

THE DIET AND ALL-CAUSES DEATH RATE IN THE SEVEN COUNTRIES STUDY*

Summary Among 12 763 men aged 0-59, 1512 died in ten years, 413 from coronary heart disease. The 16 cohorts differed in all-causes as well as in coronary death rate. Those differences were not related to cohort differences in age, relative weight, activity, smoking habits, or percentage calories from total proteins or fats in the diet but were related to differences in blood-pressure, serum cholesterol, and percentage calories from saturated fatty acids. The correlation with saturates was $r=0.47$ for all-causes, $r=0.84$ for coronary death rate. The all-causes death rate was correlated with saturates even when other dietary variables were controlled in multiple regression. Inclusion of percentage calories from saturates, mono-enes, and polyunsaturates in multiple regression gave multiple $R=0.71$ for all-causes deaths but no better discrimination for coronary deaths. Non-coronary death rate was not significantly related to the diet. Both mean blood-pressure and serum cholesterol were correlated with diet saturates but the correlation of blood-pressure with saturates is explained by inter-correlation between blood-pressure and cholesterol. The findings do not prove that saturates in the diet cause increased mortality but are consistent with the hypothesis that risk of early death is increased by diet saturates in populations in which coronary disease is a major death cause. There is no support for the suggestion that the advantage for coronary disease of a diet restricted in saturated fats may be offset by increased non-coronary mortality.

Introduction

THE 10-year experience in the Seven Countries Study amplified the 5-year finding¹ that the 16 cohorts of men aged 40-59 at entry differed strikingly in mortality from coronary heart disease.² This ranged from 1 coronary death in 686 men on the island of Crete to 78 among 817 men in east Finland. No significant part of that variability among the cohorts was explained by age, relative body weight, body fatness (skinfold thickness), smoking habits, or habitual physical activity, though some of these variables were important when individuals within cohorts were compared. Mean values for serum cholesterol and arterial blood-pressure accounted for two-thirds of the variance of coronary mortality. The average level of serum cholesterol of the cohorts was correlated with the average percentage of calories from saturated fatty acids in the diet so it is not surprising that the 10-year coronary death rate was highly correlated with the average percentage of diet calories from saturated fatty acids; $r=0.84$. But in evaluating the importance of fats in the diet it is necessary to consider the

all-causes death rate and the other fatty acids in the diet. This is the purpose of the present report.

Methods

The Cohorts

The organisation and methods of the Seven Countries Study have been described in detail.¹⁻³ Only a few notes are warranted here. 13 of the 16 cohorts were made up of the respondents to invitations issued to men aged 40-59 living in geographically defined areas. All men of the age in the area were invited for 11 cohorts. In one area, Zutphen, The Netherlands, the number of men of the age exceeded the capacity of staff and facilities so a statistical sample of four-ninths was invited. In another area, Zrenjanin, Serbia, the men invited were all the men of the age in the large cooperative of the area. Men aged 40-59 long employed in specified occupations by railroads in the northwestern part of the United States and their counterparts in the Rome division of the Italian State Railways made up 2 cohorts. The 16th cohort comprised men aged 40-59 on the Faculty of the University of Belgrade. Of all men invited, 90.4% reported for the entry examinations.

The present report concerns the 12 763 men who completed the entry examinations. After ten years, 1512 men were dead, 413 deaths being attributed to coronary heart disease and 117 to violence. The deaths from violence were excluded from the main analysis on the ground that in regard to relationship to the diet they could contribute only random "noise".

The Diet

The methods used for estimation of the habitual diets have been described in detail.^{1,4,5} The diets of the American men were estimated from their answers to a 24-hour recall questionnaire. The average diet of the Italian railroad men was estimated from 7-day food-consumption diaries returned by a subsample of men who had been selected as a stratified sample of occupations corresponding to the average age of the entire cohort. The amounts of the various food items were used to estimate nutrients from a special table of food composition for central Italy.

For the other cohorts statistical subsamples were selected for 7-day recording of weights of all foods eaten, those surveys being repeated in different seasons except in Japan. Nutrients were calculated with tables of food composition specific for the regions. Duplicate samples of foods eaten were homogenised and lyophilised and aliquots were analysed by methods including gas chromatography at the University of Minnesota. The results from chemical analyses and calculations agreed well for total calories, proteins, total fats, and saturated fats but for polyunsaturated fatty acids the averages from chemical analysis tended to be lower—as much as 18% in some instances—than those calculated from the tables. On average, however, polyunsaturated fatty acids provided only 4% of total calories so the discrepancy amounts to less than 1% of calories. For the present analysis we have used the results from chemical analysis except in the case of the railroad men where only calculated values are available.

Results

Table 1 shows the average percentages of calories provided in the diets by proteins, total fats, and the component saturated and polyunsaturated fatty acids; mono-enes can be calculated as the difference between total fats and the sum of saturated and polyunsaturated fatty acids. Variation in proteins was small, ranging only from 10.6% of calories in Crete to 14% in Dalmatia, Belgrade, and the American railroad men. In all cohorts polyunsaturated fatty acids supplied only a small fraction of the total calories. The high percentage of polyunsaturated fats at Zrenjanin and for the Americans is explained by the sunflower seed oil factory at

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