

ORIGINAL COMMUNICATION

Fiber intake and risk of nonfatal acute myocardial infarction

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Objective: To investigate the association between fiber intake and risk of acute myocardial infarction (AMI), also according to type and source of fiber, in a Mediterranean country.

Design: Hospital-based case-control study.

Setting: Northern Italy.

Subjects: A total of 507 cases of first nonfatal AMI and 478 controls in hospital for acute conditions.

Interventions: Subjects were interviewed with a questionnaire that included a validated food frequency section. Odds ratios (OR) were obtained using multiple logistic regression, and adjusted for several recognized risk factors for AMI. Fiber was measured as non-starch polysaccharides.

Results: Compared with the lowest one, the OR in the highest tertile was 0.72 for total fiber, 0.64 for soluble fiber, 0.77 for total insoluble fiber, 0.71 for cellulose, 0.81 for insoluble non-cellulosic polysaccharides, 0.82 for vegetable fiber, 0.64 for fruit fiber and 1.11 for cereal fiber, and the estimates were statistically significant for soluble and fruit fiber. When further adjusted for β -carotene, vitamin C and vitamin E intake, the fruit fiber still showed the strongest inverse relation, although the association was no longer significant. The protective effect of fiber was more marked in, or restricted to, subjects with other AMI risk factors, such as smokers, diabetics and hypertensives.

Conclusions: Though an inverse association between fiber intake and AMI risk appears established, the causality of this association is still open to debate. In this population, cereal fiber derives chiefly from refined grains, and this may explain the lack of protection by this type of fiber.

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Introduction

Several, mostly prospective, epidemiological studies, (Bolton-Smith *et al*, 1992; Burr & Sweetnam, 1982; Fehily *et al*, 1993; Humble *et al*, 1993; Khaw & Barrett-Connor, 1987; Kromhout *et al*, 1982; Kushi *et al*, 1985; Morris *et al*, 1977; Pietinen *et al*, 1996; Rimm *et al*, 1996; Wolk *et al*, 1999)

have investigated the relation between fiber intake and risk of acute myocardial infarction (AMI) or cardiovascular disease in general. Most have found significant inverse associations, although only a few have presented estimates adjusted for energy intake and separately for different types and sources of fiber (Kushi *et al*, 1999). These studies were conducted in the USA (Humble *et al*, 1993; Khaw & Barrett-Connor, 1987; Kushi *et al*, 1985; Rimm *et al*, 1996; Wolk *et al*, 1999), the UK (Bolton-Smith *et al*, 1992; Burr & Sweetnam, 1982; Fehily *et al*, 1993; Kushi *et al*, 1985; Morris *et al*, 1977) or Northern Europe (Kromhout *et al*, 1982; Pietinen *et al*, 1996), and no data are available, to our knowledge, from Mediterranean countries, where the composition of the diet is qualitatively different, and smoking patterns and other relevant lifestyle habits and environmental exposures also differ.

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Thus, we analyzed the association between dietary fiber intake and AMI risk using data from a case-control study conducted in Italy (Tavani *et al*, 2001).

Subjects and methods

Between 1995 and 1999, we conducted a case-control study of nonfatal AMI in the greater Milan area, northern Italy. Cases were 507 patients, 378 men and 129 women (median age 61, range 25–79 y) with a first episode of nonfatal AMI (International Classification of Diseases, ICD-9, 410) admitted to a network of general hospitals in the area. Controls were 478 patients, 297 men and 181 women (median age 59, range 25–79 y) from the same area, admitted to the same network of hospitals for acute conditions. Patients were not eligible as controls if the diagnosis which led to the present hospital admission was a cardio- or cerebrovascular, neoplastic, metabolic or a recognized smoking- or alcohol-related condition. Also subjects with a history of myocardial infarction were excluded from the study. Among controls, 34% had traumatic conditions, 30% non-traumatic orthopaedic disorders, 14% acute surgical conditions, and 22% miscellaneous other illnesses. Less than 5% of cases and controls approached refused.

Interviews were conducted in hospital using a structured questionnaire including personal and socio-demographic characteristics, anthropometric variables, physical activity, smoking and other lifestyle habits, a problem-oriented medical history, family history of ischaemic heart disease, gynaecological and obstetric data, and history of use of oral contraceptives and hormone replacement therapy.

An interviewer-administered food frequency questionnaire was developed to assess the usual diet during the year preceding diagnosis or hospital admission for the controls. The questionnaire included 78 foods, groups of foods or dishes divided into six sections: (i) bread, cereals and first courses; (ii) second courses (meat and other main dishes); (iii) side dishes (ie vegetables); (iv) fruits; (v) sweets, desserts and soft drinks; and (vi) milk, hot beverages and sweeteners. An additional section concerned alcoholic beverages.

For a few seasonal vegetables and fruit, consumption in season and the corresponding duration were elicited. At the end of each section, one or two open questions were used to report foods not included in the questionnaire but eaten at least once per week. Dietary supplements were not considered, given their low level of consumption by this population. Reproducibility and validity of the food frequency questionnaire were satisfactory (Decarli *et al*, 1996; Franceschi *et al*, 1995).

To compute energy and nutrient intake, Italian food composition databases were used for about 80% of food items, and integrated with other sources when needed (Salvini *et al*, 1996, 1998). The published tables included dietary fiber computed with the enzymatic gravimetric method only (AOAC, 1980). The composition tables were subsequently extended (publication in preparation), to include dietary

fiber derived using the Englyst procedure (Englyst & Cummings, 1988; Englyst *et al*, 1992), which measures fiber as nonstarch polysaccharides (NSP). A value was obtained for total fiber and soluble and insoluble fiber. A modification of the method allows cellulose to be measured separately from insoluble noncellulose polysaccharides (NCP). We did not include resistant starch in the computation of total fiber, since its amount depends on how each food is processed and consumed (Cummings & Englyst, 1995), and related food composition tables were not available. Fiber intake was also divided according to the food from which it originated, ie vegetable, fruit or cereal. In the control group the median intake of fiber measured as NSP was 16.0 g/day, and 21.9 g/day when measured using the enzymatic gravimetric method (AOAC, 1980). The Pearson correlation coefficient between the two measures of fiber intake was 0.95.

Statistical analysis

Odds ratios (OR) and the corresponding 95% confidence intervals (CI) were obtained using multiple logistic regression models (Breslow & Day, 1980). The various types of fiber were entered in the models both as tertiles of the distribution of controls and in continuous. In the latter case, the unit was set at 5 g. Several models were fitted to the data, all adjusted for age and sex. Further models included terms for education, body mass index, physical activity, tobacco, alcohol and coffee consumption, diabetes, hypertension, cholesterol, family history of ischaemic heart disease, and energy intake. Additional adjustment was made for intake of β -carotene and vitamins C and E, when indicated.

Results

Table 1 gives the distribution of cases and controls according to sex, age and education. Table 2 shows the distribution of

Table 1 Distribution of 507 cases of acute myocardial infarction (AMI) and 478 controls according to sex, age and education. Milan, Italy, 1995–1999

| | AMI | | Controls | |
|----------------------------|-----|--------|----------|--------|
| | n | % | n | % |
| Sex | | | | |
| Males | 378 | (74.6) | 297 | (62.1) |
| Females | 129 | (25.4) | 181 | (37.9) |
| Age (y) | | | | |
| <45 | 42 | (8.3) | 61 | (12.8) |
| 45–54 | 108 | (21.3) | 99 | (20.7) |
| 55–64 | 166 | (32.7) | 162 | (33.9) |
| ≥65 | 191 | (37.7) | 156 | (32.6) |
| Education (y) ^a | | | | |
| <7 | 234 | (46.2) | 236 | (49.4) |
| 7–11 | 162 | (32.0) | 148 | (31.0) |
| >11 | 104 | (20.5) | 86 | (18.0) |

^aThe sum does not add up to the total because of some missing values.

cases in tertiles of fiber intake computed on the distribution of controls, the corresponding OR and the OR for an increase in intake of 5 g/day. The cut-off points for soluble and insoluble fiber were similar, indicating that the two types contributed approximately to the same extent to total fiber intake. Compared to the lowest one, the OR in the highest

tertile was 0.72 for total fiber, 0.64 for soluble fiber, 0.77 for total insoluble fiber, 0.64 for cellulose and 0.81 for insoluble NCP, and the estimate was significant for soluble fiber only. The OR for an increase in intake of 5 g/day was 0.68 for soluble as compared to 0.83 for insoluble fiber. When insoluble fiber was further split, the OR for 5 g/day of cellulose

Table 2 Odds ratio^a (OR) and 95% confidence interval (CI) of acute myocardial infarction according to intake of different types of fiber,^b Milan, Italy, 1995–1999

| | Tertile of intake ^c | | | χ^2 trend | per 5 g intake |
|-------------------------------------|--------------------------------|-------------------|------------------|----------------|------------------|
| | I | II | III | | |
| Total fiber | | 14.2 ^d | 18.0 | | |
| Cases | 188 | 155 | 164 | | |
| OR (95% CI) | 1 ^e | 0.79 (0.55–1.12) | 0.72 (0.48–1.07) | 2.74 (P=0.10) | 0.87 (0.73–1.04) |
| Soluble fiber | | 7.0 | 8.9 | | |
| Cases | 180 | 174 | 153 | | |
| OR (95% CI) | 1 ^e | 0.92 (0.64–1.30) | 0.64 (0.42–0.97) | 4.25 (P=0.04) | 0.68 (0.46–1.01) |
| Insoluble fiber | | 7.2 | 9.2 | | |
| Cases | 186 | 153 | 168 | | |
| OR (95% CI) | 1 ^e | 0.78 (0.54–1.11) | 0.77 (0.52–1.14) | 1.75 (P=0.19) | 0.83 (0.61–1.13) |
| Cellulose | | 3.6 | 4.7 | | |
| Cases | 197 | 152 | 158 | | |
| OR (95% CI) | 1 ^e | 0.77 (0.54–1.10) | 0.71 (0.49–1.05) | 3.04 (P=0.08) | 0.60 (0.34–1.04) |
| Insoluble noncellulose fiber | 3.6 | 4.5 | | | |
| Cases | 188 | 136 | 183 | | |
| OR (95% CI) | 1 ^e | 0.69 (0.48–0.98) | 0.81 (0.55–1.21) | 1.13 (P=0.29) | 0.91 (0.49–1.70) |

^aEstimates from unconditional logistic regression models adjusted for sex, age, education, body mass index, physical activity, tobacco, alcohol and coffee consumption, diabetes, hypertension, cholesterol, family history of ischaemic heart disease and energy intake.

^bDefined as nonstarch polysaccharides.

^cComputed on the distribution of controls. The number of controls in each tertile is 159–160.

^dLower cut-off point of the tertile in grams.

^eReference category.

Table 3 Odds ratio^a (OR) and 95% confidence interval (CI) of acute myocardial infarction according to intake of fiber^b from different sources, Milan, Italy, 1995–1999

| | Tertile of intake ^c | | | χ^2 trend | per 5 g intake |
|------------------------|--------------------------------|------------------|------------------|----------------|------------------|
| | I | II | III | | |
| Vegetable fiber | | 4.6 | 6.4 | | |
| Cases | 186 | 156 | 165 | | |
| OR (95% CI) | 1 ^e | 0.85 (0.60–1.20) | 0.82 (0.57–1.18) | 1.16 (P=0.28) | 0.89 (0.64–1.18) |
| Fruit fiber | | 4.2 | 6.6 | | |
| Cases | 202 | 168 | 137 | | |
| OR (95% CI) | 1 ^e | 0.73 (0.52–1.04) | 0.64 (0.44–0.92) | 5.88 (P=0.01) | 0.78 (0.62–1.00) |
| Cereal fiber | | 4.2 | 5.7 | | |
| Cases | 150 | 167 | 190 | | |
| OR (95% CI) | 1 ^e | 1.03 (0.71–1.48) | 1.11 (0.71–1.75) | 0.22 (P=0.64) | 1.27 (0.79–2.03) |

^aEstimates from unconditional logistic regression models adjusted for sex, age, education, body mass index, physical activity, tobacco, alcohol and coffee consumption, diabetes, hypertension, cholesterol, family history of ischaemic heart disease and energy intake.

^bDefined as nonstarch polysaccharides.

^cComputed on the distribution of controls. The number of controls in each tertile is 159–160.

^dLower cut-off point of the tertile in grams.

^eReference category.

intake was 0.60 and that for insoluble non-cellulose NSP was 0.91.

When fiber intake was analysed according to its source, vegetables, fruit and cereals contributed approximately one-third each to total fiber (Table 3). The most unbalanced distribution in cases was for fruit fiber: 202 cases were in the first tertile, 168 in the second and 137 in the third. The OR for the highest tertile compared to the lowest one was 0.82 for vegetable fiber, 0.64 for fruit fiber and 1.11 for cereal fiber.

When the sources of fiber were further adjusted for β -carotene, vitamin C and vitamin E intake, the one showing the strongest inverse relation was still fruit fiber, with an OR of 0.74 in the highest tertile and 0.89 for an increase in intake of 5 g/day (Table 4). However, these estimates were no longer significant.

Table 5 shows the OR of AMI for an increase of 5 g in the intake of total and fruit fiber in strata of selected covariates. In general, the protective effect of fiber (total and fruit) appeared more marked in, or restricted to, subjects with another AMI risk factor. Thus the OR for total fiber was 0.66 for current smokers, but 1.04 for never or ex-smokers, 0.70 for those with cholesterol above the median, but 1.21 for those below; 0.74 for those with a history of hypertension, but 0.92 for those without; 0.35 for diabetics, but 0.89 for non-diabetics. For fruit fiber, the pattern was similar to that of total fiber. When the few subjects with history of angina or other heart disease were excluded, the ORs for total and fruit fiber were similar to those for the whole dataset, if anything slightly closer to unity.

Discussion

This case-control study found an inverse association between fiber intake and risk of nonfatal AMI, particularly for soluble and fruit fiber. The relation appeared more pronounced in, or restricted to, subjects with other AMI risk factors, ie hypertension, diabetes, high cholesterol and in current smokers, and was not explained by allowance for other major recognized risk factors for AMI. In case-control studies, information on exposure is collected after the diagnosis of cases, and it is possible that changes in diet are caused by early

symptoms of the disease itself. However, when we excluded from the analysis the few subjects reporting history of angina or other heart disease, we obtained very similar results. The use of hospital controls has been widely debated (Breslow & Day, 1980), and dietary habits of hospital controls may differ from the general population. In this study, we excluded from the control group all diagnoses which might have involved any long-term changes in the diet. On the other hand, the similar interview setting for cases and controls and the almost complete participation are reassuring, as are the satisfactory reproducibility and validity of the food frequency questionnaire (Decarli *et al*, 1996; Franceschi *et al*, 1995).

Mediterranean diet is a general concept, and there are differences in food consumption patterns across Italy (Tur-rini *et al*, 2001). Milan experienced, however, substantial immigration from Southern Italy, and its diet reflects the mixed composition of its population.

Several definitions of dietary fiber have been proposed and used in different studies. In our study, we have used the definition proposed by Englyst and Cummings (1988). However, although the intake of fiber measured as NSP was lower than the intake of fiber measured using the enzymatic gravimetric method (AOAC, 1980), there was a very high correlation between the two measurements.

When comparing various types of fiber some factors must be considered. The tertiles of consumption imply different intakes across different types of fiber. However, for each type of fiber they reflect the differences that can be observed in a real population, in the absence of supplementation. The OR for an increase in intake of 5 g may appear more comparable at first sight, but can also be misleading, since in food the various types of fiber come together, and thus their intakes are closely correlated. Thus, a dietary intake of 5 g of one type of fiber implies necessarily a greater intake of total fiber, and the less one type of fiber is consumed, the more total fiber is needed. Thus, the OR for an increase of 5 g/day should be compared only across types of fiber with approximately the same amount of intake, like soluble and insoluble fiber (median intake about 8 g each). This does not apply to the different sources. Anyway, in this population, the median intake was around 5 g for all three major sources of fiber.

Table 4 Odds ratio^a (OR) and 95% confidence interval (CI) of acute myocardial infarction according to intake of fiber, Milan, Italy, 1995–1999

| | Tertile of intake | | | χ^2 trend | per 5 g intake |
|--------------------------|-------------------|------------------|------------------|------------------------|------------------|
| | I | II | III | | |
| Total fiber ^b | 1 ^c | 0.86 (0.60–1.25) | 0.89 (0.55–1.43) | 0.29 (0.59) | 1.02 (0.79–1.30) |
| Vegetable fiber | 1 ^c | 0.88 (0.61–1.26) | 0.91 (0.59–1.39) | 0.22 (0.64) | 1.07 (0.68–1.68) |
| Fruit fiber | 1 ^c | 0.79 (0.55–1.13) | 0.74 (0.47–1.17) | 1.80 (<i>P</i> =0.18) | 0.89 (0.63–1.24) |
| Cereal fiber | 1 ^c | 1.03 (0.71–1.49) | 1.12 (0.71–1.77) | 0.23 (<i>P</i> =0.63) | 1.30 (0.80–2.12) |

^aEstimates from unconditional logistic regression models adjusted for sex, age, education, body mass index, physical activity, tobacco, alcohol and coffee consumption, diabetes, hypertension, cholesterol, family history of ischaemic heart disease, and intake of energy, vitamin C, β -carotene and vitamin E.

^bDefined as nonstarch polysaccharides.

^cReference category.

Table 5 Odds ratio^a (OR) and 95% confidence interval (CI) of acute myocardial infarction for an increase of 5 g in daily intake of fiber^b in strata of selected covariates, Milan, Italy, 1995–1999

| Stratum | Cases: controls | OR (95% CI) Total fiber | Fruit fiber |
|---|-----------------|----------------------------|------------------|
| Sex | | | |
| Male | 378:297 | 0.83 (0.67–1.03) | 0.85 (0.64–1.13) |
| Female | 129:181 | 0.93 (0.65–1.33) | 0.64 (0.39–1.04) |
| Age (y) | | | |
| <60 | 231:240 | 0.84 (0.69–1.08) | 0.65 (0.46–0.92) |
| ≥ 60 | 276:238 | 0.93 (0.71–1.21) | 0.99 (0.70–1.40) |
| Education (y) | | | |
| <7 | 241:244 | 0.96 (0.73–1.26) | 0.85 (0.60–1.21) |
| ≥ 7 | 266:234 | 0.81 (0.63–1.03) | 0.71 (0.50–1.00) |
| Smoking habits | | | |
| Never or ex-smoker | 276:332 | 1.04 (0.82–1.31) | 1.03 (0.76–1.40) |
| Current smoker | 231:146 | 0.66 (0.49–0.89) | 0.51 (0.34–0.77) |
| Body mass index (kg/m²) | | | |
| <25.7 | 225:239 | 0.86 (0.66–1.11) | 0.74 (0.52–1.05) |
| ≥ 25.7 | 282:239 | 0.89 (0.68–1.15) | 0.80 (0.57–1.12) |
| Cholesterol level (mg/dl) | | | |
| <213 | 113:133 | 1.21 (0.80–1.82) | 1.05 (0.63–1.77) |
| ≥ 213 | 195:134 | 0.70 (0.50–0.96) | 0.66 (0.42–1.04) |
| Missing | 199:211 | 0.89 (0.67–1.17) | 0.70 (0.48–1.01) |
| History of hypertension | | | |
| No | 348:359 | 0.92 (0.74–1.14) | 0.85 (0.64–1.12) |
| Yes | 159:119 | 0.74 (0.50–1.09) | 0.58 (0.34–0.97) |
| History of diabetes | | | |
| No | 433:448 | 0.89 (0.74–1.07) | 0.85 (0.66–1.09) |
| Yes | 74:30 | 0.35 (0.10–1.22) | 0.29 (0.07–1.21) |
| History of angina or other heart disease | | | |
| No | 485:450 | 0.93 (0.77–1.12) | 0.84 (0.66–1.07) |
| Yes | 22:28 | Not estimable | Not estimable |
| Energy intake (kcal) | | | |
| <2366 | 253:239 | 0.88 (0.66–1.18) | 0.63 (0.42–0.93) |
| ≥ 2366 | 254:239 | 0.86 (0.68–1.08) | 0.92 (0.67–1.26) |

^aEstimates from unconditional logistic regression models adjusted for sex, age, education, body mass index, physical activity, tobacco, alcohol and coffee consumption, diabetes, hypertension, cholesterol, family history of ischaemic heart disease and energy intake (whenever appropriate).

^bDefined as nonstarch polysaccharides.

This study confirms in a Southern European population the inverse association found in studies from Northern Europe and the USA (Bolton-Smith *et al*, 1992; Burr & Sweetnam, 1982; Fehily *et al*, 1993; Humble *et al*, 1993; Khaw & Barrett-Connor, 1987; Kromhout *et al*, 1982; Kushi *et al*, 1985; Morris *et al*, 1977; Pietinen *et al*, 1996; Rimm *et al*, 1996; Wolk *et al*, 1999).

Only a few studies, however, adjusted for energy intake and presented data separately for different types and sources of fiber. Among these, a prospective study based on about 44 000 male health professionals from the United States and 734 documented cases of AMI found a relative risk (RR) of 0.64 for the highest quintile of dietary fiber intake compared

to the lowest one (Rimm *et al*, 1996). The protection was slightly stronger for cereal (RR=0.71) than for fruit (RR=0.81) or vegetable fiber (RR=0.83). Another study from the USA based on about 70 000 female nurses and 591 coronary heart disease events, found a RR of 0.77 for the highest quintile of dietary fiber intake compared to the lowest one (Wolk *et al*, 1999). In that study, the inverse relation was restricted to cereal fiber (RR=0.71), and no relation was seen with vegetable (RR=0.93) or fruit fiber (RR=0.98). In a cohort of about 22 000 male Finnish smokers with 1399 major coronary events, the RR for the highest quintile of intake was 0.84 for total fiber, 0.94 for cereal fiber, 0.84 for vegetable fiber and 0.90 for fruit fiber (Pietinen *et al*,

1996). In all three studies, further adjustment for intake of micronutrients like vitamin C, vitamin E, β -carotene, folate etc tended to attenuate the association with fruit and vegetable fiber, but not that with cereal fiber. In the Finnish study, the RR were 0.79 for soluble and 0.86 for insoluble fiber, and the inverse associations for any type of fiber were stronger when only deaths were considered as the endpoint (Pietinen *et al*, 1996).

In this study, soluble fiber conferred slightly stronger protection than insoluble fiber. When insoluble fiber was further split into cellulose and noncellulosic NSP, the inverse association was stronger for cellulose, though not significant. Vegetables and fruit contain proportionally more cellulose and soluble NCP and less insoluble NCP than cereals. Among the sources of fiber, fruit showed the strongest association, even after allowance for intake of several micronutrients, and specifically vitamin C, which was highly correlated with fruit ($r=0.59$) and fruit fiber intake ($r=0.72$), and inversely related to AMI risk in this (Tavani *et al*, 2001) and other studies (Khaw *et al*, 2001). Thus, it cannot be ruled out that the differences in the strength of the association observed between the various types of fiber are due to differences in their food sources, rather than to their physiological effects.

The differences in the source of fiber showing the (strongest) inverse association may simply be due to random variation, since in most studies the OR for the various types of fiber were compatible with a common OR. Alternatively, differences in dietary habits of the populations under study may play a role. In Italy, bread and cereal products are mostly consumed refined. In this study, 90% of controls did not consume wholegrain bread, while over 60% ate two or more portions of refined bread per day, and refined bread was the major source of starch and cereal fiber in this population (Favero *et al*, 1997). A high intake of starch raises postprandial glucose and consequently insulin levels and leads to insulin resistance and diabetes, which in turn, is related to atherosclerotic cardiovascular disease (DeFronzo & Ferrannini, 1991; Meyer *et al*, 2000). This may outweigh any beneficial effect of grain fiber observed in other populations. Wholegrain intake lowered cardiovascular risk in several studies (Jacobs *et al*, 1998, 2001; Liu *et al*, 1999), and in the Iowa Women's Health Study cohort whole grain, but not refined grain, was inversely related to all-cause mortality (Jacobs *et al*, 2000).

Fiber may have a favourable effect on several AMI risk factors (Anderson & Hanna, 1999; Van Horn for the Nutrition Committee, 1997). Soluble fiber in particular can reduce serum cholesterol levels. A meta-analysis of published trials on the cholesterol-lowering effect of dietary fiber found a significant effect, although it was small in practical terms, and may thus only imply a small reduction in AMI risk (Brown *et al*, 1999). Dietary fiber can also help in controlling energy intake, preventing overweight and obesity and improving the waist-to-hip ratio (Burton-Freeman, 2000; Ludwig *et al*, 1999); it can lower blood pressure (He &

Whelton, 1999), and slow the absorption of carbohydrates, thus reducing postprandial glucose and insulin levels, contributing to the control of diabetes and related disorders (Jenkins & Jenkins, 1985).

Although an inverse association between fiber intake and AMI risk appears to be established, the causality of this association is still open to debate (Wynder *et al*, 1996). When studying the complexity of diet in an observational context, it is difficult to separate the effect of the various components, and the possibility that fiber intake has no causal link to AMI risk, but is simply an indicator of a healthier lifestyle, cannot be ruled out (Wynder *et al*, 1996).

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