Diet in 45- to 74-Year-Old Individuals with Diagnosed Diabetes: Comparison to Counterparts without Diabetes in a Nationally Representative Survey (Etude Nationale Nutrition Santé 2006-2007)

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ARTICLE INFORMATION

Article history:
Accepted 31 July 2013
Available online 30 October 2013

Keywords:
Middle-aged adults
Diabetes
Diet
Recommendations
National survey

2212-2672/$36.00
http://dx.doi.org/10.1016/j.jand.2013.08.002

ABSTRACT
A healthy diet has been shown to prevent diabetes complications. However, the eating habits of individuals with diabetes who are aware of their glycemic condition have been poorly studied. This study's objective was to assess the dietary behavior overall and according to dietary recommendations in adults diagnosed with diabetes compared with those of a general population of the same age (45 to 74 years) in a nationally representative survey carried out in France in 2006-2007 (Etude Nationale Nutrition Santé) (n=1,476 including 101 patients with diabetes). Trained dietitians assessed diet using three 24-hour recalls and diabetes was self-declared. After weighting and using multiple adjustments, mean food and nutrient intakes were compared according to diabetes status. Interactions with age and sex were sought. Adults with diabetes had lower intakes of sweetened foods (40 g/day vs 125 g/day), alcohol (1.45 g/day vs 1.64 g/day), energy (1,790 kcal/day vs 1,986 kcal/day), and simple sugar (63.1 g/day vs 89.8 g/day) and higher intakes of meat (126 g/day vs 109 g/day), complex carbohydrates (26.3% energy intake vs 23.6% energy intake), and vitamins B and E (628 μg/day vs 541 μg/day). In addition, 45- to 59-year-old individuals with diabetes ate more fruits and vegetables, fiber, beta carotene, folate, vitamin C, and potassium than adults of the same age who did not have diabetes. Overall, 45- to 74-year-old adults with diabetes had a higher-quality diet than individuals without diabetes. However, compared with recommendations, a healthy diet continues to represent a public health challenge in terms of preventing diabetes complications.
J Acad Nutr Diet. 2014;114:918-925.

JUST LIKE FOR PRIMARY PREVENTION OF TYPE 2 diabetes,[1] the roles of diet and exercise have been widely emphasized for secondary and tertiary prevention of diabetes complications.[2,3] On the whole, the aims of dietary recommendations for patients with diabetes, referred to as "medical nutrition therapy," are to control glycemia, maintain or achieve a healthy weight (especially because insulin medication can lead to a weight increase) and, to as great an extent as possible, prevent micro- and macrovascular complications and diabetes-associated mortality.

However, translating dietary recommendations into real-life situations can be difficult for patients with diabetes. Their diet is often far from the recommendations.[4-7] In people with diabetes, compared to those without diabetes, substitution of specific food groups, such as simple sugars, might not lead to a higher-quality diet.[8-12] As in France,[9,13] surveys of the diets of individuals with type 2 diabetes carried out in North America[5,14] and the Mediterranean region[4,6,11] were mostly conducted during the 1990s.[10]

We had previously shown that, in France, diet in the general population is far from attaining recommended amounts for fruits and vegetables, fish, saturated fat, and overall carbohydrates.[15] Using the dietary information of individuals already diagnosed with diabetes, the aims of this study were to compare their dietary intake with the rest of the population and to assess compliance with expert recommendations on the basis of a nationally representative survey carried out in France.[15]

METHODS

Study Design and Population

The ENNS (Etude Nationale Nutrition Santé) study was a cross-sectional survey carried out on 3,115 adults 18 to 74 years of age.[15] The design was based on geographically stratified three-stage sampling launched between February 2006 and March 2007. Briefly, the survey first sampled 190 towns stratified by geographic region and degree of urbanization. Within towns, a sample of households was randomly

taken and one participant per household was selected using the date of birth method. The survey protocol received formal approval from the Cochin Hospital Ethics Committee (Paris, approval no. 2264) and the French Data Protection Authority (Commission Nationale de l'Informatique et des Libertés, authorization no. 905481).

General Data Collection

Standardized questionnaires, administered by trained dietitians in the home, collected sociodemographic information, including age, sex, marital status, education, occupation, and smoking habits. In addition, personal medical information, including history of diabetes, was collected via self-reported questionnaires. During the home interview, self-reports of drugs currently used were checked against medication packaging and/or physician's prescriptions. Body height (Seca Bodymeter 206; Seca) and weight (Seca Bellissima 841; Seca) were measured using World Health Organization procedures.[16]

Diagnosed Diabetes Status

Diagnosed diabetes was identified in participants who answered "yes" to the self-reported question, "Have you ever been told by a doctor or health professional that you had diabetes?" and/or who used diabetes medication (ie, oral hypoglycemic agents and/or insulin). Participants identified by biochemical examination as having newly diagnosed diabetes and impaired fasting glucose were included in the comparison group. Because they had not been aware of their glycemic status before assessment, they had not received diet counseling.

Diet Data Collection and Treatment

Dietary intake was estimated using three 24-hour recalls randomly spread over a period of 2 weeks, one of which was on the weekend. For the overall sample, they were carried out during a 1-year period to take into account seasonality of diet. Participants, interviewed by phone by trained dietitians, were asked to describe in detail all meals and beverages consumed the previous day (from midnight to midnight). They were requested to describe in detail the composition of the food and the quantities via a validated photographic manual of food portions[17] or according to typical measurements (eg, home containers, grams indicated on the package). Twenty-four–hour dietary information was filled in using NutriXpert software (Medical Expert System) that included >3,400 foods and beverages. In addition, consumption of alcoholic beverages and seafood was described using weekly frequency questionnaires. Intake of energy, macro-, and micronutrients was then calculated using a food-content database published previously,[18] but updated for recent products and recipes. For each individual, daily dietary intake was calculated as the average of the 24 recalls weighted for distribution between weekdays and weekends. Foods were categorized into groups according to French guides.[19]

Data Analysis

Because diabetes is very uncommon before 45 years of age, the present study focused on 45- to 74-year-old participants in the ENNS survey (n=1,714). Among them, 48 participants

Table 1. Characteristics of 45- to 74-year-old adults according to diagnosed diabetes status, Etude Nationale Nutrition Santé survey 2006-2007[a]

	Diagnosed Diabetes		
Characteristics	Yes (n=101)	No (n=1,37)	*P* value
Sex (% male)	71.7	47.1	***
Age (y)			
Mean (standard error)	61.6 (1.1)	56.2 (0.3)	***
45-59 (%)	41.0	67.0	***
60-74 (%)	59.0	33.0	
Marital status (%)			
Living with a partner	86.8	82.4	NS[b]
Single	5.5	4.5	
Widowed, divorced	7.7	13.1	
Education (%)			
University	3.2	14.5	**
High school	6.1	11.1	
Secondary school	46.9	41.9	
Primary school	43.8	32.5	
Occupation (%)[c]			
Management, intermediate professions	20.6	26.9	NS
Employees, manual workers	68.2	62.8	
Self-employed, farmers	11.2	10.3	
Smoking habits (%)			
Never smoker	31.6	49.4	**
Current smoker	15.8	20.1	
Former smoker	52.6	30.5	
BMI[d]			
Mean (standard error)	30.8 (0.6)	26.2 (0.2)	***
Slim to normal (BMI <25) (%)	8.4	43.5	***
Overweight (25≤BMI<30) (%)	35.9	39.3	
Obese (BMI ≥30) (%)	55.7	17.2	
Grade I (30≤BMI<35) (%)	42.3	13.4	
Grade II (35≤BMI<40) (%)	10.2	2.9	
Grade III (40 ≤BMI) (%)	3.2	0.9	

[a]All values (mean, proportion, and standard error) were assessed, accounting for the complex survey design.
[b]NS=not significant.
[c]Individuals who self-reported never having been employed were excluded (n=28).
[d]BMI=body mass index. Estimates based on 1,190 participants with available weight and height measurements (75 with diagnosed diabetes; 1,115 without diagnosed diabetes).
**$P<0.01$.
***$P<0.001$.