Clinical Reports

Nutritional Studies of Vegetarians

III. Dietary Levels of Fiber

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AN INVESTIGATION of the nutritional, physical, and laboratory findings, together with the dietary and serum levels of cholesterol, of 88 non-vegetarian, 86 lacto-ovo-vegetarian, and 26 "pure" vegetarian adults, adolescents, and pregnant women was reported earlier.[1,2] Lacto-ovo-vegetarians include milk and eggs in their diet but do not eat flesh of animals (meat, poultry, fish). "Pure" vegetarians eat no food of animal origin. The details concerning the selection and composition of these groups are described in the preceding papers. The present study deals with the fiber content of the diets of these several groups.

The food composition tables of the U. S. Department of Agriculture[3] provided most of the data for the computation of the fiber content of the foods consumed. In a few instances information was also obtained from other sources.[4,5]

FINDINGS

As summarized in Table I, the fiber intake of the lacto-ovo-vegetarians was nearly twice that of the non-vegetarians and a little less than half that of the "pure" vegetarians.

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An examination of the diets reveals that the high fiber intake of the pure vegetarian diets was due to the unrefined, natural character of the foods. The calories and protein were derived mainly from whole grain cereals, legumes, and nuts, and some from oily, nut-like seeds as sunflower and sesame. Characteristic of this group was the consumption of unusually large amounts of nuts and nut butters, and of fresh, dried, and canned fruits. Vegetables and legumes were also eaten in considerably greater quantities than by either of the other two dietary groups. Some individuals included very large raw vegetable salads in their diets. Almost every food used contributed some fiber. The consumption of foods low in fiber as white sugar, white flour, refined cereals, customary desserts, and commercially prepared foods was at a minimum, if not wholly lacking in the pure vegetarian diets.

In general the food pattern of the lacto-ovo-vegetarian parallels that of the average American except for the absence of flesh foods. Dairy products and eggs, both lacking in fiber, provided much of the protein and approximately 20 per cent of the calories. This group was not as strict in the non-use of white sugar, refined foods and commercial preparations as were the pure vegetarians. However, they did consume considerable quantities of legumes, nuts, whole grain cereals and dark bread as well as fruits and vegetables of all kinds. Because these diets included both fiber-free and low-fiber foods, the total fiber intake was significantly less than that of the pure vegetarians.

The diets of the non-vegetarians were the

TABLE I

Comparison of Fiber Intakes of Vegetarian and Non-Vegetarian Groups

Groups	No.	Calories	Fiber			
			g/day Mean	g/day S.D.*	mg/100 cal Mean	mg/kg Mean
Adults						
Males						
L-o-vegetarian†	15	3020	16.3	9.3	537	220
Pure vegetarian	14	3260	23.9	7.0	787	362
Non-vegetarian	15	3720	10.7	3.3	288	139
Females						
L-o- vegetarian	15	2450	12.6	9.3	515	201
Pure vegetarian	11	2400	20.7	7.3	857	390
Non-vegetarian	15	2690	8.4	1.9	313	131
Adolescent						
Males						
L-o-vegetarian	15	4450	17.8	8.2	399	278
Non-vegetarian	15	5350	12.2	3.2	228	192
Females						
L-o-vegetarian	15	3030	12.9	7.3	417	242
Non-vegetarian	15	4100	10.6	2.2	257	208
Pregnant women						
L-o-vegetarian	26	2650	12.4	11.1	467	210
Non-vegetarian	28	3010	8.4	5.4	282	144

* Standard Deviation.
† Lacto-ovo-vegetarian.

lowest in fiber content, yet well above Cowgill's[6] estimate of daily fiber requirement of 90 to 100 mg/kg of body weight, or approximately 6 g for an adult. Meat, milk, and eggs, foods almost devoid of fiber, were the main sources of protein and contributed approximately 30 per cent of the total calories. The free use of sugar and other refined and processed foods, added but little fiber to the diet. However, the amounts of fruits and vegetables consumed, though less than that of either of the preceding groups, more then met the usually recommended dietary pattern.

DISCUSSION

From time to time the question is raised as to the compatibility of a diet high in crude fiber with the normal functioning of the human digestive system. It is of interest that the regimes of the two vegetarian groups, with their large intake of fiber, had been maintained for long periods of time. The pure vegetarian males averaged 16 years and the females 9 years on their diets, with a minimum of 5 years for any subject studied. The lacto-ovo-vegetarian groups had, except for a few of the pregnant women, consumed their dietaries throughout life. Some had a history of this pattern of nutrition for two and three generations.

Subjectively, neither vegetarian group revealed any complaints relative to the digestive system. Even the large fiber intake of the pure vegetarians caused no alimentary disturbance. Since even the lower level of fiber obtained by the non-vegetarian groups was in excess of Cowgill's estimated requirement, it is not surprising that constipation was practically unknown among any of the groups. While the fiber content *per se* does not necessarily indicate the total bulk of the stools,[7-9] it may contribute materially to it. Unfortunately, the circumstances under which this study was done made it impractical to measure stool volumes.

The previous report[2] of the study of these groups showed that the levels of serum cholesterol of the adults were appreciably lower in the pure vegetarians (average 206 mg/100 ml) than in the non-vegetarians (average 291 mg/-

100 ml), with the lacto-ovo-vegetarians having intermediate values (average 256 mg/100 ml). Body weights varied somewhat in proportion to the level of cholesterol, but dietary fat intake did not, the lacto-ovo-vegetarians and pure vegetarians having essentially the same total fat intake as the non-vegetarians, though more of the fat was from dairy and/or vegetable sources.

It is possible that the increased fiber content of the vegetarian diets reported here may have played some role in the lower cholesterol levels observed, though we have no direct evidence of this. Certainly one would expect the fiber content to affect markedly the bacterial flora, which in turn might affect cholesterol metabolism. People on low-fat diets in whom lower cholesterol levels have frequently been reported usually also have diets high in fiber.

SUMMARY AND CONCLUSIONS

The results of this study indicate that lacto-ovo-vegetarians consume significantly more fiber than non-vegetarians, and pure vegetarians significantly more than lacto-ovo-vegetarians.

The generous intake of fiber in the diet of vegetarians for long periods of time and even for lifetimes, appears wholly compatible with normal functioning of the gastrointestinal tract. Since constipation was practically unknown in all dietary groups, it would appear that even the lower fiber content of the non-vegetarian groups was sufficient for physiologic needs. The possible relationship between fiber content of these diets and cholesterol levels is pointed out.

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