

Diabetes Nutrition and Complications Trial

Trends in nutritional pattern between 1993 and 2000 and targets of diabetes treatment in a sample of Spanish people with diabetes

THE DIABETES AND NUTRITION STUDY
GROUP OF THE SPANISH DIABETES
ASSOCIATION*

Nutrition therapy plays an important role in the treatment of diabetes and must be based on regular alimentary diet habits, lifestyle, and personal preferences in order to attain the goals of diabetes management (1–5). If goals are not met, changes must be made in overall diabetes care, including the nutrition plan. In 1993, the usual diet of diabetic patients in Spain was a high-fat diet (>40%), basically rich in monounsaturated fatty acids (>50% of total fat intake) and poor in carbohydrates (<40%) (6). Despite this, between 60 and 85% of the diabetic patients reached a near-optimal metabolic control according to old targets (6,7), and a low cardiovascular morbidity/mortality (8,9) and a low prevalence of microvascular complications (10–12) have been reported in the Spanish population. Since 1993, treatment goals have been modified according to present evidences and lower targets of metabolic control may be achieved.

The Diabetes Nutritional Complications Trial is a prospective, observational, population-based, multicenter study. In this investigation, we report the changes in the nutrition pattern (based on 7-day food diaries) that occurred between 1993 and 2000 and their connection to diabetes treatment goals in a sample of diabetic patients from Spain.

RESEARCH DESIGN AND METHODS

— A total of 192 diabetic patients, 93 type 1 diabetic patients (41

men, 34.7 ± 15.1 years of age, and disease duration of 20.1 ± 9.5 years; 52 women, 36.7 ± 12.8 years of age, and disease duration of 18.9 ± 10.1 years) and 99 type 2 diabetic patients (42 men, 66.6 ± 8.6 years of age, and disease duration of 17.1 ± 7.7 years; 57 women, 66.3 ± 11.0 years of age, and diabetes duration of 18.0 ± 8.6 years) attending the four outpatient diabetes clinics between 1993 and 2000 completed the study. The requirements and a wide description of the experimental design have been previously reported (6).

RESULTS — Table 1 shows the median daily intakes (Q1–Q3) of energy and macronutrients, the clinical and laboratory data in both type 1 and type 2 diabetic patients in the year 2000, and the change in relation to 1993. A tendency to reduce protein consumption (between -1.4 and -6.9%) and to increase total fat consumption (between 1.0 and 8.2%) due to an increase in intake of poly- and monounsaturated fatty acids (between 11.9 and 21.6% and 4.0 and 20.7% , respectively) was observed.

There was no correlation between the day-to-day variability in carbohydrate intake and HbA_{1c} or other diabetes control parameters.

Of the diabetic patients, 85% had an optimal HDL cholesterol level, 95% had a non-HDL cholesterol value <130 mg/dl, 86% had a triglycerides level <150 mg/dl, and 58% had an HbA_{1c} value <7.5%.

The percentage of diabetic patients with an adequate metabolic control has increased since 1993. Excluding diabetic patients treated with lipid-lowering drugs, and/or blood pressure-lowering drugs, the percentage of diabetic patients with LDL cholesterol <100 mg/dl and with systolic blood pressure <130 mmHg and diastolic blood pressure <80 mmHg increased up to 64.8, 57.1, and 49.4%, respectively.

CONCLUSIONS — The nutrition pattern in people with diabetes in Spain remains high in fat consumption, mainly monounsaturated fatty acids, and low in carbohydrate intake. Usual diet is characterized by a low carbohydrate intake, mainly vegetables, fruits, and cereals but fewer legumes, and a high intake of olive oil, a moderately high intake of fish, and a moderate intake of saturated lipids, as well as a low intake of ethanol. A tendency to increase the consumption of mono- and polyunsaturated fatty acids and to decrease protein consumption have been observed. However, consumption of saturated fat is still excessive, but monounsaturated fatty acids-to-saturated fatty acids and polyunsaturated fatty acids-to-saturated fatty acids ratios have increased. These trends are associated with favorable changes in diabetes metabolic control parameters. Likewise these changes in monounsaturated fatty acids-to-saturated fatty acids and polyunsaturated fatty acids-to-saturated fatty acids ratios have been associated to salutary cardiovascular changes (13–16).

More than 80% of diabetic patients comply with the recommendation of consuming >60% of daily calories as carbohydrate and monounsaturated fatty acid, but <10% of diabetic patients have adhered to the recommendation of reducing saturated fat consumption to <10% of daily calories consumption, and <8% consume under 300 mg/day cholesterol. Despite this, many people with diabetes

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Table 1—Nutrient intake, clinical characteristics, and laboratory data of study subjects

	Type 1 diabetes				Type 2 diabetes							
	Men	Change	CV	Women	Change	CV	Men	Change	CV	Women	Change	CV
n	41			52			42			57		
Energy (kcal/day)	2,290 (1,947–2,635)	7.5	18	1,736 (1,482–2,203)	6.8	18	1,936 (1,654–2,239)	–0.9	19	1,581 (1,325–1,773)	1.4	17
Carbohydrate (%)	38.7 (34.3–43.8)	–1.7	18	37.2 (33.7–42.0)	–1.1	21	37.9 (34.8–42.4)	4.8	16	38.4 (34.0–43.1)	0.3	19
Grams	218 (169–271)	10.1	23	162 (132–211)	5.1	24	181 (156–213)	2.7	26	146 (118–183)	1.9	23
Protein (%)	17.7 (16.3–21)	–5.0	21	18.1 (16.4–20.4)	–4.2	22	19.4 (18.022.4)	–6.9	17	21.0 (19.4–24.3)	–1.4	18
Grams	106 (91–117)	0.2	23	77 (69–89)	0.5	25	95 (81–104)	–9.7	22	82 (73–97)	–2.6	20
Total fat (%)	40.1 (36.6–44.8)	1.0	16	42.7 (39.9–47.0)	8.2	18	37.8 (33.4–42.7)	3.2	16	39.3 (35.1–42.1)	5.5	20
Grams	99 (85–121)	10.5	28	79 (73–107)	17.0	28	82 (68–94)	2.8	26	68 (56–81)	8.1	30
SFAs (%)	31.6 (27.2–43.7)	5.0	31	32.6 (26.1–41.0)	17.0	33	30.1 (23.2–36.9)	–4.3	33	30.8 (24.6–40.0)	7.3	38
MUFAs (%)	54.5 (44.7–66.1)	20.7	31	54.8 (48.3–70.6)	19.7	32	56.2 (45.2–68.5)	4.0	28	56.0 (43.1–66.2)	17.4	33
PUFAs (%)	14.5 (10.5–17.0)	13.0	42	13.0 (9.8–16.2)	16.5	39	13.2 (10.1–17.1)	21.6	33	12.1 (9.9–14.6)	11.9	38
MUFAs/SFAs	1.72 (1.27–1.98)	38.7	49	1.69 (1.35–2.13)	14.5	42	1.87 (1.52–2.01)	39.3	39	1.89 (1.53–2.13)	32.4	41
PUFAs/SFAs	0.45 (0.38–0.55)	34.5	41	0.41 (0.38–0.50)	11.1	36	0.44 (0.36–0.56)	44.3	36	0.40 (0.36–0.49)	36.5	44
Cholesterol (mg)	452 (366–566)	3.9	52	333 (278–393)	0.9	54	362 (312–434)	–9.7	52	297 (218–374)	0.8	56
Fiber (g)	19.1 (13.0–24.1)	3.8	43	14.7 (11.9–18.5)	–13.5	46	19.6 (15.5–28.3)	–1.6	37	18.6 (14.3–20.8)	–6.2	40
Alcohol (%)	5.0 (0–11.0)	5.2	86	0.0 (0.0–2.2)	0.2	82	4.5 (0.0–11.6)	0.7	88	0.0 (0.0–2.5)	–0.1	92
Body weight (kg)	71.6 (66.4–78.5)	7.4		60.0 (54.5–68.3)	4.5		75.3 (71.2–86.5)	1.6		70.9 (67.0–76.5)	1.7	
BMI (kg/m ²)	24.1 (22.5–26.8)	2.0		23.7 (21.5–26.9)	1.7		30.5 (27.2–34.5)	0.5		32.8 (30.1–38.5)	3.8	
Waist perimeter (cm)	84 (80–93)	5.5		73 (70–82)	3.2		104 (92–122)	5.1		99 (89–106)	3.2	
Waist-to-hip ratio	0.89 (0.84–0.92)	0.0		0.79 (0.71–0.83)	0.0		0.97 (0.89–1.08)	0.0		0.88 (0.80–0.94)	–0.0	
Systolic blood pressure (mmHg)	125 (110–135)	4.2		120 (110–133)	1.7		140 (140–160)	4.3		140 (136–160)	–2.0	
Diastolic blood pressure (mmHg)	77 (70–80)	3.7		75 (65–80)	4.3		80 (79–86)	1.2		80 (76–85)	4.7	
HbA _{1c} (%)	6.9 (6.1–8.0)	–1.1		7.5 (6.3–8.6)	–0.7		6.4 (5.5–8.2)	–1.1		6.3 (5.8–8.6)	–1.2	
Cholesterol (mg/dl)	188 (154–206)	–6.1		208 (167–229)	6.1		193 (169–217)	–20.3		209 (188–221)	–8.9	
HDL cholesterol (mg/dl)	60 (53–65)	5.7		69 (58–79)	11.5		58 (48–65)	13.2		61 (53–69)	12.8	
LDL cholesterol (mg/dl)	110 (78–138)	–1.6		118 (92–140)	–5.3		111 (84–134)	–35.9		116 (105–137)	–17.4	
Triglycerides (mg/dl)	74 (60–100)	–1.2		58 (43–77)	–22.8		98 (82–138)	–13.2		95 (73–128)	–8.3	
Non-HDL cholesterol (mg/dl)	125 (92–145)	–0.3		135 (96–164)	–6.2		136 (102–158)	–18.5		143 (113–178)	–15.6	
Apolipoprotein A1	143 (126–156)	NV		171 (143–189)	NV		144 (132–156)	NV		157 (145–172)	NV	
Apolipoprotein B	73 (56–97)	NV		82 (68–95)	NV		105 (88–118)	NV		100 (84–115)	NV	
Lipoprotein(a) mg/dl	11.6 (9.6–24)	NV		10.6 (9.6–24.5)	NV		16.4 (9.6–48.3)	NV		17.2 (9.6–85)	NV	
Albumin-to-creatinine ratio <30 mg/g	35 (85.3)	0		43 (82.7)	5.8		24 (57.1)	–14.3		44 (77.2)	–8.8	

Data are median (Q1–Q3) and n (%). CV, coefficient of variation; MUFAs, monounsaturated fatty acids; NV, not evaluated in 1993; PUFAs, polyunsaturated fatty acids; SFAs, saturated fatty acids. Change was calculated as (value in year 2000 – value in year 1993) × 100/value in year 1993.

in Spain still have near-optimal metabolic control values.

However, <30% present LDL cholesterol levels <100 mg/dl. Recently, the non-HDL cholesterol level has emerged as an alternative for LDL cholesterol in order to identify diabetic patients at cardiovascular risk (17–19). Likewise, it has been reported that both apolipoprotein B and non-HDL cholesterol can more precisely identify diabetic patients at cardiovascular risk than LDL cholesterol (20–22). Data obtained from our report reinforce this hypothesis. According to apolipoprotein B and non-HDL cholesterol levels, >85% of the diabetic patients studied would be at low cardiovascular risk, as would be expected considering the epidemiological data of cardiovascular morbidity previously reported (8,9). One basic goal of the nutritional treatment in people with diabetes is to help them adapt the treatment to the changes in their lifestyle. Even though we have not analyzed the adaptation of food consumption to the changes in lifestyle, the existence of high macronutrient variation rate values assures that diabetic patients present substantial day-to-day variability in their food consumption, which guarantees that the 7-day food diary was being filled out while the patients were living their habitual lifestyle. Moreover, this variability in the day-to-day carbohydrate consumption was not associated with a deterioration in glycemic control, thus suggesting proper adaptation.

Based on these data, the Spanish Diabetes Association recommends not modifying the usual diet of diabetic patients, but rather encouraging the decrease of saturated fat consumption.

APPENDIX

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References

1. American Diabetes Association: Standards of medical care for patients with diabetes mellitus (Position Statement). *Diabetes Care* 26 (Suppl. 1):S33–S50, 2003
2. European Diabetes Policy Group 1998: A desktop guide to type 1 (insulin-dependent) diabetes mellitus. *Diabet Med* 16:253–266, 1999
3. European Diabetes Policy Group 1999: A desktop guide to type 2 diabetes mellitus. *Diabet Med* 16:716–730, 1999
4. American Diabetes Association: Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications (Position Statement). *Diabetes Care* 26 (Suppl. 1):S51–S61, 2003
5. Diabetes and Nutrition Study Group of the EASD: Recommendations for the nutritional management of patients with diabetes mellitus. *Diab Nutr Metab* 8:186–189, 1995
6. The Diabetes and Nutrition Study Group of the Spanish Diabetes Association (GSEDNu): Diabetes nutrition and complications trial (DNCT): food intake and targets of diabetes treatment in a sample of Spanish people with diabetes. *Diabetes Care* 20:1078–1080, 1997
7. The Diabetes and Nutrition Study Group of the Spanish Diabetes Association (GSEDNu): Diabetes nutrition and complications trial (DNCT): Adherence to nutrition recommendations and targets of diabetes treatment in a sample of Spanish people with diabetes. *Diabetes Res* 33:129–138, 1998
8. The Global Lower-Extremity Amputation Study Group: Epidemiology of lower extremity amputation in centres in Europe, North America and East Asia. *Br J Surg* 87:328–337, 2000
9. Calle-Pascual AL, Garcia-Torre N, Moraga I, Diaz A, Duran A, Moñux G, Serrano FJ,

- Martin-Alvarez PJ, Charro A, Marañes JP: Epidemiology of nontraumatic lower-extremity amputation in Area 7, Madrid, between 1989 and 1999. *Diabetes Care* 24:1686–1689, 2001
10. Cabezas-Cerrato J, the Neuropathy Spanish Study Group of the Spanish Diabetes Society (SDS): The prevalence of clinical diabetic polyneuropathy in Spain: a study in primary care and hospital clinic group. *Diabetologia* 41:1263–1269, 1998
11. Estmatjes E, Goicolea I, Cacho L, de Pablos PL, Rodriguez MR, Roche MJ, Albero R, Benito P, Pesquera C: Nefropatia en la diabetes mellitus tipo II: Prevalencia en España. *Av Diabetol* 13:29–35, 1997
12. Fernandez-Vigo J: Retinopatía diabética en España. *Av Diabetol* 15 (Suppl. 1):13–14, 1999
13. Calle-Pascual AL, Grupo de la SED para el estudio de la Nutrición (GSEDNu): Nutrición y diabetes: normas básicas y recomendaciones clínicas. *Av Diabetol* 15 (Suppl. 1):40–45, 1999
14. Ramirez-Tortosa MC, Lopez-Pedrosa JM, Suarez A, Ros E, Mataix J, Gil A: Olive oil and fish oil enriched diets modify plasma lipids and the susceptibility of low-density lipoproteins to oxidative modification in free-living male patients with peripheral vascular disease: the Spanish Nutrition Study. *Br J Nutr* 82:31–39, 1999
15. Ramirez-Tortosa MC, Suarez A, Gonzalez MC, Mir A, Ros E, Mataix J, Gil A: Effect of extra-virgin olive oil and fish-oil supplementation on plasma lipids and susceptibility of low-density lipoproteins to oxidative alteration in free-living Spanish male patients with peripheral vascular disease. *Clin Nutr* 18:167–174, 1999
16. Calle-Pascual AL, Saavedra A, Benedi A, Martín-Alvarez PJ, Garcia-Hondurilla J, Calle JR, Marañes JP: Changes in nutritional pattern, insulin sensitivity and glucose tolerance during weight loss in obese patients from a Mediterranean area. *Horm Metab Res* 27:499–502, 1995
17. Lu W, Resnick H, Jablonski KA, Jones KL, Jain AK, Howard WJ, Robbins DC, Howard BV: Non-HDL cholesterol as a predictor of cardiovascular disease in type 2 diabetes: the Strong Heart Study. *Diabetes Care* 26:16–23, 2003
18. Cui Y, Blumenthal RS, Flaws JA, Whitman MK, Langenberg P, Bachorik PS, Bush TL: Non-high-density lipoprotein cholesterol level as predictor of cardiovascular disease mortality. *Arch Intern Med* 161:1413–1419, 2001
19. Bittner V, Hardison R, Kelsey SF, Weiner BH, Jacobs AK, Sopko G: Non-high-density lipoprotein cholesterol levels predict five-year outcome in the bypass angioplasty revascularization investigation (BARI). *Circulation* 106:2537–2542, 2002
20. Wagner AM, Perez A, Calvo F, Bonet R,

- Castellvi A, Ordoñez J: Apolipoprotein (B) identifies dyslipidemic phenotypes associated with cardiovascular risk in normocholesterolemic type 2 diabetic patients. *Diabetes Care* 22:812–817, 1999
21. Grundy SM: Low-density lipoprotein, non-high-density lipoprotein and apolipoprotein B as targets of lipid-lowering therapy. *Circulation* 106:2526–2529, 2002
22. Wagner AM, Perez A, Zapico E, Ordoñez-Llanos J: Non-HDL cholesterol and apolipoprotein B in the dyslipidemic classification of type 2 diabetic patients. *Diabetes Care* 26:2048–2051, 2003