" foods (rich in sugar, saturated fats and cholesterol). The CAP may, however, have had a somewhat stronger and less benign impact on countries outside the EU. Preliminary results suggest that the swift deterioration of the diet in the Near-East/North Africa region could have been accelerated, though not caused, by some CAP policy measures in the past.

Keywords: Changes in food consumption patterns, EU diets, overweight, obesity, CAP, agricultural policies.

[1] The views expressed in this document are those of the author, not necessarily those of the Food and Agriculture Organization of the United Nations, FAO.

Introduction

According to the World Health Organization (WHO), about 56% of all adults in the EU-15 are overweight and nearly 15% are clinically obese (see Table A2). By far the highest prevalence of both overweight and obese adults is found in Greece, where 75% of the population are overweight and nearly 20% are obese. Data from the International Obesity Task Force (IOTF, 2005) suggest that men are more likely to be overweight but women are more likely to be obese (IOTF, 2005). IOTF data also suggests that 14 million schoolchildren in the EU are overweight, and 3 million of them are obese (IOTF, 2005). Most worrying, the trend has been accelerating over the 1990s and current prevalence levels are above what a mere continuation of the trend since 1970 would have suggested[2]. Some of the highest incidences are in the Mediterranean countries (Greece leads the way but Italy, Spain and Portugal are close behind). WTO data also suggest (WTO Infobase, 2006), that these high levels of overweight and obesity are not limited to Europe or to the developed world. WTO data suggests that overweight and obesity have become global problems and that a rising number of emerging economies are increasingly affected.

From a health perspective, obesity is not just a matter of coping with excess fat: a considerable body of studies confirms that it is a disease whose rising incidence reduces longevity and advances a number of health problems (World Cancer Research Fund, American Institute for Cancer Research, 1997). Epidemiological studies associate obesity with a variety of non-communicable diseases such as cancer, insulin resistance, hyperglycemia, hypercholesterolemia, hypertension, and gallbladder disease; other problems include orthopedic impairment, pulmonary difficulties, and surgical risk (World Cancer Research Fund, American Institute for Cancer Research, 1997).

Amidst growing concerns about obesity and its health consequences a multitude of measures have been suggested to address these problems. Food and health policy-makers face calls for better labelling of food, education, including the teaching of cooking skills in schools, more physical education in schools, controls on food advertising, counter-balancing private-sector advertising with pro-healthy eating campaigns, and using taxes and subsidies to manipulate relative prices in favour of healthy eating (a theme encapsulated within the recurrent demands for a 'fat tax'). Food manufacturers, retailers and the food service industry are urged to reduce fat, salt and sugar in processed foods and to make portion sizes smaller. There are also calls to examine the potential contribution of long-standing agricultural policies and there is the claim that the EU's Common Agricultural Policy (CAP) is one of the main culprits for the rapid increase in European overweight and obesity problems (Schäfer Elinder, 2003). These claims will be examined in greater detail in the second part of this paper. The rest of this paper is organised as follows: The first part will examine the evolution of dietary patterns in the EU over the last 40 years and will evaluate the findings against the population nutrient goals suggested by an expert consultation organized by WHO and FAO in 2003 (WHO, 2003). The second part will present the main policy instruments of the CAP and examine their effects on food consumption. The analysis includes both the effects on food consumption in and outside the EU.

[2] http://www.iotf.org/popout.asp?linkto=http://www.iotf.org/media/IOTFmay28.pdf

1. Examining and evaluating the European diet

1.1 The dietary energy balance and the incidence of overweight and obesity

Humans need, as all other animals, energy from food. However, the amount of energy needed - in the state of energy balance, that is without gaining or losing weight - varies considerably as a function height, weight, age, race, sex and physical activity. It is therefore difficult to provide ubiquitously valid advice for energy intake. For a more homogenous group of populations such as those of the European Union, however, an analysis of the changes in the energy supply should be more enlightening. Changes in dietary energy supply in conjunction with information about changes in energy expenditures should allow one to make educated guesses about changes in the energy balance and thus help explain changes in mean body mass index (BMI) of a population. Where distributional changes in food supply and consumption are small, and where food supplies are good predictors for food consumption, a change in the energy balance should also be a good predictor for changes in excess body weight, i.e. overweight and obesity[3].

For most countries of the European Union, a stable distribution of energy needs may indeed be a reasonable assumption. At the high levels of per capita incomes attained in essentially all EU countries, the responsiveness of calorie consumption to income changes should be low, income distributions in turn are known for being both rather equal and stable. These factors should mean that a positive change in the energy balance in EU countries should provide a strong signal for a rising obesity problem[4]. Less reasonable is to assume that food supplies as measured by the DES are a good predictor for marginal changes in food consumption or more precisely, food ingestion. This important differentiation arises from the fact that the DES includes household waste and that the importance of household waste increases disproportionately strongly with rising DES levels (Scott Kantor et al., 1997). Some even claim (Smil, 2000) that calories above a DES level of 3000 kcal/p/d are being wasted[5]. This would clearly weaken the quality of DES increases as a signal for rising overweight problems.

With these caveats in mind, the next section will provide an overview as to how DES levels have evolved over the past forty years for all EU member countries. The evolution of per capita dietary energy supplies are summarized in Table 1. To begin with the EU as aggregate, DES levels rose from 2930 kcal/p/d in 1961/63 to 3530 kcal/p/d in 2001/03, an increase of more than 20%. Even more noticeable is the increase in some EU regions. Countries with relatively low income levels in the 1960s experienced the fastest growth. The Mediterranean countries, for instance, caught up rapidly with the EU average, eventually even surpassing their previously richer peers (Table 1). Calorie intake in the MED-3 countries (Greece, Italy and Spain) increased from 2860 kcal/p/d to 3530 kcal/p/d, i.e. by 25%; the aggregate of the

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[3] In conjunction with a representative measure for the distribution of food availability and a minimum energy requirements (cut-off point), the energy balance is used to measure the prevalence of energy deficits (undernourishment) in FAO's undernourishment indicator. With an appropriate cut-off point at the upper side, the same measure could be used to gauge the prevalence of over-nutrition and thus overweight and obesity.

[4] This could be particularly so as other, non-dietary factors such as a population-wide genotypic predisposition or a long-term phenotypic predisposition (see e.g. Barker et al.) can be disregarded as important contributors to epidemiological changes in the prevalence of overweight and obesity in the EU.

[5] *"On the most general level, total per capita food energy supply has increased with progressing affluence from pre-industrial means of less than 2,500 kcal/day to satiation levels between 2,800 and 3,000 kcal/day:* ***virtually all of the production above that level appears to be wasted****. These satiation levels are achieved during early stages of modernization, at per capita incomes less than one-fifth of today's rates for the rich world (that is, generally below US$4,000/capita)".*

MED-6 countries (Greece, Italy, Spain, Portugal, Cyprus and Malta) saw an even stronger increase from 2830 kcal/p/d to 3590 kcal/p/d, i.e. of 27%.

Table 1: Dietary energy supply (DES) in Kcal/p/d

Country/region	**1961/63**	**1971/73**	**1981/83**	**1991/93**	**2001/03**
EU-15	2932	3115	3181	3301	3534
Austria	3211	3253	3366	3516	3742
Belgium-Luxemburg	2971	3202	3358	3605	NA
Denmark	3130	3109	3088	3303	3451
Finland	3163	3163	3044	3071	3153
France	3237	3269	3433	3537	3643
Germany	2920	3181	3359	3365	3490
Greece	2796	3234	3407	3612	3682
Ireland	3368	3476	3574	3611	3694
Italy	2979	3466	3418	3491	3670
Netherlands	3062	3065	3032	3285	3439
Portugal	2565	3017	2812	3505	3753
Spain	2673	2820	3046	3279	3405
Sweden	2818	2878	2975	3095	3157
UK	3285	3265	3155	3263	3444
MED-3	**2857**	**3217**	**3282**	**3424**	**3572**
EU-25	2964	3150	3204	3293	NA

Source: FAOSTAT-1, own calculations

In broad terms, two distinct groups of countries can be distinguished: the first is composed of "traditional" EU members, particularly the founding EU-6. In these countries, DES levels have always been relatively high and generally above 3200 kcal. To the extent that calories availability is a good predictor of calorie intake and to the extent that "non-nutritional" factors[6] can be excluded, the growing obesity problem in these countries could largely be explained by a decline in calorie expenditures. The second group is largely composed of countries that joined the EU at a later stage, such as Portugal, Greece and Spain. In these countries, the rapid and often massive increase (Greece) in the prevalence of overweight and obesity was most likely driven by a combination of higher calorie consumption and lower calorie expenditures.

Higher intake and lower expenditures have made Greece today the EU member country with the highest average BMI and the highest prevalence of overweight and obesity (Table 2). Today three quarters of the Greek population are overweight or obese. And, with the exception of France, Belgium and the Netherlands, the percentage of people with excess body weight now exceeds 50% in all other EU countries too. Dietary changes were a crucial factor in bringing about this development. How diets have changed and in what regards diets have become increasingly unhealthy will be analysed in the remainder of the first part of this paper.

1.2. The yardstick: The WHO/FAO population nutrient goals, their scope and limits

Nutritionists often express good and bad diets by assigning intake limits for nutrients and chemical components of food. But people consume foods and drinks. These foods and drinks, rather than their chemical components create the overall dietary patterns. Dietary recommendations to the broader public may therefore be largely ineffective if provided in terms of recommended limits or ranges for the chemical components of a diet rather than for

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[6] Amongst other factors, for instance, a country-specific degree of phenotypic or genotypic predisposition.

foods and drinks that people ultimately relate to. Why then does much if not most research on diets, nutrition and non-communicable diseases focus on nutrients rather than on foods? An important reason for this is that nutrients provide a logical common denominator that allows scientists to aggregate nutrients and their diverse components over individual foods, examine diets in their totality and thus compare them with scientific limits that are deemed to provide the guidelines for a healthy diet.

Table 2: Prevalence of overweight and obesity in the EU-15 (in 2002)

	Mean BMI	Overweight	Obese	Overweight	Obese	Population
	Percent of Population			millions		
EU-15		**56.0**	**14.8**	**212.7**	**56.3**	**379.7**
Austria	26.2	59.0	19.5	4.8	1.6	8.1
Bel-Lux	25.1	49.0	11.4	5.3	1.2	10.8
Denmark	25.2	50.7	9.6	2.7	0.5	5.4
Finland	26.5	63.8	18.0	3.3	0.9	5.2
France	24.6	44.1	7.2	26.5	4.3	60.0
Germany	26.6	63.7	19.7	52.5	16.2	82.4
Greece	27.6	74.6	26.2	8.2	2.9	11.0
Ireland	25.1	50.0	9.5	2.0	0.4	3.9
Italy	25.4	51.9	12.2	29.8	7.0	57.5
Netherlands	24.8	46.7	9.6	7.5	1.5	16.1
Portugal	25.7	55.5	13.1	5.6	1.3	10.1
Spain	25.8	55.7	15.6	22.8	6.4	41.0
Sweden	25.3	51.7	10.1	4.6	0.9	8.9
UK	26.4	62.5	18.7	37.1	11.1	59.4

Source: WHO Infobase, UN population assessment 2004, own calculations

The foods vs. nutrients dilemma is a pivotal problem for the analysis in this paper. On the one hand, there are dietary recommendations that have been set in accordance with results from scientific research. Technically, these recommendations express dietary quality as a vector of criteria for the chemical contents of food, and deviations from these criteria as indicators of good or bad diets. On the other hand, the diets in the EU (and elsewhere) have evolved as changes in the consumption of specific foods and beverages and the public policies (CAP) analysed in the second part of this paper relate to specific foods and not to the chemical nutrients contained therein. This dilemma complicates both the nutrition and the policy analysis enormously: neither is it always straightforward to relate changes in nutrient intakes to changes in food consumption patterns nor is it always possible to infer causality between changes in nutritional patterns and policy measures. In fact, as far as the CAP is concerned, the paper will show that it is largely impossible to draw such inferences at all.

The dietary guidelines used in this paper are based on the expert consultation, *Diet, Nutrition and the Prevention of Chronic Diseases* jointly organised by WHO and FAO (WHO/FAO, 2003). These guidelines have been published in the WHO Technical Report Series No 916, henceforward referred to as TRS916. Before reviewing these recommendations in detail, a number of caveats need to be noted. First, as all scientific recommendations, TRS 916 also classifies good or bad diets according to their chemo-nutritional patterns rather than to their food and beverage composition. The key reasons were explained above: only nutrients allow an aggregation over foodstuffs and only the nutrient contents allows to judge diets that can be based on a great variety of different foods against an aggregate quality measure[7]. Second, it is important to note that these dietary guidelines constitute a set of *population nutrient intake*

[7] The recommendation to consume at least 400 g of fruit and vegetables is the only exception in the TRS 916 criteria.

goals, they are the means of distributions of nutrient intake goals, not or not necessarily recommendations for the diet of an individual or a given group of individuals. In fact, most of these recommendations are highly unpractical as nutrition guidelines: even a nutrition expert may not always be able to say whether his individual diet exceeds 300 mg Cholesterol per day or contains more than 6% but less than 10% of polyunsaturated fatty acids[8]. Instead, these guidelines relate to *population-wide* dietary quality, they were established with a view to providing a more balanced diet on a *population-wide* basis, to address the epidemical dimensions of overweight and obesity and come to grips with the associated health problems on a *collective* basis. And finally, the recommendations provided in TRS 916 are not to be interpreted as "single best values". Instead TRS 916 emphasises that, *"consistent with the concept of a safe range of nutrient intakes for individuals, there is often a range of population averages that would be consistent with the maintenance of good health"* (TRS 916, p. 54).

Within these qualifications, however, TRS 916 and the background studies reviewed therein provide evidence that the stated criteria can function as an apt guide towards a balanced diet and adherence to these criteria as a means to prevent chronic diseases on a population-wide basis. However, TRS 916 also emphasises that the quality of the evidence varies across the various epidemiological studies underlying these recommendations and that inferences cannot always be drawn with the same high levels of the confidence. Without repeating the rationale for the various criteria or the quality of the evidence from the underlying studies, it should suffice here to repeat the main recommendations; they are summarised in Table 3.

Table 3: Ranges of population nutrient intake goals

Dietary Factor	**Recommendation (WHO/FAO)** [percentages are shares of the DES]
Total Carbohydrates	55 – 75 %
Total dietary fibre/Non-starch polysaccharides (NSP)	(>25 g, or 20g/d of NSP) from whole grain cereals, fruits, and vegetables
Free sugars	< 10 %
Total Fat	15 – 30 %
Polyunsaturated Fatty Acids	6 – 10 %
ω6/ω3 ratio	< 4-5[9]
Saturated Fatty Acids	< 10 %
Trans Fatty Acids	< 1 %
Cholesterol	< 300 mg/day
Protein	10 – 15%
Sodium chloride *(sodium)*	< 5 g/day *(< 2 g/day)*
Fruit and vegetables	≥ 400 g per day

Source: WHO/FAO, 2003, TRS 916

The use of these guidelines as the yardstick for the quality of the European diet made it necessary to create a population-based set of actual nutrient intake levels for all EU countries. To this end, a nutrient database for all EU countries was calculated, providing nutrient intake

[8] There are of course dietary recommendations based on individual foods rather than on nutrients. It may suffice at this juncture to mention FAO's food-based dietary guidelines (WHO/FAO, 1997). They offer practical advice for individuals to follow a healthy diet; however, they neither allow evaluating diets based on hundreds of foods against a set of scientific criteria, nor do they allow comparing such diets across different countries.

[9] The ratio is derived from the recommended share for ω-6 PUFAs of 5-8% and of ω-3 PUFAs of 1-2%. For details see WHO/FAO, 2003, TRS-916, p. 54.

levels for all TRS 916 criteria[10]; the time span covered was limited to all years available in FAOSTAT-1, i.e. 1961-2003, and, owing to data limitations, could not be extended to more recent years and FAOSTAT-2 coverage. Box A1 (Annex) provides further details of the scope and the limits of this database.

1.3 Overview of the results

To obtain a first, general overview of the dietary situation in the EU, a headcount of countries was created with the number of countries below and above the most important recommendations (Table 4). The time span covered is 1961/63 to 2001/2003 and the four decadal steps beginning in 1961/63 make it possible to show changes in the availability of individual dietary components over the past forty years relative to the recommended levels of intake.

Table 4: How many EU-15 countries fail to meet the recommendations? A headcount[11]*

WHO/FAO recommendation	1961/63	1971/73	1981/83	1991/93	2001/03
Protein					
< 10%	0	0	0	0	0
> 15%	0	0	0	0	0
Total Lipids					
> 30%	9	12	13	14	14
< 15%	0	0	0	0	0
Fatty Acids					
SAFA > 10%	10	11	12	12	14
PUFA < 6%	12	11	8	3	4
PUFA > 10%	0	0	0	0	0
ω6/ω3 < 4-5	0	0	0	0	0
Carbohydrates					
< 55%	7	12	14	14	14
> 75%	0	0	0	0	0
Total Dietary Fibre <25g/p/d	6	8	11	6	5
Sugar < 10%	8	11	9	10	10
Cholesterol < 300 mg/p/d	10	13	13	14	14
Sodium Chloride/Sodium					
Sodium (food borne) < 2 g/p/d	0	0	0	1	1
Sodium (total) < 2g/p/d	4	7	11	14	14
Fruits and Vegetables ≥ 400g/p/d	8	5	5	2	0

* Belgium and Luxemburg are counted as one country

A first, cursory inspection of the results presented in Table 4 already reveals that there has been both improvement and deterioration in the EU diet. On the positive side, the number of countries reaching or exceeding the recommended 400g/person/day minimum for fruit and vegetable consumption has steadily increased over the last 40 years: while only six countries met the target in the early 1960s, all 14[12] EU countries managed to do so by 2001/03.

[10] If fact, the nutrient database covers all 128 nutrients distinguished in the USDA nutrient database, version SR18. For details see box 1.

[11] This is an update of Schmidhuber and Traill, 2006.

[12] Belgium and Luxemburg treated as a single unit in this analysis.

Likewise, the number of countries below the 6 percent limit for polyunsaturated fatty acids constantly declined from twelve to four. On the negative side, the number of countries with national averages above 300 mg cholesterol/p/d and 30% of total fat increased from ten in the early 1960s to include all fourteen EU member countries forty years later. Similarly alarming is the fact that the salt content of the European diet has constantly increased and that now all 14 member countries have attained levels that exceed the recommended 2g of sodium per person per day. Finally, while not all countries now exceed the 10% limit for sugar, more do than in the early 1960. To summarize the changes colloquially: the European diet has become ***too fat, too salty and too sweet*** over the past 40 years[13].

How these changes came about, which countries experienced the most significant quality losses or improvements in their diets and how exactly the various dietary components have changed over the past forty years will be examined in greater detail in the next sections. This review will start at the most general level of a diet, the overall dietary energy supply, then delve into the developments in the main dietary components and finally venture an evaluation of the dietary changes in the EU against the specifics of the TRS 916 recommendations.

1.4 The EU diet in greater detail

After a first inspection of the overall evolution of dietary energy supply, some further insights can be gained from analysing the changes in macronutrients (carbohydrates, fats, protein)[14]; macronutrients are the main carriers of dietary energy supplies and thus show what main dietary shifts evolved within the increasing overall food energy supply. This paper will only deal with carbohydrates and fats; proteins have been left out as no EU country consumes proteins in excess or signals a protein deficit[15]. All countries have protein shares between 10 and 15% of dietary energy and this for the entire time span from 1961/63 to 2001/03.

1.4.1 Carbohydrates

Carbohydrates include starches, sugars and fibre (or non-starch polysaccharides). These are chemically similar, but they can vary vastly in their physiological effects. Starchy and sweet foods may be consumed in whole form, as whole-grain bread or other cereal products or even completely unprocessed as whole roots, tubers, plantains or simply as fresh fruit. These unprocessed forms of carbohydrates typically contain considerable levels of nutritionally valuable micronutrients, they are richer in vitamins, minerals and dietary fibre, more generally in valuable non-starch polysaccharides (NSP). Starchy and sweet foods may also be consumed in processed form, as refined and finely milled flour, as white rice or pasta, or as extrinsic (refined) sugar. Milling and refining typically removes the valuable micronutrients, fibre and vitamins and thus important nutrients. This makes no sense from a nutritional perspective, but eases further industrial processing to numerous forms of modern foods. Leavened bread, for instance, requires finely milled flour to yield the consistency and texture that makes it so widely appreciated in Western diets and, more recently, a main staple in many other regions.

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[13] Interestingly, these changes also reflect the quasi universal, evolutionary craving for traditionally scarce foodstuffs: fat, sugar and salt. Equally interesting, these cravings have been perfectly catered for by the typical food assortments of the fast food industry, whose "meals" are rich in all of these three nutrients, but often also *only* in these three nutrients.

[14] The shares of carbohydrates, fats and protein may not always add up to 100%. This is due to the application of simple Atwater factors to the absolute quantities. The margins of error however are within 1-2%.

[15] Protein shares are available from Annex Table A3.

Table 5: Share of Calories from Carbohydrates in total Dietary Energy Supply (%)

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	54.3	51.1	48.6	47.8	49.8
Austria	56.6	52.1	47.3	47.0	48.6
Belgium-Luxemburg	51.6	47.1	46.5	47.6	48.2
Denmark	55.3	51.6	50.2	52.4	52.4
Finland	57.4	54.3	52.0	53.5	52.4
France	53.4	49.4	45.0	44.8	45.6
Germany	53.0	51.2	50.1	50.0	51.6
Greece	59.9	54.0	53.2	50.5	51.3
Ireland	58.2	54.3	51.6	51.9	50.9
Italy	61.1	56.3	52.4	50.0	49.7
Netherlands	55.4	52.4	50.2	52.0	51.8
Portugal	63.2	58.4	54.0	52.2	51.3
Spain	62.8	56.3	50.6	47.0	45.9
Sweden	52.2	52.6	50.8	51.5	51.5
UK	52.2	51.2	51.2	50.6	53.0
MED-3	61.6	56.1	51.8	49.0	48.4
EU-25	55.5	52.1	49.7	49.3	51.0

Source: FAOSTAT-1, own calculations

For global nutrition, carbohydrates are by far the most important source of dietary energy. In general, this is also true for the EU. About half of the EU's DES comes from carbohydrates; cereals, starchy roots, and sugar alone account for 40% of the dietary energy supply. But both the overall importance of carbohydrates and their underlying food sources have changed considerably over time. While carbohydrate consumption was traditionally high in Mediterranean countries (62% in 1961/63) and exceeded the recommended TRS916 minimum of 55%, it has fallen considerably over time and is now uniformly around 50% in all EU member countries (Table 5). This convergence process has already been noticed for overall dietary energy and it will reoccur, when changes in other components of the EU diet are analysed.

What has replaced carbohydrates? The answer is: mainly fats. Again, the shift from carbohydrates to fat was most pronounced in the Mediterranean countries. It is also born out in the overall increase in the DES, which was most pronounced in the MED-3 aggregate.

However, while the importance of carbohydrates declined in relative terms absolute consumption levels measured in g/p/d remained effectively unchanged (see Annex Table A2 for further details). What is more, the quality of the carbohydrates consumed in the EU also remained largely unchanged, at least measured in terms of glycemic load (see Box 1 for the underlying methodology)[16]. The glycemic load of the EU diet increased by only 8% over the past forty years, exactly the same increase as for the carbohydrates in g/p/d. That means that – contrary to common belief and contrary to developments in many other countries - foods rich in simple carbohydrates such as extrinsic sugar and refined flour have *not* replaced in large measure foods rich in complex carbohydrates. It is emphasised here because it is a development where EU agricultural policies have had a crucial influence. Particularly for sugar, CAP policies have kept domestic prices at multiples of world prices and within the EU sugar prices at very high levels relative to most other foods. It is also worth noting, because

[16] The role of proteins remained largely unaffected by these shifts; the share of proteins in dietary energy supply stayed for all countries and all years within the recommended 10-15% range.

the only moderate increase in the glycemic load is a specific EU feature. Many non-EU countries and particularly non-EU Mediterranean countries have experienced a much stronger increase in the consumption of glycemic carbohydrates in an agricultural policy environment that provided the incentives for such increases.

Box 1: How to measure the glycemic load of an entire diet?

The total dietary glycemic load (TDGL)[17] is formally described below; informally, it could be interpreted as the overall carbohydrate consumption per person per day, weighted by the glycemic index of each individual foodstuff.

$$TDGL_{i[g/p/d]} = \sum_{i=1}^{444} GI_i \cdot gCH_i \cdot C_i$$

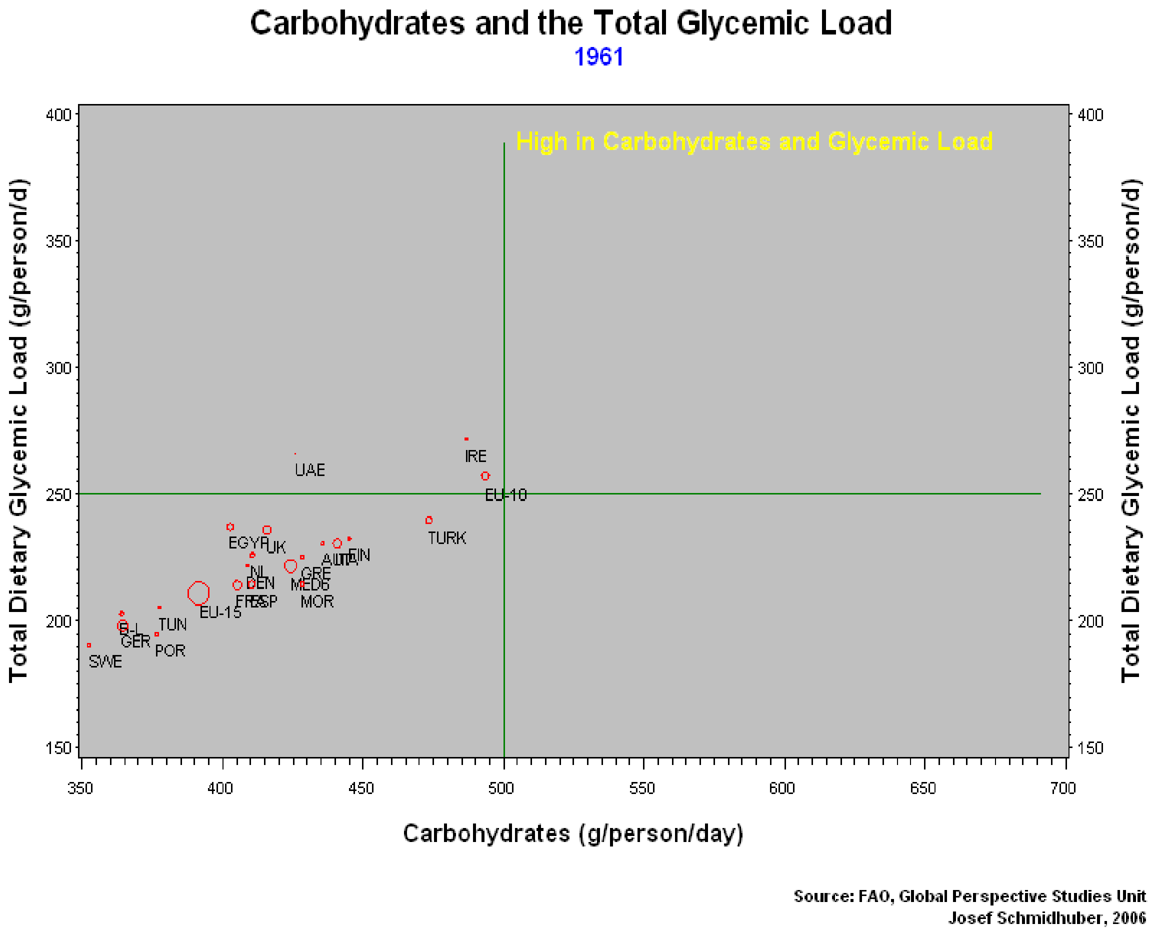
whereby:

GI_i = Glycemic index of food item i, i=1-444 SUA foods
gCH_i = Carbohydrates of SUA food item i
C_i = Consumption of SUA food item I [g/p/d]

The definition still requires a clear understanding of the glycemic index (GI). The GI *"is a ranking of carbohydrates on a scale from 0 to 100 according to the extent to which they raise blood sugar levels after eating. Foods with a high GI are those which are rapidly digested and absorbed and result in marked fluctuations in blood sugar levels. Low-GI foods, by virtue of their slow digestion and absorption, produce gradual rises in blood sugar and insulin levels, and have proven benefits for health. Low GI diets have been shown to improve both glucose and lipid levels in people with diabetes (type 1 and type 2). They have benefits for weight control because they help control appetite and delay hunger. Low GI diets also reduce insulin levels and insulin resistance. Recent studies from Harvard School of Public Health indicate that the risks of diseases such as type 2 diabetes and coronary heart disease are strongly related to the GI of the overall diet. In 1999, the World Health Organisation (WHO) and Food and Agriculture Organisation (FAO) recommended that people in industrialised countries base their diets on low-GI foods in order to prevent the most common diseases of affluence, such as coronary heart disease, diabetes and obesity"(* http://www.glycemicindex.com/*.).*

How moderate the increase in the glycemic load of the EU diet was can be appreciated when it is compared with the developments in other regions, particularly the neighbouring non-EU countries of the Mediterranean region. Figures 2a and 2b show that the diets of these countries have become massively glycemic, with some countries, notably Egypt, reaching averages of 400 grams of glycemic carbohydrates per person per day. Without inferring causality, the correlation with the increase in NCDs such as type 2 diabetes is striking. The same holds for the noticeable boost in overweight and obesity in many countries of the region, particularly in Lebanon, Egypt, and other countries in the Near East/North Africa (NENA) region that occurred in tandem with leaps in the DES and the glycemic load of the diet. Particularly the link between the high glycemic load and the region's high prevalence of diabetes may warrant further quantitative, multi-variant based examination. The question that will be further examined in this paper is how these massive increases in the glycemic load of the NENA diet came about and what role food and agricultural policies could have played in this process.

[17] The TGDL was conceptualized and compiled for this analysis. It is expressed in g/p/d. The underlying values for the glycemic index of individual foods have been taken from the international GI database, based in the Human Nutrition Unit, School of Molecular and Microbial Biosciences, University of Sydney. More information is available from http://www.glycemicindex.com/.



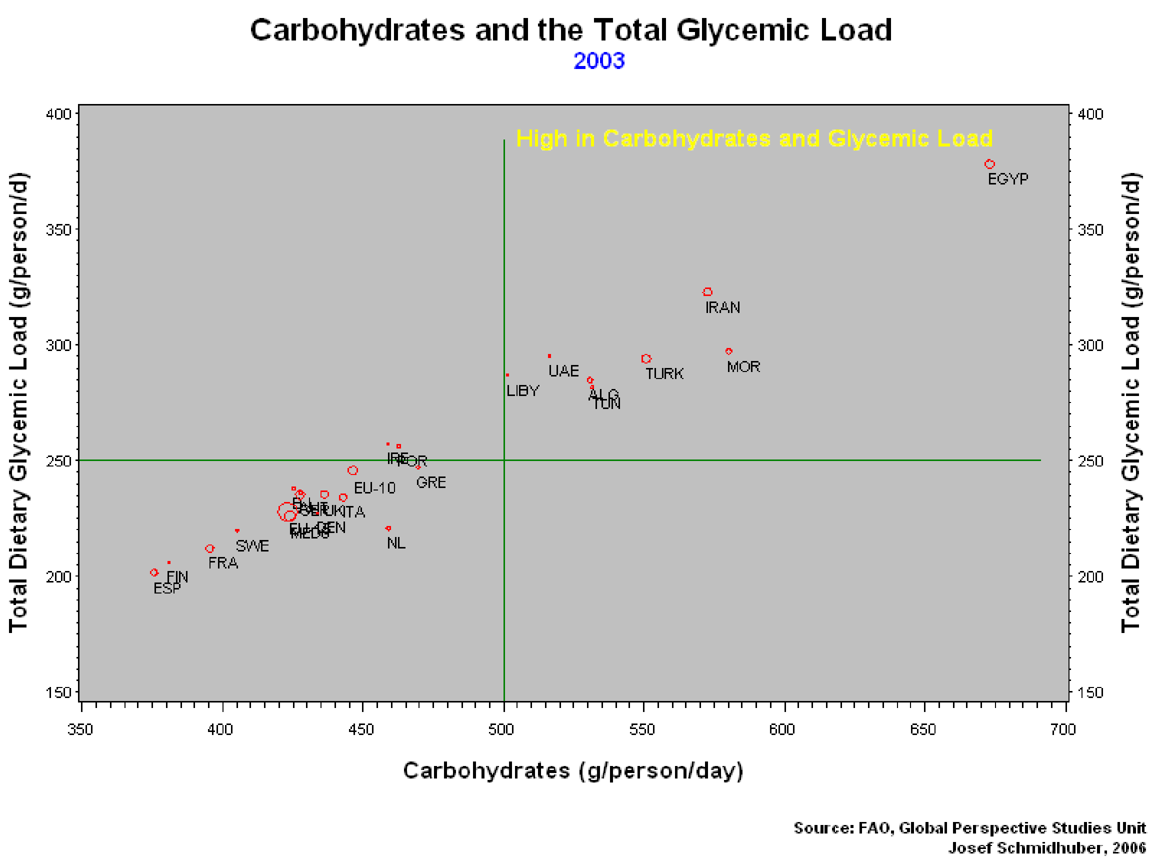


Figure 2a/b: The glycemic load of EU and NENA diets has increased sharply over the past 40 years

Table 6: Total Dietary Glycemic Load in grams/person/day

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	211	213	206	210	226
Austria	229	217	204	215	235
Belgium-Luxemburg	206	206	214	231	237
Denmark	221	210	206	221	226
Finland	219	222	193	202	205
France	217	205	196	201	211
Germany	199	214	221	222	234
Greece	220	233	239	240	246
Ireland	269	259	249	262	256
Italy	230	248	228	222	233
Netherlands	224	214	199	226	219
Portugal	204	224	197	240	255
Spain	215	204	197	196	200
Sweden	191	199	195	210	219
UK	232	223	214	214	234
MED-3	224	231	218	214	222
EU-25	216	218	211	214	229

Source: Nutrient database, own calculations

From the outset it is important to note that countries in the NENA region that display drastic increases in glycemic load are at different stages of the nutrition transition as compared with their neighbours in the EU. Albeit countries such as Egypt, Morocco, Tunisia or Iran have meanwhile reached DES ranges similar to those prevailing in EU countries, i.e. 3200-3400 kcal and more, they are just completing the early phases of their nutrition transition where calories are just added (expansion effect) without replacing existing ones (substitution effect). This expansion phase means more consumption of carbohydrates and - other things being equal - lifts the glycemic load of a diet. More remarkable however is that this expansion phase has lasted so long and that the additional carbohydrates remained highly glycemic. In some countries, the increase in the TDGL was even faster than the growth in carbohydrates consumption, suggesting that the added carbohydrates have become more glycemic than the traditionally consumed ones.

A combination of diverse factors has driven these shifts. First, the region's diet was traditionally rich in carbohydrates. When incomes rose, existing, carbohydrate-rich food consumption patterns were merely extended. Second, with higher incomes the region has relied more and more on imports for its food supplies. This was driven by the fact that domestic food production was increasingly circumscribed by natural resource limits, notably land and water scarcity. For instance, the region as a whole already uses 90% of its suitable agricultural land and 65% of its renewable water resources (Bruinsma, 2003). These shares can be even higher in individual countries of the region. Higher imports were also driven by the availability of foreign exchange from exports oil and gas that afforded the region the purchasing power to buy ever increasing quantities of food from abroad. This has made the region the world's largest food importer – at least in quantitative terms; but imports focused on a few, readily and cheaply available foods, notably cereals and sugar. In short, expensive *hydrocarbon* exports financed cheap *carbohydrate* imports.

Where proceeds from oil and gas exports were not available or insufficient, domestic affordability was often fostered through the so-called "urban bias" in agricultural policies, a widespread food policy approach which effectively taxed farmers and subsidized staple foods for consumers in urban areas. A study by Krueger, Schiff and Valdes (KSV, 1991) estimated that the burden of taxation on agriculture was over 20% in many countries of the region and that subsidies to consumers were of the same magnitude. The incentive structure of food policies was thus quite the opposite of what the CAP provided. CAP policies taxed consumers and subsidized producers, "urban bias" policies subsidized consumers and taxed producers.

In addition to domestic policies, the agricultural policies of OECD countries also affected the region's production and consumption of food. EU policies were no exception. On the export side, the EU provided - through various trade and association agreements - preferential access to its relatively lucrative (i.e. high-price) market, particularly for off-season shipments. In many cases, preferences were given for agricultural products that were perceived to represent the region's comparative advantage: olive oil and certain fruits and vegetables which were clearly also the most valuable products nutritionally. On the region's import side, the EU was a supplier of commodities which produced in excess of EU domestic demand and not consumed at home at high EU prices. These surpluses were subsidized down to the price levels of recipient countries, including to those of the NENA region. Carbohydrate-rich, highly glycemic foods, notably sugar and wheat (semolina) were amongst the most important EU exports to the region.

Sugar

One of the most controversial TRS916 recommendations is that calories from sugar should not exceed 10% of total dietary energy supplies. This controversy arose from a conflict of interest between sugar producers and processors on the one hand and nutritionists on the other. The basic case made against the 10% limit rests on the notion that there is no good or bad food as such and that indeed high consumption levels of any and all foods may cause detrimental health effects. The basic case in favour of this limit rests on the empirical observation that progressively negative health outcomes follow as sugar exceeds the 10% limit. Among the best documented problems are the links to diabetes and dental decay as well as overweight and obesity (see e.g. background documents of TRS 916).

Less well known but no less important is the link of excessive sugar consumption to micronutrient deficiencies. This link arises from the simple fact that sugar only contains carbohydrates; it contains no micro-nutrients, no proteins/amino acids, no fats/fatty acids, no vitamins, no minerals. Therefore, where sugar assumes an important role in the diet, it can "crowd-out" other foodstuffs, and thus result in low intakes of vitamins and other micronutrients. The crowding-out effect can also be traced with the nutrient database created for this analysis and it is – as expected - particularly pronounced in developing countries. Figure 3 illustrates just one case, the crowding-out effect of iron with rising sugar consumption in Cuba. The same effect can be observed for many other micro-nutrients (e.g. zinc or vitamin A) and in many other countries where sugar accounts for a high share of overall dietary energy supply (e.g. Columbia, Venezuela)[18]. The negative impacts of the crowding-out effect are less visible in developed countries, where foods are often fortified and thus a higher share of sugar is made possible without creating micro-nutrient deficiencies. This is the case in the US for instance. Regardless of the possibility of offset the crowding-out effect in rich countries, high shares of sugar remain a main contributing factor to dental decay as well as to overweight and obesity.

[18] The crowding-out effect for micro-nutrients is even underestimated, as the USDA nutrient database includes many fortified foods.

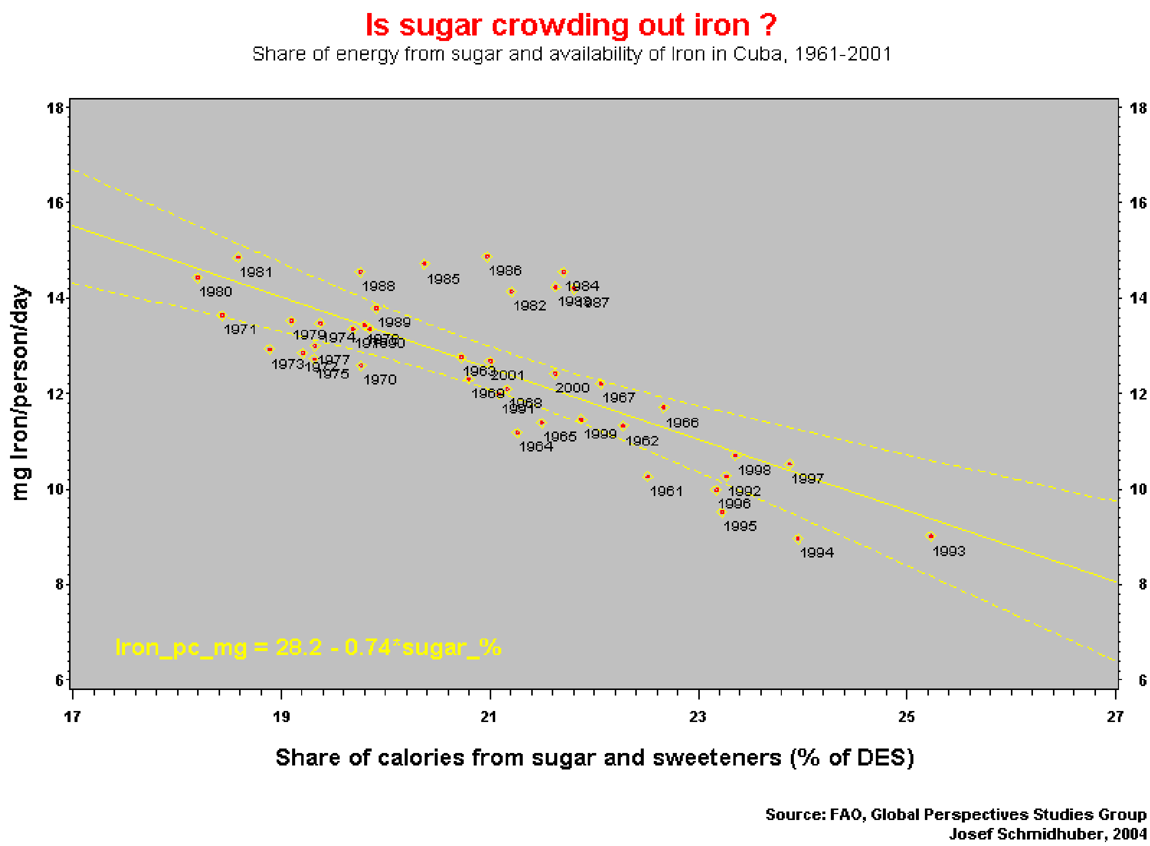


Figure 3: The crowding-out effect of high sugar consumption

As far as the EU is concerned, the overall contribution of sugar to the dietary energy supply has essentially remained constant at about 11%, i.e. slightly above the recommended limit. But the largely unchanged level for the EU as a whole masks important shifts within some of its member countries. In the early 1960s, the proportion of calories from sugar varied considerably (Table 7) across member countries. The shares were considerably below the 10% mark in the Mediterranean countries, while they were substantially above that mark in the UK, Ireland, Denmark, the Netherlands and Sweden. Over time, sugar calorie shares began to converge and gradually approached the 10% level in almost all member countries.

On the face of it, the catch-up process of the Mediterranean countries appears to be linked to membership of the EU and may thus be linked to the adoption of CAP measures. Some of the policy issues of relevance have already been touched upon, and greater detail will be provided in Section B of this paper. At this juncture it may suffice to say that the adoption of the CAP has sharply increased sugar prices in the acceding countries and should have, if anything, lowered sugar consumption. And, while essentially all food prices have risen with accession to the EU, sugar prices - the CAP's most protected and, from the consumer's point of view the most taxed foodstuff - have risen relative to all other foods and food ingredients.

Table 7: Share (%) of Calories from Sugar in total Dietary Energy Supply

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	10.6	11.8	11.2	10.6	10.4
Austria	12.4	12.7	12.4	12.1	11.6
Belgium-Luxemburg	9.9	10.2	10.9	11.8	0.0
Denmark	16.3	16.6	15.0	14.3	14.2
Finland	12.2	15.4	11.7	13.4	10.6
France	9.7	12.4	9.9	10.1	10.6
Germany	11.6	12.6	12.9	12.6	12.8
Greece	5.1	7.8	9.2	8.6	9.0
Ireland	15.1	15.1	12.2	12.5	10.7
Italy	8.3	9.2	9.2	8.4	8.2
Netherlands	15.4	15.7	13.6	15.9	13.7
Portugal	7.0	8.9	9.2	8.7	8.3
Spain	7.9	10.2	9.5	8.4	9.7
Sweden	15.5	16.2	14.9	14.8	13.9
UK	14.7	14.5	14.0	11.5	11.5
MED-3	7.8	9.4	9.3	8.4	8.9
EU-25	10.5	11.8	11.3	10.8	10.7

Source: FAOSTAT-1, own calculations

Non-Starch Polysaccharides (NSP), dietary fibre

TRS 916 recommendations pay tribute to the special health effects of NSP in two ways. First, by issuing a separate target for dietary fibre with a recommended minimum intake of 20 g/p/d. Second, by adding a separate target for fruit and vegetables which are – inter alia – a key provider of NSP. Without repeating the beneficial dietary effects of NSP explained in TRS 916, it should suffice here to mention that NSP (i) helps reduce plasma cholesterol in general and LDL cholesterol in particular, (ii) reduces the risk of many forms of cancer (colon cancer in particular, see e.g. World Cancer Research Fund, American Institute for Cancer Research, 1997 or Meyerhardt et al. 2007) and (iii) lowers the risk of coronary heart diseases (CHD).

The EU diets are faring relatively well as far as their NSP content is concerned, and, overall, the NSP content of the diet has been increasing in many EU member countries, particularly over the past two decades. While only three out of 14 countries met the 25 g/p/d in 1981/83, their number increased to 10 by 2001/03 (Table 8). And even those below the recommended minimum are not far away from meeting the 25 gram target. Top of the list is Greece with more than 30 g/p/d, clearly owing this to the very high levels of fruit and vegetable consumption of more than 1100 g/p/d. High fibre content also characterizes the diet of the other Mediterranean countries, it is also one of the last positive features of a widely praised diet which has otherwise decayed into a moribund state over the past forty years.

The relatively high NSP content is also compatible with the relatively low glycemic load of the EU diet, described above. CAP policy measures may have had an impact on these positive features of the EU diet. Price support for farmers for fruits and vegetables was relatively limited and mostly provided through border protection, particularly against high-season imports. This is not to say that CAP policies promoted fruits and vegetable consumption, this was certainly not the case. But the consumer tax on fruits and vegetables through price support measures for producers of fruits and vegetables was a lot lower than for other products such as sugar.

Table 8: Non-Starch Polysaccharides, availability in grams/person/day

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	24.5	23.6	22.7	24.6	25.5
Austria	33.3	27.1	24.5	24.6	28.6
Belgium-Luxemburg	21.0	23.0	23.4	26.5	21.6
Denmark	27.1	23.5	23.5	25.3	25.1
Finland	27.6	22.6	22.3	22.4	23.1
France	23.0	20.3	20.2	22.4	23.0
Germany	28.6	26.9	26.2	25.8	26.1
Greece	26.2	28.7	30.4	31.8	31.4
Ireland	22.3	23.1	25.3	26.4	27.3
Italy	26.0	26.9	24.5	27.3	27.5
Netherlands	19.5	18.3	18.9	22.8	22.1
Portugal	32.3	32.3	23.9	29.1	29.8
Spain	27.4	26.5	24.8	26.8	25.6
Sweden	20.9	20.8	21.1	21.3	21.5
UK	20.4	20.6	20.2	24.2	26.3
MED-3	26.5	26.9	25.2	27.6	27.2
EU-25	26.5	24.8	23.7	25.2	26.1

Source: Nutrient Database, own calculations

1.4.2 **Fruit and Vegetables**

High levels of fruit and vegetable consumption are generally associated with positive health effects, even though the benefits of high consumption levels cannot easily be ascribed to a single nutrient or bioactive substance. Fruit and vegetables are rich in minerals, vitamins, fibre and antioxidants and thus afford every diet a host of essential nutrients. The broad spectrum of essential nutrients was the main reason for the explicit inclusion of fruit and vegetables into the dietary recommendations[19]. The broad range of benefits also explains why fruit and vegetable consumption has been targeted for increase by most countries in campaigns to promote healthy eating (e.g. the five a day campaign).

FAO Food Balance Sheet (FBS) data suggest that all EU countries have reached and exceeded the recommended minimum intake levels of 400g/p/d for fruit and vegetables. This development marks an important enhancement in the evolution of dietary patterns: 40 years ago only 6 countries had more than 400g of fruit and vegetables available per person per day (Table 9). Higher FBS estimates notwithstanding, "apparent" consumption of fruit and vegetables may overstate, more than for any other product category, actual intake levels. For example, *intake* data for the UK suggest that average fruit and vegetable consumption among 19- to 64-year-olds is below three 80 gram portions per day, i.e. below 240 grams (Henderson et. al., 2002) whereas FBS availability estimates are significantly in excess of 400 grams. This suggests that losses at the household level could account for more than 40% of availability at country level. Likewise, Naska et. al. (2000) find, using DAFNE data (Lagiou, et al. 2001 and Dafne), that only in the Mediterranean countries did the mean daily population intake of fruit and vegetables clearly exceed recommendations.

[19] Note that the WHO/FAO recommendation for fruit and vegetables is in terms of aggregate weight (in grams) rather than in terms of a calorie or other nutrient share in the diet.

Table 9: Fruit and vegetable consumption, availability in grams/person/day

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	457	519	535	616	623
Austria	533	504	546	605	602
Belgium-Luxemburg	396	493	467	679	702
Denmark	270	300	315	408	629
Finland	167	210	326	382	435
France	590	541	492	581	651
Germany	378	469	469	547	561
Greece	688	943	1117	1211	1144
Ireland	228	261	371	404	528
Italy	632	750	787	853	818
Netherlands	394	439	491	630	660
Portugal	477	549	456	702	831
Spain	586	666	714	779	748
Sweden	280	333	354	428	509
UK	340	384	396	459	526
MED-3	621	738	791	860	825
EU-25	457	519	535	616	623

Source: FAOSTAT-1, own calculations

Notwithstanding these high potential losses for fruit and vegetables, there has been an impressive increase in overall availability, and in most countries availabilities have exceeded recommended levels by sometimes more than 100%. This means that even after accounting for losses, most country averages should still be above the 400g per person per day recommendation (Figure 11). What is more, there are reasons (e.g. the rise of supermarkets) to believe that the variety of fruits and vegetables available to consumers has increased and their availability throughout the year has improved.

1.4.3 Total lipids and their fatty acids: the good, the bad, and the ugly

Dietary fat consists mostly of fatty acids esterified to glycerol and other alcohols. About 90% of fats in foods are triglycerides with one molecule of glycerol and three fatty acids. Fatty acids are chains of several carbon atoms with hydrogen atoms attached.

Fat consumption comes in a rather diverse range of different forms. Most visibly, fat intake increases with increased consumption of butter, other dairy products and meats from domesticated animals[20]; most of the increase in fat consumption, however, comes in less visible forms and is not necessarily of animal origin. Hidden fats are often consumed in the form of deep-fried foods, potato chips and other fast food products; other important sources of hidden fats are pastries, cakes and biscuits. Not only have these foods become an important source of overall fat consumption, the shortenings and hydrogenated oils used as staple ingredients in the manufacturing processes of these foods are also a main source of saturated fats and trans-fatty acids.

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[20] Game, by contrast, in not only leaner but also richer in ω-3 fatty acids. Typically, the ω-6 to ω-3 ratio of game meat does not exceed the value of 3, i.e. would be perfectly compatible with TRS 916 recommendations. Eaten et al. (1997) see the main reason in the widening of the ratio in the domestication of animals: *" ... domestication of animals increases their saturated fat levels and alters the ratio of ω-6 to ω-3 fatty acids. Most Americans consume an 11:1 ratio of ω-6 to ω-3 fatty acids. But a more ideal ratio, based on evolutionary and anthropological data, would be in the range of 1:1 to 4:1. In other words, our ancestors consumed a higher percentage of ω-3 fatty acids - and we probably should too."*

Fat consumption typically increases with economic development, specifically with industrialisation and urbanisation. Econometric estimates suggest that fat consumption is relatively more income responsive than other foods up to a per capita GDP level of about US$12000/year (Figure 4). Consumption of some speciality oils such as olive oil or pumpkin seed oil even increases at very high per capita income levels, but mostly at the expense of other fats and oils.

Income changes also characterized the consumption path in the EU. At relatively low GDP levels, many EU countries experienced a rapid increase in fat consumption, resulting in a growing overall convergence process in fat consumption. The catch-up process was particularly pronounced in the previously poorer member countries of the Mediterranean region, which stepped up fat consumption as personal incomes caught up with core EU countries (Table 10). EU accession was a watershed for many of these countries, both in terms of income growth and distribution and consequently for changes in consumption patterns. The CAP, by contrast, was not likely a main cause for change. In fact, adopting the CAP meant higher prices for most fats, notably for animal fats such as butter and for fats that come with higher meat consumption.

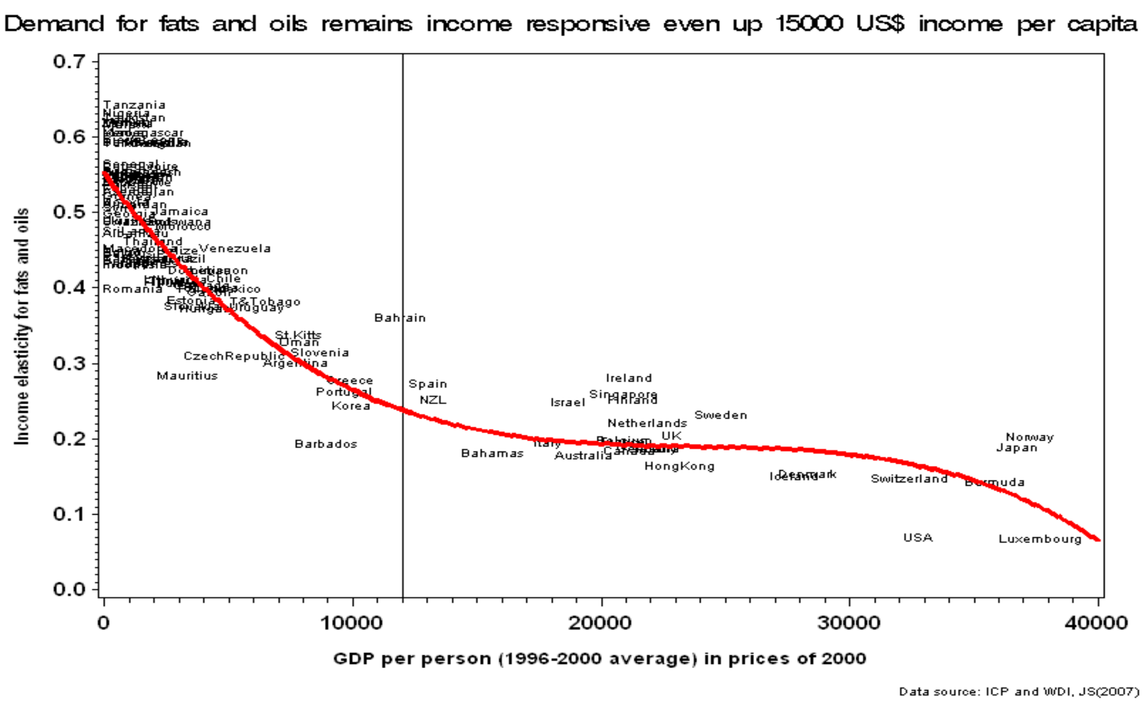

Figure 4: Consumption of fats and oils in relation to personal incomes

The convergence process for overall fat consumption was followed by a convergence process in the composition of the various sources for fats and oils. While Mediterranean countries gradually caught up with the high animal fat consumption levels of the other EU countries, core EU members diversified their oil consumption to include the oils and fats of the Mediterranean countries, a development that is most visible in the rapid increases in consumption of sunflower oil and olive oil outside the Mediterranean region.

Where do these developments leave the EU with respect to the TRS 916 recommendations? The Mediterranean countries of the EU-15 started off from a lower (healthier) level (25% of calories from fat), well within the 15-30% range of TRS916. But they caught up rapidly with the core EU countries over the 1980s and 1990s and by 2001/03 even surpassed the high EU-15 average of 37%. In all countries, the increase in fat consumption was so marked that the upper bound of the 15-30% range has been surpassed (Table 10). In some countries notably Germany, Belgium-Luxemburg and Spain fat consumption now exceeds the upper TRS 916 bound by as much as 10 percentage points. Within the Mediterranean countries, Spain experienced the most pronounced increase, where the share of fats rose from 25 to 40%; it is the main culprit for the overall increase and the high levels currently reached in the Mediterranean countries (Table 10).

These increases are even more worrisome as they represent shares of a rising absolute value, the DES[21]. In Spain, for instance, fat consumption in absolute terms outright doubled from 72g/p/d to 154g/p/d. Even more pronounced were the changes in some of the key sources of animal fats and cholesterol. In terms of foods, the main contributing factor was rapidly rising meat consumption which increased by a factor of 4.5 from 25 kg/p/yr to 118 kg/p/yr, with the most pronounced increase in pig meat consumption which rose from 8.9 kg/p/yr to 65 kg/p/yr. Less spectacular, but still impressive, was the growth in milk and egg consumption with increases from 87 kg/p/yr to 170 kg/p/yr and 9.4 kg/p/yr to 14.2 kg/p/yr, respectively. On the positive side, the consumption of other, healthier carriers of fat also increased. However, these increases remained rather subdued. Olive oil consumption, for instance, rose only by about 30% from 8.2kg/p/yr to 11.7 kg/p/yr. Similar shifts in consumption patterns occurred in Italy and Greece and explain the massive deterioration of the fatty acid composition of their diets as described below. In sum, fat consumption and patterns went through a 40-year transition from good to bad to ugly.

Table 10: Share of calories from lipids in the Dietary Energy Supply

Country/region	**1961/63**	**1971/73**	**1981/83**	**1991/93**	**2001/03**
EU-15	30.6	33.0	34.9	36.7	37.2
Austria	31.9	35.0	39.1	39.5	37.5
Belgium-Luxemburg	36.4	40.1	40.5	41.0	41.5
Denmark	35.6	37.7	36.6	33.2	33.0
Finland	32.6	34.0	34.5	33.0	33.0
France	29.0	33.4	38.4	40.8	41.0
Germany	35.5	35.0	34.8	36.4	35.0
Greece	30.3	36.8	36.3	39.1	37.6
Ireland	31.8	34.4	37.0	35.7	34.5
Italy	24.8	29.7	33.9	37.1	37.7
Netherlands	35.9	37.0	36.7	35.7	35.5
Portugal	20.3	24.6	28.6	31.4	32.5
Spain	24.7	30.4	35.2	39.1	40.0
Sweden	36.3	34.8	36.1	36.1	35.2
UK	37.7	37.8	37.3	37.7	34.9
MED-3	25.3	30.6	34.6	38.0	38.6
EU-25	30.0	32.4	34.4	35.6	36.1

Source: Nutrient database, own calculations

[21] It should be recalled, however, that fats and oils (lipids) are also the commodity group where the difference between "apparent" calorie consumption and actual intake is highest. This is particularly the case where fats and oils, used for frying food, are thrown away rather than eaten. In these cases, a part of the increase in dietary energy supply may be a reflection of increased waste rather than increased consumption.

Fatty acids and cholesterol

As mentioned, 90% of food fats are composed of fatty acids esterified to glycerol. Fatty acid chains differ in chain length and degree of saturation (number of double bonds between carbon atoms). Saturated fatty acids, (including hydrogenated fats and oils) have no double bonds and they are usually solid at room temperature. Mono-unsaturated fatty acids (MUFAs) have one double bond[22], poly-unsaturated fatty acids (PUFAs) more than one double bond. The only specific requirement for fat in the diet is that for essential fatty acids. These include linolenic acid (18:2) and alpha-linolenic acid (18:3), an ω-3 fatty acid not synthesised by humans. Cholesterol, albeit not a fat, is included in the discussion here because of its related biology and its physiological interactions with saturated fats. Cholesterol is solely of animal origin, saturated fats are mostly of animal origin.

From a health perspective, the fatty acids composition of the diet is at least as important as its total lipid content. TRS 916 provides for specific targets for the various fatty acid fractions: Saturated fats should not account for more than 10% of the DES, at least 6% but not more than 10% should come from poly-unsaturated fats, the (variable) rest from MUFAs, without exceeding the 30% upper bound for total fats. Within the fraction of poly unsaturated fats, the ratio of ω-6 to ω-3 acids should not exceed a range of 4-5, which is apparently the most demanding hurdle in a modern diet, not only in the EU but also in essentially all other developed countries. The developments for saturated and mono-unsaturated fats in the EU are summarized in Table 13, those for PUFAs and ω-6/ω-3 ratios in Table 12.

Unsaturated fats

Most unsaturated fat is of vegetable origin. In general, unsaturated fats have been found to promote good health and longevity, ω-3 fatty acids have been identified as particularly beneficial to good health. Monounsaturated fats come from a variety of foods. The most concentrated food source is olive oil, in which 70-90% of the fat is mono-unsaturated. Olive oil, with its high share of mono-unsaturated fats, has become emblematic of the Mediterranean diet and is generally associated with good health. Also rich in mono-unsaturated fats are avocados and canola oil[23]. Poly-unsaturated fats are divided into ω-3 and ω-6 fatty acids[24]. A rich body of experimental research ascribes particularly beneficial health effects[25] to ω-3 fatty acids.

Scrutiny of the results for mono-unsaturated fats in the EU renders an intuitive and already familiar consumption pattern across member countries. One of the (few) positive features of the otherwise moribund Mediterranean diet is its high share of mono-unsaturated fats in total fats consumption. In Greece, Spain and Italy, more than 15% of all fats come from mono-unsaturated fatty acids, in Spain it is even more than 20%. Also interesting is the finding that Italy and Spain have nearly doubled that share over the last forty years, while Greece merely recorded a modest increase. Still, with MUFA shares at or above 20% of total energy intake, it can be said that all three countries managed to preserve this important aspect (one of the

[22] The predominant fatty acid is oleic acid (18:1). Particularly olive oil and rapeseed oil are rich in oleic acid.

[23] Canola emerged from genetic improvements of rapeseed varieties (removal of erucic acid and glucosinolates) and boasts the highest shares of unsaturated fats. After olive oil, it is the most important vegetable source mono-unsaturated fats and after flax oil it is the most important source of alpha linolenic acid, an ω-3 fatty acid. For details see e.g. http://www.canola-council.org/PDF/GNs.pdf.

[24] According to the distance of their first double bond from the methyl end of the carbon chain.

[25] ω-3 fatty acids can improve allergies, cardiovascular health, nerve problems, cholesterol control, circulatory health, weight management, eczema, vision, immune deficiencies, osteo-arthritis, rheumatoid arthritis, viral illness, reduce risk of skin cancer, learning difficulties.

few) of a typical Mediterranean diet. Equally obvious is which foods have contributed to the high share of mono-unsaturated fats in the Mediterranean diet. Olive oil consumption in Italy has increased from 9.6 kg/p/a to 13.1 kg/p/a in 2001/03, in Spain from 8.2 kg/p/a to 11.7 kg/p/a and Greece from 14.5 kg/p/a to 15.9 kg/p/a. On average, the consumption of mono-unsaturated fats in these countries is about 25% above the EU-15 average and olive oil consumption is three to four times higher. But even for the EU-15 as an aggregate, the growth in mono-unsaturated fats and olive oil consumption remains impressive. Indeed olive oil was the single most important vegetable oil in 2001/03 (4.4 kg/p/a), even surpassing per capita consumption of sunflower oil (4.3 kg/p/a) and soybean oil (3.5 kg/p/a).

The high growth rates and subsequently high consumption levels of olive oil in non-Mediterranean countries have posed the question of whether the CAP played a role in promoting this outcome. A look at the subsidy estimates for vegetable oils provides clues as to how the CAP may have affected this outcome. For vegetable oils, market price support is generally low. There is no intervention price system and tariffs are relatively low, with *ad valorem* rates ranging between 0% and 16%. Support is mainly provided through direct payments based on area, inputs, etc. This means that CAP prices are largely at the same level as world prices for vegetable oils and that consumers are neither taxed nor subsidised through the CAP.

Table 11: Share (%) of calories from mono-unsaturated fats in the DES

Country/region	**1961/63**	**1971/73**	**1981/83**	**1991/93**	**2001/03**
EU-15	12.2	13.5	14.5	15.3	15.5
Austria	12.5	14.2	15.8	15.4	13.9
Belgium-Luxemburg	14.3	15.6	15.7	15.8	16.4
Denmark	13.0	14.5	13.8	13.0	12.6
Finland	10.2	12.1	12.5	12.8	13.1
France	10.7	12.9	15.2	16.6	16.7
Germany	14.1	14.2	14.0	14.4	13.1
Greece	15.0	19.1	18.5	19.4	18.3
Ireland	10.7	12.1	12.7	13.5	12.6
Italy	11.7	13.6	15.1	17.2	17.8
Netherlands	14.1	14.4	14.4	13.6	13.4
Portugal	9.6	11.8	14.4	14.0	14.5
Spain	11.2	14.5	17.9	20.1	20.5
Sweden	14.1	14.4	14.5	13.7	13.6
UK	13.4	13.7	13.5	13.7	12.6
MED-3	11.8	14.4	16.4	18.5	18.9
EU-25	11.8	13.2	14.1	14.8	14.9

Source: Nutrient database, own calculations

The combined value of payment to EU oilseed producers (other than olive oil producers) was €2.05 billion in 2001/03 (PSE estimate, OECD PSE/CSE database), but as mentioned, consumers have not been (significantly) affected by these subsidies given that the volume of world markets for oilseeds are large (in fact 15 times larger) as compared to EU production and that the implicit price effects of direct payments (wealth effect, risk effect) are negligibly small relative to the value of production.

The olive oil market is different. While direct payments play an even more important role, there are three distinct differences relative to the markets for other oils and oilseeds. First, EU import tariffs on olive oil are higher[26]. They vary between 53 and 65 percent, depending on the grade of olive oil. Second, with €2.36 billion EAGGF expenditure in 2001/03 (OECD PSE/CSE database), the subsidies given to olive oil producers are large and in fact exceeded the combined value of subsidies given to the producers of all other oilseeds in the EU. And third, the EU market share for olive oil in the world market is very large (the EU accounts for about 75-85% of global olive production and for about 72% of consumption[27]). The high level of production support in conjunction with the dominant role in global production suggests that an endogenous price effect of subsidies on olive oil prices cannot and in fact should not be excluded. Differently put, EU subsidies to olive oil producers have pushed EU production and with it overall supply above their equilibrium levels and resulted in lower prices not only on world markets but also within the EU. EU consumers of olive oil (as well as consumers in non-EU countries) have benefited from lower prices and, given the superior nutritional features of olive oil (particularly its high content of mono-unsaturated fatty acids), the CAP has probably provided a very positive contribution to the nutritional quality of the EU diet.

Poly-unsaturated fats and ω-6/ω-3 ratios

Unlike for mono-unsaturated fats, the food sources for PUFAs are more varied. They include fatty fish, but also rapeseed oil or soybean oil. Even red meat and butter are rich sources of poly-unsaturated fats. The varied origins of PUFAs mean that there is no clear pattern across countries in any of the five data points shown in. Over time and with increasing overall fat intake, however, the number of countries above the 6% threshold has been increasing and the average intake level for the EU as an aggregate has risen from 4.5% of dietary energy in 1961/63 to 7% by 2001/03 (Table 12); PUFA consumption for the EU-15 as a whole has thus exceeded the minimum of 6% without violating the recommended upper bound of 10%. All in all this means that both the average has improved and that the improvements were shared in by a rising number of countries and constitute another improvement in the EU diet over the past forty years.

The PUFA quality: ω6/ω3 ratios

While the overall PUFA consumption level improved, its quality, in terms of ω-6 to ω-3 ratio, somewhat deteriorated. The ratio widened from 10 to 12 and thus remained considerably above the recommended range of 4-5. The difference across EU countries are also small, only Portugal and Denmark on the lower end with a ratio of 9 and the UK and Austria with ratios above 15 stand out (Table 12). At the same time, Portugal and Denmark failed to meet the overall PUFA target while Austria and the UK have attained the highest overall intake levels and the most significant increases over time. Taken together, these changes suggests that growth in overall PUFA consumption was solely driven by more consumption of ω-6 PUFAs, an important qualification to be made with regard to the improvements stated above.

[26] While overall import tariffs for olive oil are higher, it is important to note that many other olive oil producers have preferential access – within quotas - to the EU olive oil market. This has been a traditional feature in EU association agreements with Mediterranean and has afforded important non EU suppliers such as Tunisia with preferential access to the EU market. With European Neighbourhood Policy (ENP) such preferences have meanwhile been extended to other countries in the region such as Syria.

[27] For details see Annex tables A5 and A6

Table 12: Percentage shares of calories from poly-unsaturated fats and ω6/ω3 ratios[28]

	1961/63		1971/73		1981/83		1991/93		2001/03	
	PUFA%	ω6/ω3	PUFA%	ω6/ω3	PUFA%	ω6/ω3	PUFA%	ω6/ω3	PUFA%	ω6/ω3
EU-15	**4.5**	**9.7**	**5.1**	**10.3**	**5.7**	**10.8**	**6.6**	**11.5**	**7.0**	**11.9**
AUT	4.1	10.7	5.4	15.1	6.6	13.9	7.6	20.1	8.1	15.1
B-L	5.4	11.0	7.0	12.9	7.3	11.6	8.0	10.0	7.9	10.2
DEN	6.2	9.1	6.1	9.6	6.4	9.9	5.5	9.4	5.0	8.6
FIN	2.8	5.7	3.3	7.1	3.5	7.5	3.9	8.7	4.4	9.4
FRA	3.8	10.1	4.4	9.4	5.7	12.0	6.2	13.3	6.5	12.5
GER	5.2	10.7	5.1	11.6	5.3	10.9	6.7	9.8	7.3	12.1
GRE	4.2	10.0	4.2	8.4	4.4	9.4	5.4	12.1	5.5	12.7
IRE	3.1	6.8	4.3	7.6	5.4	8.1	6.8	10.2	7.0	11.7
ITA	3.8	10.8	5.2	11.1	6.1	10.0	6.2	11.2	6.1	10.6
NL	7.6	10.3	8.8	10.2	6.5	10.7	7.6	10.3	7.8	10.3
POR	3.5	10.3	4.3	11.4	4.5	12.0	5.8	8.8	5.4	9.2
ESP	5.0	8.9	5.2	8.8	5.4	10.1	6.3	10.9	6.3	10.3
SWE	4.9	9.6	5.2	11.7	4.9	11.0	6.5	10.8	6.0	11.9
UK	5.0	8.1	5.7	9.2	7.4	11.2	9.1	14.5	8.5	16.0

Source: Nutrient database, own calculations

Saturated fats, trans-fatty acids and cholesterol

High levels of plasma cholesterol have probably become the single most popular indicator of individual and epidemiological health problems. Measuring cholesterol and its main fractions (LDL and HDL cholesterol) has become a regular feature of health checks in developed countries, particularly for patients above the age of forty[29]. Much of the attention given to these tests is owed to experimental and epidemiological evidence of co-morbidity between high plasma cholesterol levels (in particular high LDL cholesterol levels) and the prevalence of coronary heart disease.

While the epidemiological link between high plasma cholesterol levels is well-established, the link between the intake of food cholesterol and level of plasma cholesterol appears to be much weaker (see e.g. Corr et al, 1997 or D'Avanzo, et al, 1995). Many other factors appear to play a role. They include nutritional factors as well as non-nutritional ones. On the nutritional side, food cholesterol appears to be a much better predictor of high plasma cholesterol where it is associated with high levels of saturated fat consumption. On the non-nutritional side, factors such as physical activity, social[30] or work-related stress appear to determine the correlation between food and plasma cholesterol levels more than the intake levels of cholesterol.

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[28] ω-3 PUFAs are the sum of: 18:3 undifferentiated + 22:6 n-3+Timnodonic 20:5 Ω 3 (EPA) n-3 + Clupanodonic ω-3 22:5 (DPA) n-3 + Gamma-linolenic 18:3 n-6 c,c,c + Alpha-linolenic 18:3 n-3 c,c,c + 18:3i; while ω6 PUFAs are the sum of: 18:2 undifferentiated + 20:4 undifferentiated + 18:2 t not further defined + 18:2 i + 18:2 CLAs + 18:2 n-6 c,c + Parinaric 18:4.

[29] Measurement of plasma cholesterol levels have also become integral part of entry checks in numerous companies and organisations and it is, for that matter, also part of the blood test, required by FAO and WHO in the entry health checks for staff members - regardless of the age of the applicant.

[30] The importance of social stress in determining the level of plasma cholesterol and coronary heart disease is also integral part of the so-called Rosetto effect (Egolf, 1992). The Rosetto effect also could also help explain the high correlation between urbanization and the incidence of CHD.

All this is not to say that the examination of intakes of food cholesterol is a futile exercise. Nor that the recommendation that food cholesterol should not exceed 300mg/p/d is superfluous. Food cholesterol does have an influence on plasma cholesterol, but the impact is rather weak and a high level of food cholesterol in a country's diet may not be the sole factor contributing to high levels of plasma cholesterol or in the sequel to the prevalence of CHD. But it does indicate that high plasma cholesterol levels are a multi-variant problem and that food cholesterol is simply one contributing factor. It also important to note that experimental evidence suggests that high saturated fat intake heightens the relevance of cholesterol for CHD. Cholesterol intake and intake of saturated fats are summarized in Table 13.

Table 13: Shares of calories from saturated (% of DES) and Cholesterol (mg/p/d)

	1961/63		1971/73		1981/83		1991/93		2001/03	
	SAT	CHOL	SAT	CHOL	SAT	CHOL	SAT	CHOL	SAT	CHOL
EU-15	**11.4**	**326**	**11.7**	**381**	**12.0**	**415**	**11.9**	**418**	**12.0**	**463**
AUT	12.5	388	12.5	397	13.6	465	13.4	503	12.6	531
BL	13.8	385	14.5	481	14.4	475	14.2	438	14.2	421
DEN	13.5	368	14.3	377	13.6	421	12.1	468	12.8	510
FIN	16.4	406	15.5	477	15.4	460	13.4	395	12.7	510
FRA	11.9	396	13.3	457	14.4	525	14.8	547	14.6	598
GER	13.5	366	12.9	435	12.8	471	12.6	410	12.0	403
GRE	9.1	190	11.3	302	11.1	342	11.8	400	11.4	384
IRE	15.0	477	14.9	481	15.6	524	12.5	441	12.1	437
ITA	7.3	225	8.6	305	10.1	360	11.1	398	11.1	403
NL	11.4	338	11.0	345	13.0	400	11.8	398	11.6	447
POR	5.5	155	6.5	203	7.6	220	9.2	360	10.2	462
ESP	6.5	203	8.4	305	9.3	386	9.9	404	10.3	446
SWE	14.4	400	12.4	427	13.8	450	13.2	470	12.8	514
UK	16.3	436	15.3	433	13.5	399	12.1	399	11.0	487
MED3	**7.2**	**214**	**8.8**	**304**	**9.9**	**368**	**10.7**	**400**	**10.8**	**417**
EU-25	**11.2**	**321**	**11.7**	**380**	**12.0**	**415**	**11.7**	**412**	**11.7**	**450**

Source: Nutrient database, own calculations

Even a cursory look at the estimates provided in Table 13 reveals that both intake of cholesterol and the importance of saturated fat in the diet of EU countries have increased[31]. Within the country aggregate of the EU-15, two developments warrant closer inspection. They also help illustrate some of the controversy in the discussion about the importance of food and plasma cholesterol. The first is France, whose diet is characterized by the highest levels of cholesterol (600 mg/p/d) and saturated fat (15% of dietary energy) consumption of all EU member countries (Table 13). This is – taken as such - not a surprising result as it merely reflects the country's food consumption patterns, which are rich in animal fats (18.4 kg/p/a), meats (100 kg/p/a) and dairy products (276 kg/p/a) - all rich in saturated fats and cholesterol. But France is also the country with one of the lowest prevalence levels of CHD in the EU, a fact that has created the notion of the "French paradox" (Bryla, 2004). Speculation about the reasons of this low correlation abound. They include lower social stress and benefits of "savoir vivre", i.e. less stress and a better ability of the body to metabolize high intakes of cholesterol. Other explanatory factors include the idea that a diet is more than the sum of its parts and that the composition is more important than individual components.

[31] . The fact that cholesterol consumption rises much faster than saturated fat shares is mainly a reflection of the fact that saturated fat estimates are expressed in shares of a rising over dietary energy supply level, while cholesterol intake is measured in absolute terms. If both are measured in absolute terms, the increase in cholesterol is just about as fast as the one for saturated fats.

The second outstanding development is the rapid increase in saturated fat and cholesterol intake in the Mediterranean countries. While still somewhat below the average of the EU-15, the forty year "catch-up" process in their consumption levels to EU averages was impressive. They essentially doubled their cholesterol intake from 210 mg/p/d in 1961 to 420 mg/p/d in 2001/03, the share of saturated fats increased from 7% to nearly 11% of dietary energy intake. Probably more than any other change, these increases symbolize the deterioration of the Mediterranean diet overall. They stand for a rapid increase in consumption of meat, eggs, butter and other animal fats. Expressing these increases in saturated fats and cholesterol allows to aggregate changes over a multitude of different individual foods.

Trans-fatty acids

In addition to the limits for SAT, MUFA, PUFA and cholesterol TRS 916 also specifies a maximum for trans-fatty acids[32] (TFAs). Naturally, i.e. in the absence of food processing, TFAs should be of minor importance. In unprocessed foods, TFAs occur in small quantities in milk and milk products, notably in butter. The main source of TFAs is the hydrogenation processing of vegetable oils; TFAs can therefore be found in margarines and shortenings and in baked goods such as biscuits or cakes. They may constitute up to 35% of these foods; as a result, differences in the TFA content of various diets are mainly a reflection of the different technologies used in processing vegetable oils. TFAs in the nutrient database constructed for this analysis only capture the small quantities contained in unprocessed foods. Total TFA amounts cannot be calculated without detailed knowledge about how fats and oils are processed in a given country and have therefore been excluded in this analysis.

1.4.4 Salt[33]

Salt intake varies substantially across the world. Outside the EU, the highest salt consumption levels are reported for China; inside the EU, the highest consumption levels are found for Portugal. The nutrient database constructed for this analysis confirms this result and suggests that sodium intake in Portugal has reached a level of 5400 mg/p/d.

Requirements are considerably below this level. On a population basis, a safe sodium intake has been estimated at 500 mg/p/d, a level that stands just at a quarter of the TRS 916 maximum. A look at Table 14 immediately reveals that all countries have exceeded this maximum by 2001/03, some of them by a margin of 100% and more. Table 14 also shows that the high levels attained in 2001/03 are the result of a steady increase and that the number of countries above the recommended maximum has increased from four in 1961/03 to 14 to 2001/03.

High salt intake has been identified as an important cause of hypertension and stroke and not only TRS 916 but also other studies have recommended strict intake limits (NAS, 1989; WHO 1990). There is no reason to believe that the CAP had a direct influence on salt consumption in the EU. There is not a single policy measure that would directly influence salt

[32] Almost all naturally occurring unsaturated fatty acids have a "cis" configuration, meaning that the two hydrogen atoms attached to the double bonded carbon atoms are on the same side of the chain. Transfatty acids, in which the hydrogen atoms are on the opposite side of the chain, are produced by hydrogenation, a manufacturing process that increases the degree of saturation of an unsaturated fat and thereby makes it more solid (World Cancer Research Fund, 1997).

[33] Salt is Sodium Cloride ($NaCl$), which by weight is approximately 40% sodium and 60% chloride. Thus, 10g Sodium are about 25g of salt. Salt consumption in Portugal in 2001/03 was there for about 13500 mg, 13.5g.

consumption, either through CAP subsidies or through CAP-related taxes. Salt consumption is, however, to be mentioned here as the health effects of excessive salt consumption are related to those that could be caused or aggravated by CAP measures.

Table 14: Salt consumption (Sodium: mg/p/d)

Country/region	1961/63	1971/73	1981/83	1991/93	2001/03
EU-15	1817	1917	2086	2319	2709
Austria	1391	1511	1787	2152	2455
Belgium-Luxemburg	1931	2240	2313	2516	2665
Denmark	1999	2353	2684	3291	3350
Finland	1762	1955	2162	2861	3438
France	1881	1925	2264	2476	2781
Germany	1796	2039	2217	2362	2503
Greece	1671	1825	2255	2594	3176
Ireland	1599	1709	2091	2864	2760
Italy	1390	1597	1826	2074	2286
Netherlands	2742	2689	2557	2648	3591
Portugal	3834	3790	2487	4547	5404
Spain	1375	1315	1877	1987	2107
Sweden	2568	2825	3005	3002	3379
UK	2199	2139	2095	2192	2789
MED-3	1411	1518	1885	2092	2308
EU-25	1759	1900	2062	2266	2639

Source: Nutrient database, own calculations

2. The Impacts of the Common Agricultural Policy (CAP)

The CAP dates back to the treaty of Rome of 1957[34]. Its objectives were laid out explicitly in The Treaty and in essence encompass five main goals[35]. They include: *(i) increased agricultural productivity; (ii) a fair standard of living for the farming community; (iii) stable markets; (iv) guaranteed security of supplies; and (v) an assurance of reasonable prices to consumers*[36]. With the help of generous producer price support inside the EU, production and productivity goals were accomplished swiftly. And, owing to high protection against foreign competition, domestic agriculture played an important role in achieving these goals.

While consumer interests were mentioned in the Treaty of Rome, in practice the CAP kept a strong focus on agricultural production issues. In fact, only when the agricultural goals had been over-accomplished did the CAP gradually begin to change. Pressure came from two sides. Outside the EU, the disposal of surpluses depressed world prices and created tensions with trading partners. Internally, producer support created expensive intervention stocks and mounting budgetary outlays. The strong production focus also aggravated growing environmental problems, notably excess animal manure and water pollution. Consumer concerns gained momentum only recently. Initially, consumer concerns revolved primarily around food safety problems, most prominently the BSE crisis but also various salmonella and E.Coli epidemics. But more recently, consumer concerns have also included the possible impacts of the CAP on food consumption and the growing problem of overweight and obesity. Over the last five years in particular, the CAP has also been increasingly associated with poor nutritional outcomes, both inside and outside the EU (e.g. Schäfer Elinder, 2003 and 2005). What role the CAP has played on food consumption patterns and overweight and whether and to what extent such concerns are warranted will be examined and evaluated in this section.

2.1 The CAP and its instruments

The traditional instrumentation of the CAP was rather simple. As mentioned, it mainly relied on a combination of high internal support prices and foreign protection (tariffs and variable levies) against more competitive produce from abroad. This allowed the EU to keep prices above equilibrium levels and helped postpone painful structural adjustment processes which would have created additional unemployment and reduced "living conditions for the farming community" and would have reduced incomes in rural areas more generally.

As long as domestic production remained below consumption, the problems of the CAP and the losses it caused in terms of allocation inefficiency and lower consumer surplus were mainly of interest to academics. Public concerns and broader awareness of CAP-caused problems emerged when domestic production began to exceed consumption, forcing resulting surpluses to be bought up and stored in intervention stocks and eventually disposed of on international markets with the help of export subsidies. As a result, the tensions with competitors on the world market escalated.

Eventually, both high budgetary costs and growing international trade tensions created the momentum for a series of successive reforms of the CAP. The first major CAP reform was ushered by the so-called MacSharry plan, conceptualized in 1992 and implemented in 1994.

[34] Until 1987, when the provisions of the Single European Act established the broader unified market, it also remained - besides the creation of the general customs union - the only genuinely common European policy area.
[35] http://www.historiasiglo20.org/europe/traroma.htm
[36] See e.g. Ritson and Fearne, 1984.

The MacSharry reforms were a watershed for the CAP. For the first time the EU succeeded in reducing the level of support prices for a number of major commodities. The core of the reform was a cut of 30% in the cereal intervention price over three years, together with smaller cuts in the institutional prices for beef and butter. These reductions in support prices were compensated by a per hectare payment in the case of cereals, and increased premium payments for beef cows and cattle[37]. The MacSharry reforms were also a watershed as they established a role model for all subsequent CAP reforms. The most important were the Agenda 2000 reforms, the Fischler reforms and the midterm review (MTR) in 2003 as well as a comprehensive reform of the EU's sugar regime in 2005/06.

What all these reform packages had in common was a gradual re-instrumentalization of the CAP. Fundamentally it involved a gradual shift away from open-ended price support to quantity-limited price support. Initially production quotas and co-responsibility fees were employed, but gradually the CAP moved on to increasingly production-decoupled support, mainly through direct payments. This process of re-instrumentalization has brought markets back into equilibrium and most EU prices back in line with international ones. Initially, the price convergence process was the result of successive price reductions in the EU. More recently, convergence has largely resulted from price increases on international markets, inter alia driven by demand for food in Asia and non-food (bioenergy) world-wide. For more effects on this more recent developments and their likely long-term evolution see e.g. Schmidhuber (2006).

The analysis of the CAP in this paper will (i) provide estimates for the degree of price distortions for the food sector as a whole (ii) evaluate taxation effects across different commodity markets (iii) and evaluate the efficiency of CAP measures with regard to consumption distortions across the food value chain.

2.2 How important is CAP for food consumers?

Measuring impacts of policy distortions across a considerable variety of different instruments and over a multitude of commodities faces the same principal challenge as measuring the quality of a diet over a great variety of different foods, i.e. the need to aggregate different measures up to a uniform unit of measurement that is comparable over time and across different countries. Faced with this problem, OECD countries agreed to measure support to their agriculture and taxation on their consumers through the so-called Producer and Consumer Subsidy Equivalents (PSEs and CSEs), later renamed to Producer and Consumer Support Estimates. The acronyms PSEs and CSEs remained unchanged[38]. The OECD defines PSEs as *"an indicator of the annual monetary value of gross transfers from consumers and taxpayers to support agricultural producers, measured at farm gate level, arising from policy measures, regardless of their nature, objectives or impacts on farm production or income*", while CSEs are "*an indicator of the annual monetary value of gross transfers to (from) consumers of agricultural commodities, measured at the farm gate (first consumer) level, arising from policy measures which support agriculture, regardless of their nature, objectives*

[37] The 1992 reform introduced a set-aside scheme in the arable sector which allowed the Commission to curtail the arable area and gain control of surpluses in that sector. The reform also included three accompanying measures, including an early retirement scheme, an agri-environment scheme and a scheme for afforestation, designed to reduce production capacity and to improve the structure of farming. More details are available from the webpage of the Institute for international Integration Studies, University of Dublin, Trinity College: http://www.tcd.ie/iiis/policycoherence/index.php/iiis/eu_agricultural_policy_reform/the_cap_reform_process.

[38] PSEs and CSEs are computed and published annually by the OECD and are available for all important agricultural commodities and all OECD member countries from 1986 onwards. For details see "Agricultural Policies in OECD countries", various years.

or impact on consumption of farm products[39]. *(OECD, Monitoring Agricultural Policies in OECD countries, various issues)*"

CSEs therefore represent a comprehensive and consistent measure to gauge the impacts of agricultural policies on "*first*" food consumption. It includes all elements of taxation and support to food consumers at the primary product level (*"first consumer"*). Applying this definition, the OECD calculates that the CAP provided a *net* tax on EU consumers to the tune of more than €48 billion or €127 per person in 2001/03 (Table 15). Table 15 also shows that €48 billion net distortions are the result of a large tax of €52.5 billion and a much smaller subsidy of nearly €4 billion, of which only about €3.2 billion are relevant in the context of promoting food consumption. Of the massive tax of €52.5 billion, €52 billion are largely due to the fact that EU prices have been kept above international ones.

Table 15: Taxation and subsidies to EU consumers through the CAP for 2001/03

	Million €	€/person/a
1. Taxes		
• Taxes through higher prices than world prices	**-51,904**	**-136.8**
• Other taxes on consumers	-698	-1.8
2. Subsidies		
• Subsidies from taxpayers to consumers	**3,762**	**9.9**
• Excess feed cost (not relevant as a food tax/subsidy)	570	1.5
Net effect (total tax)	**-48,271**	**-127**

Source: OECD, own calculations

2.2.1 The commodity specificity of food taxation through the CAP

The overall CSE tax of €52 billion hides important commodity-specific differences. These differences, their per capita equivalents and their evolution over time are summarized in Table 16[40]. The results are ordered by the level of taxation in 2001/03.

The estimates for 2001/03 in Table 16 summarize a number of important features of the current or rather recent state of the CAP, the comparison with previous years showing the impacts of various CAP reforms. Taxation of consumers through higher prices has become a highly concentrated and food-specific issue over time. In 2001/03, milk and meat together accounted for more than 87% of total consumer price taxation (€34.4 billion of €39.6 billion), milk alone for more than 40% (€16.3 billion). This means that consumers paid €34.4 billion more for milk and meat products than they would have paid in the absence of the CAP[41]. Milk and beef alone account for two thirds of all price related taxation faced by EU consumers. This concentration on animal products was the result of various rounds of CAP reforms,

[39] http://stats.oecd.org/glossary/detail.asp?ID=2150

[40] The sums of the commodity-specific amounts of support do not add-up to the totals in table 1. The reasons are threefold: first table 2 only includes the price taxation effects, without including any other form of taxation/support. Second, only foods have been included in the list and third, even if all individual commodities had been included, the sum of the individual estimates would still be below the figures in Table 16 as commodity coverage of the PSE calculations is limited and total support is prorated from the explicitly estimated commodities to arrive at an estimate for support/taxation for all agricultural products.

[41] It is important to note that PSEs and CSEs systematically overestimate the true level of price distortions, particularly where large country assumptions apply. For EU milk and meat, this is clearly the case. The overestimation of distortion results from the effect that the EU policy distortions have on the world markets of these commodities: a complete abolition of the policy distortions for milk and meats in the EU would raise world prices for those products and would thus render a smaller than the implicit consumer tax through the CSE/PSE price wedge.

which initially aimed at reducing price support for cereals and left other sectors such as milk and beef largely untouched. Regardless of the changes over time, the estimates underscore the key message that consumers have been taxed through the CAP rather than subsidized. That is a key message and invalidates from the outset that the CAP was the main culprit for rising overweight and obesity problems (Schäfer Elinder, 2003).

Table 16: CAP Consumer taxation across for different foods in the EU

	1986/88 (EU-12)				**2001/03** (EU-15)			
	Total	per person	Share	cum. Share	Total	per person	Share	cum. Share
	(mill €)	(€)	%	%	(mill €)	(€)	%	%
Oilseeds	0	0	0.0	0	0	0	0.0	0
Eggs	900	2.7	1.7	1.6	0	0	0.0	0.0
Wheat	6254	18.4	11.4	13.1	157	0.4	0.4	0.4
Rice	377	1.1	0.7	13.8	180	0.5	0.5	0.9
Potatoes	619	1.8	1.1	14.9	444	1.2	1.2	2.0
Coarse Grains	7043	20.7	12.9	27.8	559	1.5	1.4	3.4
Sheep	2497	7.4	4.6	32.3	1113	2.9	2.8	6.2
Sugar	2699	7.9	4.9	37.3	2739	7.2	6.9	13.1
Poultry	2950	8.7	5.4	42.7	3179	8.4	8.1	21.1
Pork	4473	13.2	8.2	50.9	4401	11.6	11.2	32.2
Beef	10208	30.1	18.7	69.5	10470	27.6	26.5	58.7
Milk	16667	49.1	30.5	100.0	16373	43.2	41.5	100.0
Total	**54686**	**161**	**100.0**		**39615**	**104**	**100.0**	

Source: OECD, own calculations

As explained, a traditional CAP measure was to create a positive price wedge between EU and international prices. By how much CAP prices have exceeded those on international markets is available from Table 17. The price ratio calculated in Table 17 shows how much more *first* consumers in the EU have to pay for foods compared to what they would pay in the absence of the CAP. It could essentially be interpreted as the commodity-specific "tax rate" of the CAP on the "*first* consumer" relative to consumers on the world markets. The results are consistent with the taxation patterns presented in Table 16, i.e. the "tax rates" are largely in line with the overall amounts of extra expenditures shouldered by the consumer. The high overlap between "tax rate" and "tax burden" over time could be seen as a first indicator that demand is relatively inelastic, i.e. that higher price caused by CAP taxation did not change consumption. That means that while the CAP has certainly not stimulated overall food consumption in the EU, the curbing effects of its higher food prices may not have been particularly pronounced either.

An important exception to this pattern could be sugar (Table 17). Sugar consumers have been paying two or even three times more than they would have paid in the absence of the CAP; other things being equal, this high tax on EU sugar consumers was a reason why sugar consumption remained relatively subdued in the EU, on average just a bit more than half of the consumption levels recorded in countries with comparable GDP levels such as the US. Whether the low consumption levels are indeed the result of the CAP taxation effect will be seen when the (administrative) prices for sugar will be reduced by nearly 40% in the course of the reforms of the sugar market reforms decided upon in 2005/06[42]. Of course, this presupposes that market price developments for the *final* consumers follow those for the *first* consumers.

What does all this mean for a healthy diet in the EU? First, the CAP has not been encouraging over-consumption; if anything, it had the effect of a tax on food consumption. Second, and more interestingly, the CAP taxed particularly strongly those foods that are generally associated with adverse health effects, notably sugar, milk and dairy products (butter) as well as meat, particularly beef. In terms of nutrients, the CAP appeared to have placed a particularly strong tax on saturated fats, cholesterol and sugar, i.e. those nutrients that are generally associated with particularly adverse health impacts. This may be a surprising result from a nutrition policy perspective, it was however not done by design; the beneficial nutritional outcome is merely a windfall benefit that emerged from the pursuit of (unrelated) agricultural policy goals.

Table 17: International-to-domestic price distortions through the CAP

	Domestic price distortions Ratios of EU prices to international ones			Internal distortions of relative prices (relative to EU wheat prices)		
	1986-88	**1994-96**	**2001-03**	**1986-88**	**1994-96**	**2001-03**
Wheat	2.14	1.14	0.98	1.0	1.0	1.0
Rice	2.43	1.84	1.32	1.1	1.6	1.3
Coarse grains	2.33	1.41	1.05	1.1	1.2	1.1
Oilseeds	1.0	1.0	1.0	0.5	0.9	1.0
Potatoes	1.17	1.15	1.1	0.5	1.0	1.1
Milk	**2.76**	2.14	**1.84**	1.3	1.9	1.9
Beef	**2.25**	1.63	**2.54**	1.1	1.4	2.6
Pig meat	1.38	1.17	1.25	0.6	1.0	1.3
Poultry	1.79	2.07	1.55	0.8	1.8	1.6
Sheep meat	2.86	1.59	1.36	1.3	1.4	1.4
Eggs	1.4	1.22	1.04	0.7	1.1	1.1
Sugar	**3.32**	2.13	**2.75**	1.6	1.9	2.8

Source: OECD, own calculations

2.2.2 CAP subsidies to food consumers

The CAP is not only taxing food consumers in the EU but subsidizing them too. As already seen from Table 15, the subsidies are, however, small compared with the taxation, accounting for merely €3.7 billion as compared to the €51 billion tax. Still, these subsidies have attracted

[42] From an agricultural policy perspective, the reform of the sugar market regime was undoubtedly an important step towards improving the transfer efficiency of subsidies to farmers, creating allocation efficiency gains for EU agriculture and a more level playing field in the international sugar market. From a nutritional perspective, however, it provides an incentive to consume more sugar and thus a food that is already at or above the recommended maximum of 10% of dietary energy supply. In fact, it may be argued that high sugar prices of the old CAP were a contributing factor to the relative benign carbohydrate consumption patterns in the EU and the relatively low glycemic load of the EU diet (see section 1 of this paper). More generally, recent and ongoing reforms of the CAP with a growing reduction in producer price support (and thus consumer taxation) will have a consumption stimulating effect in the EU and should at least from a nutritional perspective (and probably only from a nutritional perspective) not be welcomed.

much attention (e.g. Lang, 1996 or Elinder, 2003b). It may thus warrant examining them in detail.

Table 18 provides an overview of consumer subsidies across commodities while Table 19 gives a detailed account of how subsidies have been allocated to different consumers for milk and dairy products, probably the most controversially discussed subsidies (see e.g. the controversy about school milk subsidies in Sweden). Ignoring the commodity patterns of subsidies at first, Table 18 suggests that the total amount of subsidies afforded to EU consumers through the CAP was about 4.4 billion in 2001/03. For food alone, i.e. excluding cotton and other non-food items, the total was €2.9 billion. Table 18 also shows that these consumer subsidies have been declining over time. From 1986/88 to 2001/03 food subsidies have fallen from €3.66 to €2.89 billion or about 21% in nominal terms. Discounting the food subsidies by the average EU CPI, the decline was as high as 48% in real terms. That means that by 2001/03, the economic value of these subsidies had declined to about half of what it was in 1986/88[43].

Also from evident from Table 18 is a strong and growing concentration of the subsidy allocation across commodities. If subsidies for non-food items are excluded, two commodity groups account for 80% of the remaining food subsidies (€2.9 billion). The two groups are milk and butter with €1.03 billion and fruit and vegetables with €1.3 billion. Whether these subsidies are good or bad from a nutritional perspective and whether they refer to food consumption only is not *a priori* evident; a first indication of their nutritional impacts can be obtained from a breakdown of the allocations to the final recipients of these subsidies, as seen in Table 19.

Table 18: Transfers from EU Taxpayers to EU Consumers[44]

	1986/88 (EU-12)	**1994/96**	**2001/03 (EU-15)**
		Million Euros	
Total	**4387**	**4146**	**3762**
Food (excluding cotton)			
Cereals	310	286	249
Oilseeds	32	0	0
Sugar	-361	-138	248
Sugar storage levies (net)	-65	-24	99
Sugar chemical industry levies (net)	1	67	157
Milk and butter	**2169**	**1549**	**1035**
Olive oil	388	365	26
Cotton	723	1100	874
Fruit and vegetables (excl. wine)	**817**	**688**	**809**

Source: OECD, own calculations

Table 19 shows that only about half of all milk and butter subsidies are actually going to food consumption, the rest is provided to promote the use of skim milk powder (SMP) in animal feed rations. As far milk and butter consumption is concerned, there are good reasons to assume that these are undesirable from a nutritional perspective. Both subsidies to promote school milk and butter consumption have received much negative publicity. Particularly negative was the fact that school milk was full-fat content, which provided not only too many

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[43] The decline was even steeper on a per capita basis as the 2001/03 average refers to the EU-15, while the 1986/88 estimates which are based on transfers within the EU-12.

[44] A complete breakdown of all individual transfers from taxpayers to consumers is provided in Annex Table A1.

calories but also too much saturated fat. Having said that, school milk consumption may directly compete with soft drinks which are, from a nutritional perspective, by no means better. The controversy could probably easily be resolved by limiting school milk subsidies to low-fat milk. Notwithstanding such isolated adverse effects of the CAP, and notwithstanding the superior targeting of measures such as subsidized school milk, the subsidies given to consumers are just a tiny fraction (less than one tenth) of the taxation effect consumers have been confronted with.

Table 19: Subsidies to milk consumers through the CAP[45]

	1986-88	2001-03
	EU-12	EU-15
	(million Euros)	
Milk and butter, total	**2,169**	**1,035**
Other measures relating to butterfat	232	454
School milk	165	77
Aid for SMP for use as feed for calves	901	246
Aid for liquid skimmed milk for use as feed for calves	112	0
Aid for SMP for use as feed as animals feed not for	0	0
Aid for liquid skimmed milk for use as animal feed not for calves	179	0
Aid for skimmed milk processed into casein	580	258
Aid for powdered milk with 10% fat for use as feed for calves	0	0
Other Aid (milk)	0	0

Source: OECD, own calculations

As far as butter subsidies are concerned, the same nutritional rationale applies. Butter is a main source of saturated fat and subsidizing its consumption makes no sense from a nutritional perspective; this is particularly so when intake levels are already above the recommended maxima. Even so, these subsidies are small compared to the taxation effect of the CAP and their market effects are such that they are unlikely to have caused any major damage from a nutritional perspective. The intention of subsidizing butter was to dispose of temporary or structural butter surpluses by giving both private households and the food industry and incentive to replace otherwise cheaper vegetable fats with butter, butter oil and fat. There is some evidence that private households took advantage of temporarily lower prices butter prices: they stored cheaper butter in their freezers and used it once subsidies had lapsed.

The adverse nutritional effects of butter subsidies in the food industry may have been limited for different reasons. When butter replaces vegetable fats in the food industry, it often replaces shortenings and other hydrogenated fats. Hydrogenated fats and oils are, however, not only a source of saturated fats. They are also the main source for trans-fatty acids. To the extent that trans-fats have been reduced, subsidies to increase butter consumption may even have had a positive nutritional outcome.

The second food rubric where consumption subsidies played an important role in the CAP is fruit and vegetables. In general, higher consumption of fruit and vegetables is a highly desirable nutritional outcome and positive health effects may justify otherwise undesirable market interventions. The particular benefits of these subsidies arise from the fact that they aimed to improve access for low-income groups, i.e. consumer groups that typically consume less than the recommended 400g/p/d. Against these benefits stand the impacts of higher prices

[45] Further details are available from Table A1, Annex

for fruit and vegetables caused by intervention purchases and tariff protection against less expensive foreign supplies. In total, the EU spent about €1.5 billion[46] to support the fruit and vegetable sector in 2001/03, up from less than €1 billion in 1986/88.

2.3 The impacts of the CAP on *final* food consumption

The potentially positive nutritional effects of the CAP raise the question of whether agricultural policies in other countries have engendered comparable nutritional results. On the face of it, a positive relationship between low BMI and high CSE taxation appears to exist. Figure 5 **Error! Reference source not found.**depicts this relationship. It suggests that a high tax imposed by agricultural policies on consumers is correlated with a low incidence of overweight and obesity and vice versa. What is, however, unclear is whether *correlation* is also *causation* and, if a causal relationship really exists, how efficient agricultural policies are in pursuing nutritional goals.

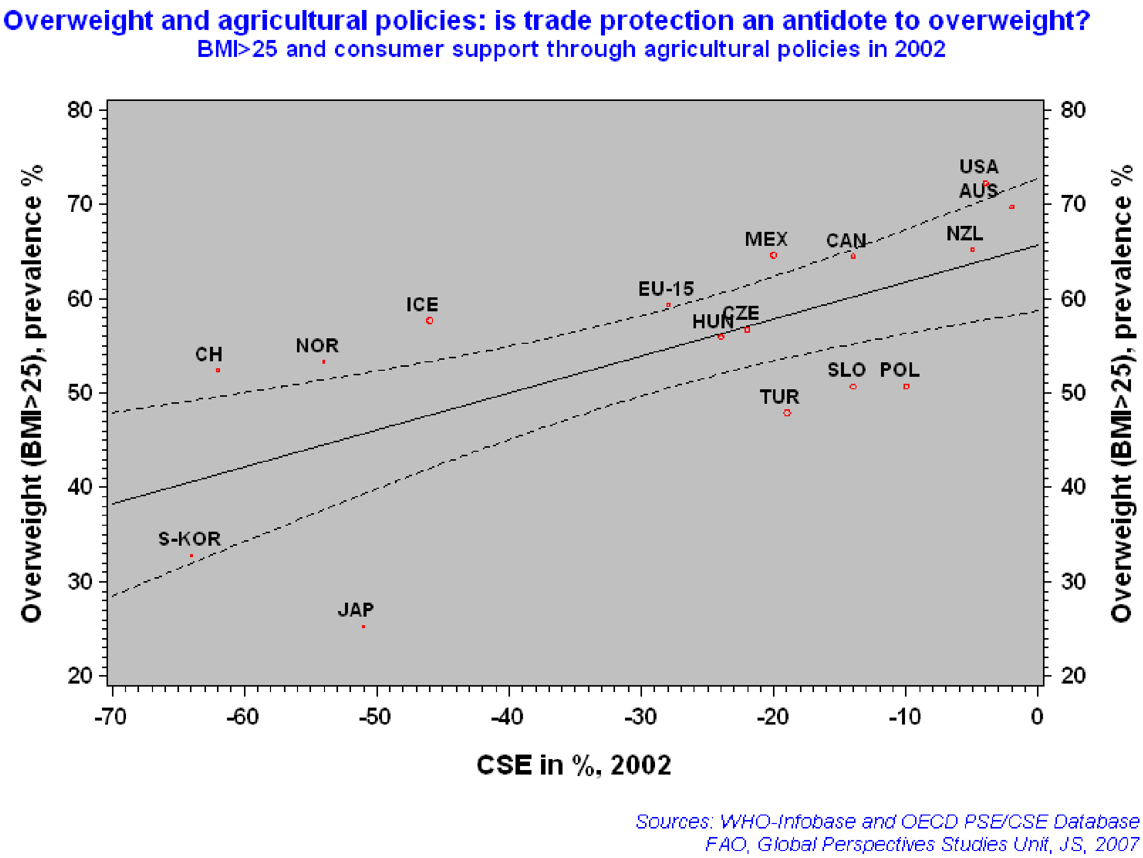

Figure 5: Taxes on first consumers and body weights in OECD countries

To answer this question it is crucial to understand how and to what extent changes in the first consumer price affect *final* consumer prices; the extent of vertical price transmission depends to a large measure on the margins for processing, marketing, distribution, etc. Where margins between the first and final consumption are high, the effect of the CAP tax on the final consumer price should be low and vice versa. Clearly, these margins are highly country- and commodity-specific. They are generally lower in developing countries and higher in

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[46] Total expenditure for the sector in the European Agricultural Guarantee and Guidance Fund (EAGGF).

developed ones, reflecting higher processing and marketing margins. For the EU, foods such as cereals fall into the high margin rubric, products such as milk, butter or eggs into the lower margin category.

Figure 7a and Figure 7b schematically illustrate the effects of high and low margins in the transmission of price signals from the producer level to the final consumer price. In the high margin case, a 20% producer price increase results in only a 10% consumer price increase, in the low margin case it is 15%. In reality, these service margins are much higher, at least in the EU. For instance, the value chain margins between bread and wheat add up to a multiple of 20 relative to the price of wheat; that means that even a 100% increase in the wheat price would

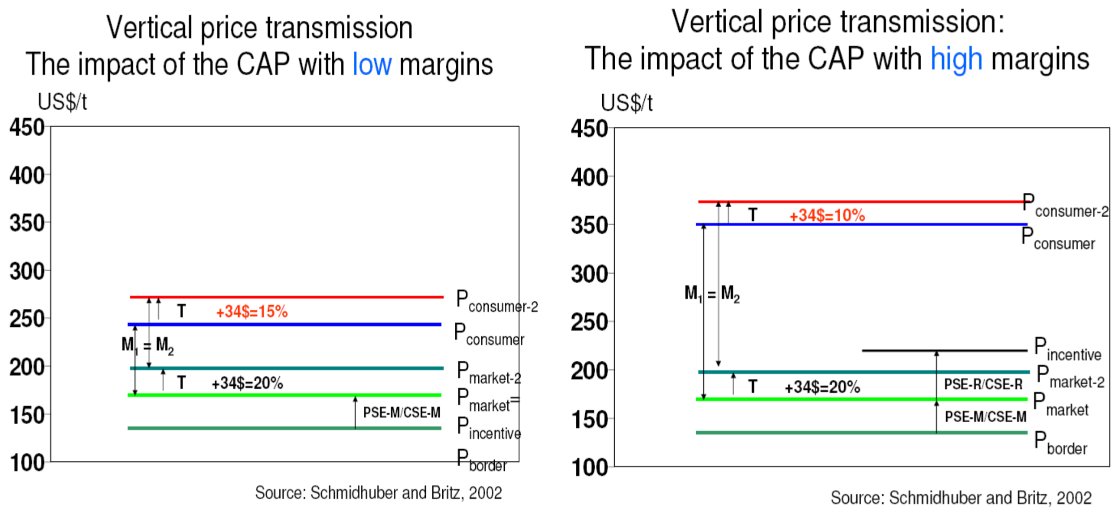

Figure 7 a/b: The mechanics of vertical price transmission at low and high margins

translate – *ceteris paribus* - into a mere 5% increase in the bread price. The value chain margins for the same process would obviously be smaller in low-income countries so that price transmission would therefore be more pronounced. Margins are also higher for other products such as eggs or meat, where value added through processing and distribution is relatively less important.

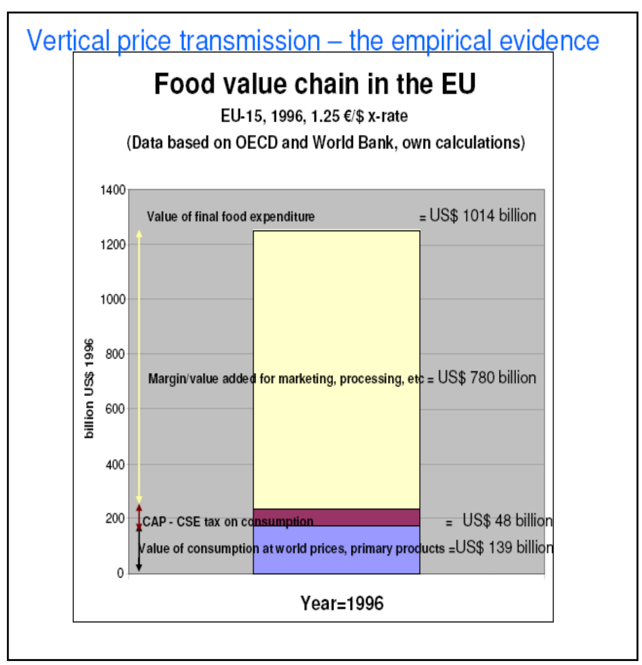

Figure 6: Vertical price transmission in the EU

The real importance of the aggregate margin for all products and all EU member countries is illustrated in Figure 6. Evaluated at world prices, the value of primary food products used to produce final foodstuffs in the EU was about US$140 billion in 1996. The CAP, which applies as a tax on this primary product level, adds another US$48 billion to the value primary product consumption at world prices (Figure 6); this amount is akin to the value of the aggregate CSE tax of the CAP. The value of food consumption at world prices plus the CSE tax amounts to US$187 billion and is the value that *first* consumers pay before they add their services to the value of primary products.

When food is eventually sold at the retail level, EU *final* consumers pay more than US$1000 billion for it, i.e. the sum of the value of primary products, the CSE tax and the value added margins. On aggregate, these value chain margins were more than four times the value of the primary product and accounted for three quarters (US$780 billion) of the final value of food sold at the retail level. Differently put, the final consumer spends more than five times the value of the first consumer, even after the CSE tax has been added to the expenditures of the first consumer.

With the main elements of vertical price transmission available, one can start making educated guesses about the efficiency of agricultural policies in taxing final food consumption. The high margins mean that even a complete removal of the CSE tax would lower aggregate food prices at the retail level by merely 5% and would thus be unlikely to stimulate food consumption. The same holds for raising the CSE tax. Even if the CSE tax were twice the 1996 level, it would have lifted – *ceteris paribus* – food prices by merely 5% and thus hardly curbed consumption. This suggests that the CAP would hardly be an efficient tool in changing food consumption in the EU; moreover, given the low price responsiveness of aggregate food consumption (low price elasticities of demand) these small changes in final consumer prices should render even smaller percentage changes in food consumption. All in all, this suggests that if the CAP has reduced food consumption in the EU, the effects should have been small. Extending the same logic to other OECD countries, the correlation depicted in Figure 5 may not necessarily or at least not fully reflect a causal relationship. At any rate, it does not support the notion that high farm subsidies have been causing a poor nutritional outcome, either in the EU or elsewhere in the OECD.

The low efficiency of the CAP as an instrument in affecting food consumption raises the question regarding more efficient tools and taxes. Alternative measures and their efficiency and effectiveness have been discussed in Schmidhuber (2004) and Schmidhuber (2006). Dealing with these alternatives would exceed the realm of a paper that deals with the CAP and thus with the effects of policy distortions on the *first* consumer.

3. Summary and conclusions

Over the last 40 years, the European diet has undergone fundamental change. From a health perspective, change often meant deterioration. The EU diet has become too rich in overall energy, it contains too much fat, particularly too much saturated fat and cholesterol, and too much salt. The average EU diet has also become too sweet, albeit growth in sugar consumption was less pronounced than for many other foods or nutrients such as fat or salt. Overall, more and more fat has replaced carbohydrates in the diet and the energy density of the diet increased. Amid these problems, there are also some important improvements. Most importantly, fruit and vegetable consumption increased in all member countries and now exceeds the minimum consumption level of 400g/p/d, recommended by WHO and FAO. And, while overall fat consumption rose considerably above the recommended maximum of 30% of the dietary energy supply, all countries experienced an improvement in the quality of the fat consumed and an increase in poly-unsaturated fats to the recommended range of 6-10% of food energy.

The developments for the EU as a whole mask important country-specific differences. Mediterranean countries saw the sharpest deterioration of their diet; particularly fat consumption and overall energy intake increased so strongly, that intakes levels are now at or even above EU averages. For many criteria, they are above the recommended maxima. As a result, the famous Mediterranean diet is increasingly hard to distinguish from the average EU food consumption pattern. And, as the Mediterranean diet converged to the EU average, it lost much of its health appeal. These changes have gone parallel to a rapid rise in the prevalence of overweight and obesity, with Greece boasting the highest rates of all EU countries.

These dietary changes evolved in the presence of a highly distorted *primary* food *production* system, the Common Agricultural Policy. Diet deterioration amid policy distortions has given rise to concerns that agricultural policies were the main culprit for the deterioration of the diet, or at least an important contributing factor. The empirical analysis undertaken in this paper does not support such claims. While some instruments (subsidized butter or school milk consumption) could have increased unwanted fat and calorie intake, their overall subsidy effect remained too small to be a key factor. What is more, consumption incentives generally declined over time. The empirical analysis also suggests that the main instruments of the CAP should even have curbed food consumption, rather than stimulated it, notably of saturated fats and sugar.

One of the main factors that has put a brake of food consumption is, or rather was, the high-price policy of the CAP. The CAP keeps EU prices above world levels and thus amounts to a tax on consumption. The tax for first consumers reached a level of €48 billion in 2001/03 before CAP reforms lowered but not completely eliminated this taxation effect. While €48 billion appear a vast tax on food consumers at first, the CAP is not a very effective tax on final consumption. CAP instruments apply predominantly to *first* consumers. Final consumers spend more than €1000 billion on food, which dwarfs the overall tax to 5% of overall food expenditures. This also means that the overall effect in curbing consumption was small. And it means that the CAP and other CAP-like instruments do not offer an efficient way of changing food consumption patterns. They have not contributed to deterioration, nor have they had a particularly beneficial effect, at least on EU consumption. More important drivers for changes in consumption patterns and excess consumption are more likely to be found in the overall increase in income, the rise of supermarkets and changes in food distribution systems, women's participation in the work force, and the growing importance of food consumed outside home, including in fast food restaurants.

While consumers in the EU have not been negatively affected by the CAP, this may not be true for consumers in third countries, particularly in food-importing developing countries. While the CAP held prices above their equilibrium levels within the EU, it contributed to depressed world prices outside the EU. High tariffs and their import substitution effect and later export surpluses and export subsidies kept world prices below levels that would have otherwise prevailed. Lower service and distribution margins in the value chain of these countries mean that the price effects of the CAP on first consumers there had a more important impact on final food consumption. Where and when recipient countries have been exposed to food deficits, these subsidies have often been justified as a means of fighting hunger. The argument gains appeal where countries have gradually exhausted their own agricultural production base (NENA). When the nutritional situation advanced, artificially low food prices boosted food consumption and may have contributed to excess consumption. The vast increase in overall calories and the glycemic load of the diets in the Near East-North Africa region may have been caused or aggravated by this CAP effect.

For the ongoing reforms of the CAP, the analysis reveals an interesting conflict of interest, albeit hardly perceived as such. Economists have made the case for CAP reforms on the basis that the CAP has created not only an unduly high burden on taxpayers but also on consumers; benefits of CAP reforms for consumers would arise from cheaper food, economist gauged these benefits in terms of an increased *consumer surplus*. These arguments certainly hold true when the possible externalities of excess food consumption can be neglected. Reforms of the CAP and decoupling of support would however also lower food prices and, *ceteris paribus*, result in higher consumption. It is therefore surprising that nutritionists (e.g. Schäfer Elinder, 2003a) have asked for the same reforms as, from the perspective of curbing excess food consumption in the EU, they should have a vested interest in keeping the CAP.

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Annex

Table A1: Transfers from Taxpayers to Consumers through the CAP, Details

	1986	1987	1988	2001	2002	2003
	EU-12			EU-15		
	Million Euros					
Total Transfers to consumers from taxpayers	**4,323**	**4,532**	**4,305**	**3,676**	**3,645**	**3,963**
Cereals	**299**	**418**	**307**	**232**	**227**	**287**
Production refunds for starch for cereals	181	312	240	20	4	0
Compensatory payments & premiums for potatoes starch	54	81	61	212	223	287
Refunds for oilseeds	64	25	6	0	0	0
Production refunds for starch for rice	0	0	0	0	0	0
Sugar	**-437**	**-336**	**-311**	**273**	**162**	**310**
Refunds on sugar used in the chemical industry	5	33	63	134	157	200
Measures to aid the disposal of raw sugar	0	15	21	16	14	20
Other intervention for sugar	0	2	3	59	40	36
Sugar production levies	-370	-336	-327	-342	-216	-142
Sugar storage levies (net)	-77	-78	-39	281	17	0
Sugar chemical industry levies (net)	5	28	-32	125	150	196
Milk and Dairy Products	**2301**	**2189**	**2015**	**1020**	**979**	**1104**
Other measures relating to butterfat	202	252	241	460	459	444
School milk	150	193	151	81	74	76
Aid for SMP for use as feed for calves	1,001	851	850	217	253	267
Aid for liquid skimmed milk for use as feed for calves	123	106	107	0	0	0
Aid for SMP for use as feed for animal other than calves	0	0	0	0	0	0
Aid for liquid skimmed milk, feed for animals other calves	277	207	54	0	0	0
Aid for skimmed milk processed into casein	548	580	612	262	193	317
Aid for powdered milk with 10% fat for calves	0	0	0	0	0	0
Other Aid (milk)	0	0	0	0	0	0
Olive oil & table olives	**254**	**478**	**432**	**21**	**27**	**29**
Consumption aid for olive oil	217	438		0	0	0
Schemes related to consumption (olive oil)	1	2	10	0	0	0
Other intervention for olive oil	36	38	0	21	27	29
Table olives	0	0	0	0	0	0
Fruit and vegetables	**908**	**899**	**644**	**770**	**821**	**835**
Comp. for withdr. & buying in and for free distrib. oper.	338	417	169	117	61	33
Compensation to promote Community citrus fruit	27	22	11	343	389	452
Compensation to encourage processing of citrus fruit	127	93	54	0	0	0
Production aid for processed tomato products	250	210	251	223	278	269
Production aid for fruit-based products	160	150	159	71	85	75
Production aid for tinned pineapple	6	7	0	6	0	0
Other intervention (fruits and vegetables)	0	0	0	0	0	0
Free distribution of fruits and vegetables	0	0	0	10	8	6
Wine and rum	**462**	**599**	**724**	**376**	**421**	**297**
Distillation of wine	406	508	627	304	346	223
Compulsory distillation of the by-products of wine making	56	91	97	72	75	74
Promotion of consumption (wine)	0	0	0	0	0	0
Processing of rum (POSEIDOM)	0	0	0	0	0	0
Miscellaneous	**532**	**285**	**494**	**982**	**1010**	**1101**
Consumption aid for dairy products (POSEIMA)	0	0	0	69	50	63
Distribution of various products to most deprived in the EU	0	0	66	180	156	165
Cotton	532	285	428	733	804	873

Source: OECD, PSE/CSE Calculations

Table A2: Carbohydrate consumption, availability in grams/person/day

Country/region	**1961/63**	**1971/73**	**1981/83**	**1991/93**	**2001/03**
EU-15	392	392	380	389	422
Austria	433	402	380	395	431
Belgium-Luxemburg	368	367	382	417	426
Denmark	406	379	374	404	426
Finland	419	398	361	376	381
France	411	380	369	379	397
Germany	366	386	399	403	430
Greece	419	445	455	456	470
Ireland	482	464	450	462	455
Italy	440	473	433	423	441
Netherlands	406	387	363	410	428
Portugal	396	429	367	444	467
Spain	411	389	375	375	378
Sweden	355	369	366	387	396
UK	411	394	378	387	430
MED-3	428	440	414	408	420
EU-25	403	402	390	396	425

Source: FAOSTAT-1, own calculations

Table A3: Share of calories from protein (total) in total Dietary Energy Supply

Country/region	**1961/63**	**1971/73**	**1981/83**	**1991/93**	**2001/03**
EU-15	11.6	11.8	12.3	12.5	13.0
Austria	11.8	11.8	12.3	12.7	13.0
Belgium-Luxemburg	12.0	12.0	12.1	11.7	10.6
Denmark	11.1	10.8	12.2	13.8	13.9
France	12.5	12.5	13.7	13.5	14.1
Germany	13.0	13.1	13.5	13.3	13.4
Greece	12.0	12.3	12.8	12.3	12.5
Ireland	11.4	11.5	12.0	12.2	12.5
Italy	11.9	12.1	12.4	12.0	12.9
Netherlands	11.1	11.5	12.5	13.1	13.2
Poland	11.7	12.1	13.1	13.3	13.3
Portugal	12.2	12.2	11.7	13.6	14.0
Spain	12.0	12.4	13.2	13.7	14.3
Sweden	12.8	13.0	13.8	13.6	14.2
UK	11.6	11.7	11.6	12.0	12.6
MED-3	11.4	11.8	12.7	13.2	13.5
EU-15	11.7	11.9	12.3	12.5	12.9
EU-25	11.8	11.8	12.3	12.7	13.0

Source: FAOSTAT-1, own calculations

Table A4: DES levels: FAOSTAT Food Balance Sheets versus Nutrient database (SR-18)

	Nutrient data base			FAOSTAT-FBS			percentage difference		
	1961/63	1981/83	2001/03	1961/63	1981/83	2001/03	1961/63	1981/83	2001/03
AUT	3211	3372	3727	3211	3366	3742	0.00	-0.19	0.41
BL	2997	3448	3708	2971	3358	NA	-0.86	-2.64	NA
CYP	2385	2819	3177	2422	2891	3244	1.56	2.56	2.10
DEN	3088	3131	3416	3130	3088	3451	1.37	-1.38	1.02
EST	NA	NA	3131	NA	NA	3157	NA	NA	0.84
FIN	3067	2915	3052	3163	3044	3153	3.15	4.43	3.32
FRA	3230	3445	3657	3237	3433	3643	0.22	-0.33	-0.38
GER	2904	3346	3500	2920	3359	3490	0.55	0.38	-0.29
GRE	2939	3590	3848	2796	3407	3682	-4.86	-5.11	-4.30
HUN	3085	3496	3506	3091	3498	3503	0.18	0.05	-0.09
IRE	3484	3661	3752	3368	3574	3694	-3.33	-2.39	-1.53
ITA	3027	3470	3730	2979	3418	3670	-1.56	-1.51	-1.62
LAT	NA	NA	2910	NA	NA	3019	NA	NA	3.72
LIT	NA	NA	3325	NA	NA	3372	NA	NA	1.41
MAL	2973	3231	3587	2900	3194	3527	-2.42	-1.14	-1.68
NL	3082	3043	3469	3062	3032	3439	-0.63	-0.39	-0.88
CZR	NA	NA	3199	NA	NA	3244	NA	NA	1.39
POL	3232	3329	3282	3286	3355	3367	1.67	0.79	2.60
POR	2629	2857	3821	2565	2812	3753	-2.45	-1.58	-1.78
SLO	NA	NA	3014	NA	NA	2969	NA	NA	-1.49
SLK	NA	NA	2816	NA	NA	2825	NA	NA	0.34
ESP	2747	3111	3462	2673	3046	3405	-2.68	-2.09	-1.64
SWE	2855	3027	3231	2818	2975	3157	-1.32	-1.72	-2.30
UK	3304	3103	3407	3285	3155	3444	-0.57	1.67	1.08
MED3	2922	3351	3642	2857	3282	3572	-2.23	-2.07	-1.91
MED6	2893	3305	3653	2829	3239	3585	-2.23	-2.01	-1.88
EU-10	3183	3359	3248	3224	3380	3303	1.29	0.63	1.72
EU-15	2951	3197	3562	2932	3181	3534	-0.66	-0.50	-0.76
EU-25	2977	3216	3511	2964	3204	NA	-0.42	-0.37	NA

Table A5: World ***production*** of olive oil* ('000 tonnes)

	EU	Turkey	Syria	Tunisia	Morocco	Other	TOTAL	EU/total
1995/96	1.518	46	84	65	40	97	1.849	82,1%
1996/97	1.899	203	125	291	85	107	2.710	70,1%
1997/98	2.294	41	70	95	74	56	2.630	87,2%
1998/99	1.838	171	115	222	69	130	2.545	72,2%
1999/00	1.873	54	81	220	44	120	2.392	78,3%
2000/01	2.090	176	165	135	38	121	2.725	76,7%
2001/02	2.650	66	92	37	64	110	3.019	87,8%
2002/03(1)	2.004	142	165	73	43	125	2.552	78,5%

Source: International Olive Oil Council (IOOC).

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Table A6: World ***consumption*** of olive oil* ('000 tonnes)

	EU	USA	Japan	Australia	Canada	Other	Total	EU/total
1995/96	1.402	105	17	17	14	374	1.928	72,7%
1996/97	1.687	144	26	22	19	473	2.371	71,2%
1997/98	1.841	152	34	18	18	485	2.548	72,2%
1998/99	1.824	159	29	24	19	501	2.556	71,4%
1999/00	1.844	174	28	24	20	480	2.570	71,8%
2000/01	1.918	212	30	31	25	497	2.713	70,7%
2001/02	1.994	221	32	28	24	461	2.760	72,2%
2002/031	2.028	225	33	29	26	490	2.831	71,6%

*Including olive pomace oil.

Source: International Olive Oil Council (IOOC).

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Box A1: Creating a nutrient data base

The main "ingredients"

The nutrient consumption data presented in this paper have been derived from a combination of food availability data from FAO's supply-utilization accounts (SUAs) and nutrient contents of the various food items from the "USDA National Nutrient Database for Standard Reference, Release 18" (USDA SR18). FAOSTAT-1 SUAs distinguish up to 444 different primary and processed food items and are available for the time span from 1961 to 2003. The SUA time series end with FAOSTAT-1 in 2003 and the breakdown into primary and processed foods is no longer available in FAOSTAT-2. The USDA nutrient database SR18 is available on the web, data, description and metadata can be lifted from: http://www.nal.usda.gov/fnic/foodcomp/Data/SR18/sr18.html. USDA SR18 distinguishes 128 different nutrients, covering the entire spectrum from macro nutrients (energy, protein, fats and carbohydrates), their constituting components (amino acids, fatty acids and individual carbohydrates) to vitamins, minerals and other micronutrients.

Constructing the nutrient database

Nutrient availability has been calculated by multiplying food availability per capita per day from FAOSTAT with the nutrient content of the corresponding food item of USDA SR18. FAO's Nutrition Division[47] kindly provided the technical expertise to "match-merge" SUA to SR18 food items. Once every SUA food item had been matched with a corresponding item of the nutrient database, the per capita availability of every nutrient j in year k and country l can be expressed as:

$$NUT_{jkl} = \sum_{i=1}^{444} NUT_{i,jkl}$$

where i is the SUA food item i; k ranges from 1961 to 2003 and l is a SUA country; over the time period k, l ranges from 158 to 178. For a region r, NUT_{jkr} is the population weighted average of all individual countries' nutrient intake.

The thus calculated values reflect the availability of a given nutrient per person per day, however, not necessarily the actual intake. Actual intakes could be calculated by adjusting (reducing) availability levels by household waste. Household waste estimates are available for only a few countries. The few existing estimates suggest that household waste can account for a significant share of food availability. For instance, Scott Kantor et al. report that household waste in the US accounts for approximately 27% of calorie availability (Scott Kantor et al., 1997). While the estimates include household waste, they have been adjusted for "refuse", i.e. the inedible or indigestible part of food (shells of groundnuts, crustaceous, etc). The coefficients for "refuse" have been taken from SR18 and, where missing, been supplemented by coefficients from FAOSTAT.

Evaluating the nutrient estimates

The creation of such a comprehensive nutrient database poses the question as to how reliable the estimates are. To answer this question, two possible approaches could be pursued. A first test would be to compare the estimates of the nutrient with those provided for by FAOSTAT's food balance sheets. Thus dereived deviations would essentially reflect deviations in the nutrient conversion factor used in FAOSTAT and USDA SR18, This exercise has been undertaken at a global level and for all years (Schmidhuber, 2005). Schmidhuber reports that the estimates for macro nutrients are very similar to those of FAOSTAT and where they differ, the energy availabilities (DES) based on SR18 often look more plausible than those reported in FAOSTAT. For European Countries in particular, the deviations are generally well below 5% for all macro nutrients (see for instance Annex Table A4). This high level of compliance will not allow to evaluate the data quality vis-à-vis an exogenous yardstick (measured data) but it allows to assume that the data quality for all other 125 nutrients is comparable to the one for energy, protein and fat in reported in FAOSTAT. The second approach towards quality control would be to "ground-truth" the nutrient estimates with nationally representative results from nutrient intake measurement surveys. The scope for such a direct approach is however circumscribed by two factors. The first is survey availability, i.e. there are only few, nationally representative estimates of nutrient intake data. The second factors is that all intake data would have to be adjusted for household waste (i.e.

[47] In this regard, the author highly appreciates the help from Ruth Charrondiere, Nutritionist, FAO.

increased by a known percentage) to arrive at a comparable availability estimate. To work around the waste problem, the comparison could be limited to ratios or shares, e.g. the share of fats or protein in total food energy[48] or, for a more sophisticated measure, the ratio of ω6/ω3[49] fatty acids[50]. For the latter, the German society for nutrition claims that the ratio is about 7:1 in Germany[51]. Simopoulos[52] reports a ration of 15.1 : 1 – 16.7 : 1 in "Western Diets".

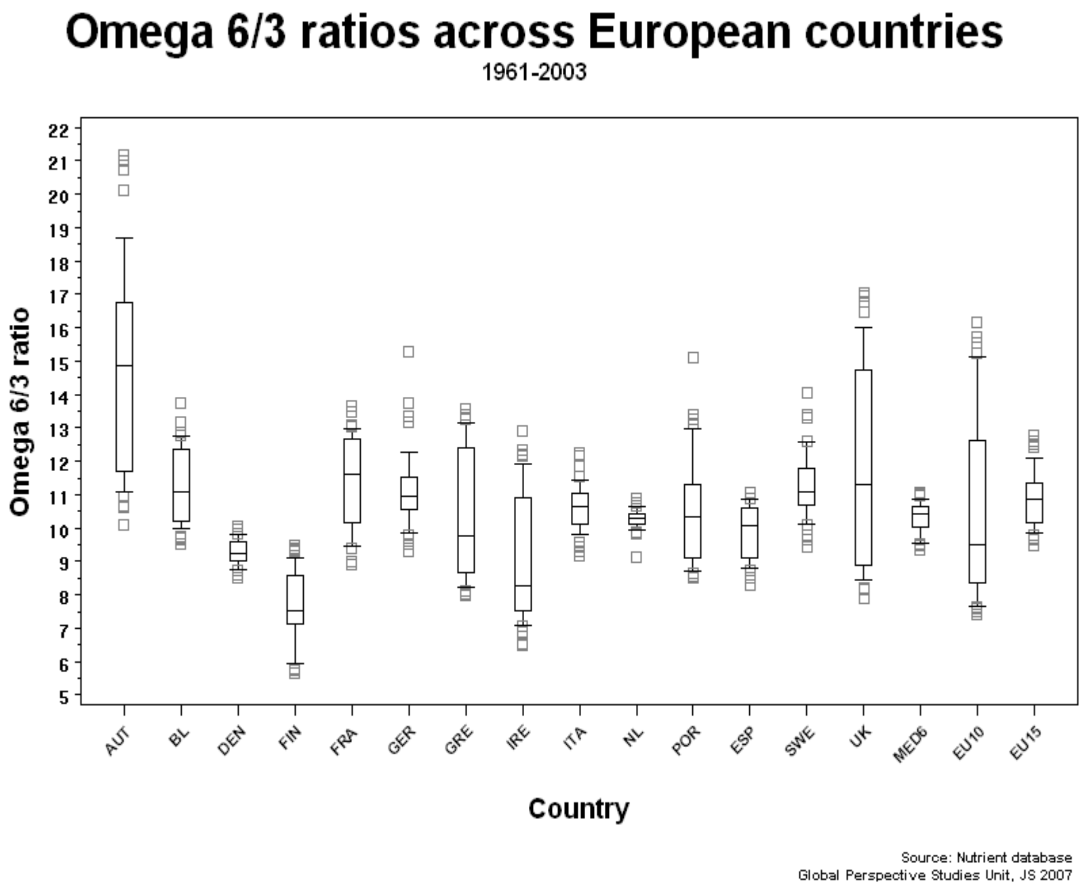

Figure 8: ω 6/3 ratios in EU diets

How do these numbers compare with those of the nutrient database? Before answering the question it should be legitimate to notice the considerable difference in the measured estimates: those cited in Simopoulos for Western Diets suggests that the ω6/ω3 ratio is more than twice as high as the German Nutrition Society publishes for Germany, a country with a typical Western Diet. A comparison of measured ω6/ω3 ratios with those calculated in the nutrient database suggests that the results for recent years are somewhere between the measured results, though on average closer to the upper bounds suggested by Simopoulos. The calculated ratios also suggest that there is a considerable range in the estimates across countries and, overall, a widening of the ratio over time. All in all, the calculated nutrients appear to be well in the range of estimates reported in the literature. Figure 8 depicts the ranges of ω6/ω3 ratios across European countries over the years from 1961 to 2003.

[48] This assumes that waste for fats and protein would be the same as for overall foodstuffs.

[49] Using the mnemonics of SR18, **ω3** PUFAs are the sum of: 18:3 undifferentiated + 22:6 n-3+Timnodonic 20:5 Ω 3 (EPA) n-3 + Clupanodonic Ω 3 22:5 (DPA) n-3 + Gamma-linolenic 18:3 n-6 c,c,c + Alpha-linolenic 18:3 n-3 c,c,c + 18:3i; while **ω6** PUFAs are the sum of: 18:2 undifferentiated + 20:4 undifferentiated + 18:2 t not further defined + 18:2 i + 18:2 CLAs + 18:2 n-6 c,c + Parinaric 18:4.

[50] This assumes that the importance of waste for both parts of the ratio is about the same.

[51] http://www.gesundheit.de/ernaehrung/gesundheitsvorsorge/ω-3-teil-i/index.html

[52] Simopoulos AP. Biomed Pharmacother. Evolutionary aspects of diet, the ω-6/ω-3 ratio and genetic variation: nutritional implications for chronic diseases. 2006 Nov; 60(9):502-7. Epub 2006 Aug 28.