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## VIEWPOINT

### Effect of low saturated fat diet in early and late cases of multiple sclerosis

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**144 multiple sclerosis patients took a low-fat diet for 34 years. For each of three categories of neurological disability (minimum, moderate, severe) patients who adhered to the prescribed diet ( $\leq 20$  g fat/day) showed significantly less deterioration and much lower death rates than did those who consumed more fat than prescribed ( $> 20$  g fat/day). The greatest benefit was seen in those with minimum disability at the start of the trial; in this group, when those who died from non-MS diseases were excluded from the analysis, 95% survived and remained physically active.**

*Lancet* 1990; **336**: 37-39

#### Introduction

The suggestion, made in 1950, that the frequency of multiple sclerosis (MS) was related to fat consumption<sup>1</sup> was based on the relative frequencies of multiple sclerosis (MS) and the calculated fat consumption of different populations, and it was later supported by a Norwegian study of the incidence of MS and nutrition,<sup>2</sup> by analysis of similar data from many geographical areas,<sup>3</sup> and by clinical studies.<sup>4-8</sup> One study, in which patients were followed up for 34 years, implicated saturated animal fats—the lowest saturated fat consumers ( $\leq 20$  g/d; mean 17 g/d) showed little worsening of disability and a low death rate of 31% (21% when non-MS deaths were excluded), whereas an increase in the fat intake to an average of 25 or 42 g/d was accompanied by striking increase in average disability (to a need for bed care) and near tripling of the death rate, to 79% and 81%, respectively. Here we examine the effects of consumption of low fat diets in relation to severity of MS in patients from the same study.

#### Patients and methods

The 156 patients who maintained contact with the MS clinic from December, 1948, to the end of April, 1954, formed the basis of this study. 2 patients were rejected because of uncertain diagnosis and 4 were lost early in the study. 6 more patients, who had been followed

during the first 20 years, were lost, leaving 144 patients to complete the study.

For most patients (72%) the diagnosis was made at the Montreal Neurological Institute; for 22% by qualified consulting neurologists in the Veterans Administration hospitals in Canada and Northern New York State; and for 6% by R.L.S. The distribution of patients in terms of age at onset of MS, neurological disability, and duration of disease before dieting were shown in table 1 of a former paper.<sup>7</sup> The criteria for a diagnosis of MS were two or more episodes of an exacerbating-relapsing neurological disease plus a history and physical findings indicating that the central nervous system had sustained damage disseminated both in time and space. In all cases the standard diagnostic tests available at the time (pneumograms, myelogram, spinal fluid examination, and electroencephalogram) did not rule out the probability of MS, and in all but 2 cases, subsequent clinical events confirmed the diagnosis of an exacerbating-relapsing neurological disease assumed to be MS. Since 1952 neurological status has been graded on a 7-point scale, with one neurological grade being approximately equal to two points on the Kurtzke scale.<sup>9</sup>

0 = normal performance and normal neurological findings, frequent fatigue, occasional exhaustion;

1 = normal performance physically and mentally, neurological signs present, frequent fatigue, periodic exhaustion;

2 = mildly impaired physical performance but ambulant, neurological signs present, able to work part time or full time, fatigue present and exhaustion periodic, occasionally variable memory impairment;

3 = severely impaired performance but ambulant, able to work (usually part time), neurological impairment usually widespread, variable memory impairment frequently present;

4 = wheelchair needed, memory often impaired;

5 = confined to bed and chair; and

6 = deceased.

Details of patient care and a detailed description of the diet have been published elsewhere.<sup>7,10</sup> Briefly, from 1949 to mid-1951, fat intake was reduced from approximately 125 g/day to 20-30 g/d, mostly by cutting down on milk and fat from other animal sources.

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In 1951, butter fats and hydrogenated oils were eliminated, and saturated animal fats were limited to 15 g/day—ie, margarines, hydrogenated peanut butter, and all shortenings were eliminated from the diet. 5 g of cod liver oil and 10–40 g/day of vegetable oils, which contain a preponderance of unsaturated fatty acids and are fluid at room temperatures, were added. However, two oils, coconut and palm, which contain a preponderance of saturated fatty acids, were eliminated from the diet. The diet contained from 60 to 90 g/day of protein from fish and seafood, white meat of chicken and turkey cooked without the skin, skimmed milk, small amounts of lean meats, 1 egg/day, and vegetables, cereals, and nuts. Results in those who adhered to the diet were compared with those in patients consuming more fat than prescribed.

Daily average intake of fats, oils, and proteins were estimated in terms of 5 g (teaspoon) amounts for each visit, for each year, for each 5-year period, and for the first 22 years. Thereafter, periodic checks indicated that eating habits established during the preceding 22 years were maintained for the rest of the study.

The study was done in accordance with the ethical standards of both supporting institutions.

Rates of deterioration and death were calculated, first including all patients, then after excluding patients who died from non-MS causes.

Results

Patients were classed as good dieters (fat consumption ≤20 g/day) or as poor dieters (consumption >20 g/day) (see accompanying table).

Minimum disability (initial neurological grade 1)

**Good dieters**—At the end of the trial the mean neurological grade was 1·9 (SD 2·2). There were 5 deaths (21%)—1 from MS or its complication, 1 from heart disease, and 3 from cancer. If the 4 patients who died from non-MS causes are excluded, 1 MS patient in 19 (5%) died from MS or its complication. These 19 patients had dieted for a mean of 30·2 (SD 4·4) years, and their mean neurological grade at the end of the trial was 1·1 (1·3). 2 years before they died the 4 patients who died from non-MS causes had an average grade of 1·0.

**Poor dieters**—Their neurological grade was 5·3 at the end of the trial. 5 (83%) patients died—4 from MS and its complications (80%) and 1 from a non-MS cause. If the patient who died from non-MS causes is excluded, the duration of dieting for the other 5 MS patients was 23·8 (5·9) years, and the average final neurological grade was 5·3 (1·6). 2 years before death the patient who died from a non-MS cause had a disability rating of 1. His average fat intake had been 22 g/day.

Moderate disability (initial grade 2)

**Good dieters**—Their mean neurological grade at the end of the study was 3·6 (2·4). There were 10 deaths (40%)—1 from cardiovascular disease, 1 from cancer, and 8 from MS or its complications. If the 2 patients who died from non-MS causes are eliminated, the final average neurological grade for the 23 MS cases would be 3·3 (2·4). The duration of dieting for patients with only MS was 27·2 (7·2) years. 8 (34%) died from causes related to MS. 2 years before death (1 heart, 1 cancer) the 2 patients who died from non-MS causes had an average neurological grade of 2·5.

**Poor dieters**—At the end of the trial their mean neurological grade was 5·4 (1·3). There were 25 deaths (76%)—9 deaths from non-MS causes and 16 from MS. The duration of dieting for the 24 patients with MS alone was 21·6 (8·2) years. 16 (66%) of these died. The final neurological grade for this group was 5·2 (1·5), an increase of

CLINICAL DETAILS

	Good dieters	Poor dieters
<i>Minimum disability (grade 1)</i>		
Number (M:F)	23 (14:9)	6 (3:3)
Mean (SD) age (yr)	31·0 (8·4)	30·8 (7·3)
Mean (SD) duration of MS	31·0 (5·8)	25·9 (7·1)
Before trial	2·4 (2·1)	3·5 (2·4)
Diet period	28·6 (5·0)	23·8 (5·9)
Mean (SD) final neurological grade [change]	1·9 (2·2) [0·9]	5·3 (1·6) [4·3]
Deaths		
All causes	5 (21%)	5 (83%)
MS only	1 (5%)	4 (80%)
Mean lipid intake		
Fats	17·1 (2·4)	35·7 (11·5)
Oils	16·3 (4·3)	11·0 (2·2)
<i>Moderate disability (grade 2)</i>		
Number (M:F)	25 (9:16)	33 (16:17)
Mean (SD) age (yr)	31·8 (9·3)	34·4 (8·2)
Mean (SD) duration of MS (yr)	32·0 (7·2)	28·0 (9·0)
Before trial	4·9 (5·2)	5·3 (4·6)
Diet period	27·1 (6·8)	22·7 (8·0)
Mean (SD) final neurological grade [change]	3·6 (2·4) [1·6]	5·3 (1·3) [3·4]
Deaths		
All causes	10 (40%)	25 (76%)
MS only	8 (34%)	16 (66%)
Lipid intake		
Fats	15·4 (3·4)	46·1 (17·0)
Oils	18·2 (3·5)	10·2 (4·1)
<i>Severe disability (grades 3-5, mean 3·21 [0·4])</i>		
Number (M:F)	24 (7:17)	33 (17:16)
Mean (SD) age (yr)	34·2 (10·2)	37·1 (7·5)
Mean (SD) duration of MS (yr)	33·8 (9·5)	29·9 (10·7)
Before trial	6·2 (7·10)	10·4 (7·8)
Diet period	27·6 (8·5)	19·5 (9·6)
Mean (SD) final neurological grade [change]	4·0 (1·8) [0·8]	5·6 (1·0) [2·4]
Deaths		
All causes	8 (33%)	28 (85%)
MS only	5 (21%)	25 (83%)
Lipid intake		
Fats	15·8 (2·6)	36·5 (10·5)
Oils	18·1 (7·9)	10·5 (6·9)

3·2 grades. 2 years before death (4 heart, 2 cancer, 2 stroke, 1 alcoholic) the 9 patients who died from non-MS causes had an average grade of 3·3.

Severe disability (initial grades 3-5)

**Good dieters**—By the end of the trial their mean neurological grade had changed from 3·21 (0·4) to 4·0 (1·8). There were 8 deaths (33%), 3 due to non-MS causes (2 heart, 1 stroke). For those who did not die from a non-MS cause, the mean duration of dieting was 29 (6·4) years and the final neurological grade for this group was 3·6 (1·8). The death rate from MS alone was 21%. 2 years before death the average neurological grade of the 3 patients who died from non-MS causes was 3·8.

**Poor dieters**—The average neurological grade of these patients at the start of the diet was 3·2 (0·4) and at completion of the trial it was 5·6 (1·0). There were 28 deaths (85%). Exclusion of the 3 patients who died from non-MS causes meant that deaths from MS alone occurred in 25 of 30 patients (83%). The patients with MS alone dieted for 20·2 (7·9) years, and their final neurological grade was 5·6 (1·0). 2 years before death (operative, cancer, tuberculosis deaths) the average neurological grade of the 3 patients who died from non-MS causes was 4·6.

In each of the three disability groups the average worsening in disability grade and the percentage of deaths of the poor dieters significantly exceeded those of the good

dieters. The greatest difference occurred among those who entered the study with minimum disability; unfortunately, there were only 6 poor dieters, compared with 23 good dieters ( $t$  test,  $p < 0.0004$ ); the benefit of the low-fat intake seemed greater when non-MS causes of death were excluded from the analysis ( $p < 0.0001$ ). Differences between good and poor dieters in the moderate and severe disability groups were also significant ( $p < 0.0005$  and  $0.0001$ , respectively) for all cases and for MS cases only ( $p < 0.0026$  and  $0.0001$ , respectively).

Good dieters consumed more oil than did the poor dieters in each disability group. The oil intake of the good dieters was approximately the same as the fat intake, but the oil intake of the poor dieters was significantly less than their fat intake.

### Discussion

Our findings indicate that a diet of  $\leq 20$  g saturated fat daily was best able to keep patients with MS ambulant and working when it was started before the patients' normal abilities and activities were restricted<sup>7</sup>—under these circumstances about 95% of MS patients remained only mildly disabled for approximately 30 years. Adherence to the diet is important. Defaulting from the diet even after 5 to 10 years was, in almost all cases, followed by reactivation of the disease. Only 7% of the patients who consumed more than 20 g of fat daily did not show a high sensitivity to fat.<sup>7</sup> This small group may have consisted of benign cases,<sup>11-12</sup> who have been estimated<sup>12</sup> to make up about 4% of MS patients. In recent years we have observed that patients consuming 10–15 g/day or less had even better improvement in energy and fatigue levels. Removing red meat from the diet and reducing intake of the dark meat of poultry helped to attain these very low fat intakes.

Patients tend, mistakenly, to view a decrease in the exacerbation rate as evidence that their disease is under control. Most of the poor dieters whose fat consumption during the trial was lower than that before the trial had a decrease in the exacerbation rate<sup>7</sup> but, with the few exceptions noted above, they became seriously disabled and had a high death rate.

Supplements of essential unsaturated fatty acids of up to 30 g daily (eg, 2 oz cod liver oil<sup>17</sup>) without control of the fat intake have been reported to be accompanied by a decrease in relapse rates in MS.<sup>13-17</sup> Increasing the oil intake is accompanied by a decrease in saturated fat intake, which may be as much as 2 g for every 1 g increase in the oil intake (figures 1 and 2 in previous paper<sup>7</sup>). If so, oil supplements of 20 to 30 g daily could be attended by a decrease in the daily fat intake of up to 40 to 60 g, sufficient to reduce relapse rates in many patients but not to delay deterioration and deaths.

Fitzgerald, Harbige, Forti, and Crawford<sup>8</sup> reported not only a reduction in exacerbation rate but also an improvement in the neurological status of patients who complied with their recommended low-fat, high-polyunsaturated-oil diet, whereas the matched controls continued to deteriorate in terms of neurological status and rate and severity of their exacerbations.

Our experience indicated that a controlled randomised study, desirable as it would have been, would have been impractical, if not impossible, in a study of many years' duration. Patients tended to make their own "random" dietary changes (albeit not without our knowledge). Another difficulty with such a long trial as ours is the effect of ageing and general medical problems that require treatment. In our study patients received conventional treatment for their

various medical problems, and ageing was taken into account in the evaluation of each patient.

This work was supported by a private grant to the Montreal Neurological Institute, by the Multiple Sclerosis Society of Canada, by the Department of Health and Welfare of Canada, by the Multiple Sclerosis Society of Portland, Oregon, by the Public Health Service Grant NB 1536, by private donors, and by the Margaret W. and Herbert Hoover, Jr. Foundation.

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## From The Lancet

Never in the history of medicine has so great a gathering of its followers taken place as that which the present week has witnessed in the chief city of the German Empire. It says much for the spirit that animates our profession that men should flock from all parts of the globe to interchange ideas, and to make the acquaintance of those whose names stand foremost in the ranks of medical science. It shows, too, that there is in our art a link that binds nations together, however much they may be divided by political and national opinion. In the remarkable success of this Tenth International Congress even the most cynical cannot fail to see the promise of a day when all nations of men shall learn that the bonds which unite are stronger than the sentiments that so often divide peoples. Nor could any country in the world be more fittingly the seat of a great medical congress than Germany. In the promotion of higher learning she undoubtedly leads the way. In medical science she has been the birth-place of many discoveries which, to use an expressive term from German source, are admittedly "path-breaking" in their results.

(August 9, 1890)