Eur J Nutr (2009) 48:120–123
DOI 10.1007/s00394-008-0771-2

SHORT COMMUNICATION

Carlotta Galeone
Alessandra Tavani
Claudio Pelucchi
Eva Negri
Carlo La Vecchia

Allium vegetable intake and risk of acute myocardial infarction in Italy

Received: 27 October 2008
Accepted: 11 December 2008
Published online: 13 January 2009

C. Galeone, ScD, PhD (✉) · A. Tavani, ScD
C. Pelucchi, ScD · E. Negri, ScD
C. La Vecchia, MD
Dept. of Epidemiology
Istituto di Ricerche Farmacologiche
"Mario Negri"
Via La Masa 19
20156 Milan, Italy
Tel.: +39-02/39014656
Fax: +39-02/33200231
E-Mail: galeone@marionegri.it

C. Galeone, ScD, PhD · C. La Vecchia, MD
Istituto di Statistica Medica e Biometria
Università degli Studi di Milano
Milan, Italy

Abstract *Background* Interest in potential benefits of allium vegetables has its origin in antiquity, but the details of these benefits are still open to discussion. Only two epidemiological studies considered the relation between dietary intake of allium vegetables and cardiovascular diseases. *Aim of the study* To provide further information we analysed the relationship between onion and garlic intake and acute myocardial infarction (AMI). *Methods* We used data from a case–control study of 760 patients with a first episode of non-fatal AMI and 682 controls admitted to the same hospitals. Information was collected by trained interviewers using a validated and reproducible food-frequency questionnaire. Multivariate odds ratios (ORs) and 95% confidence intervals (CIs) were obtained after allowance for recognized confounding factors. *Results* Compared with non-users, the ORs of AMI for subsequent categories of onion intake were 0.90 (95% CI: 0.69–1.21) for <1 portion of onion per week and 0.78 (95% CI: 0.56–0.99) for ≥1 portion per week. For garlic, the ORs were 0.84 (95% CI: 0.66–1.09) for intermediate and 0.94 (95% CI: 0.68–1.32) for high use, compared with no or low use. *Conclusion* The current study, the first from Mediterranean countries, suggests that a diet rich in onions may have a favourable effect on the risk of AMI.

Key words onion – garlic – allium vegetables – diet – myocardial infarction

Introduction

Garlic (*Allium sativum*) and onion (*Allium cepa*) are a rich source of several phytonutrients recognized as important elements of Mediterranean diet [11]. During the last three decades, several studies have reported beneficial effects of garlic and onion intake on prevention and treatment of selected diseases, including coronary heart disease, obesity, hypertension, hypercholesterolemia, platelet mediated thrombosis and cancer [3, 6]. Several in vitro studies and clinical trials on garlic supplementation suggested that garlic intake might protect from cardiovascular disease risk by reducing serum cholesterol concentration and blood pressure [2]. As for onion intake, to our knowledge, only two epidemiological studies considered the relation between dietary intake of onions and cardiovascular disease. A cohort study conducted in Finland, based on 473 deaths for coronary heart disease, found a relative risk of 0.74 [95% confidence interval (CI): 0.53–1.02) in men and 0.50 (95% CI: 0.30–0.82] in women for the highest quartile of onion intake, compared to the lowest one [9]. A cross-sec-

EJN 771

tional analysis based on the SU.VI.MAX study and including 1,286 women and 1,005 men, found that women in the highest tertile of flavonoid-rich food consumption were at lower risk for cardiovascular disease [odds ratio (OR) = 0.31; 95% CI: 0.14–0.68], whereas a direct trend was observed in men (OR = 1.38; 95% CI: 0.96–2.00) [12]. The results were similar for various foods separately, including onions.

To provide further information on the role of dietary intake of allium vegetables the risk of coronary heart disease, we analysed the relationship between onion and garlic intake and the risk of non-fatal acute myocardial infarction (AMI), using data from a case–control study conducted in Italy.

Methods

The data derives from a case–control study of non-fatal AMI, conducted in the greater Milan area, Italy, between 1995 and 2003. Cases were 760 patients [580 men and 180 women; median age 61 (range 19–79 years)] with a first episode of non-fatal AMI, defined according to the World Health Organization criteria, admitted to a network of general hospitals in the area. Controls were 682 patients [439 men and 243 women; median age 59 (range 16–79 years)] from the same geographic area, admitted to the same hospitals as cases for a wide spectrum of acute conditions not related to known AMI risk factors nor diet. We excluded subjects with history of major cardiovascular events. Among controls, 30% had traumas, 25% non-traumatic orthopedic disorders, 18%, acute surgical conditions, 18% eye, nose, throat disorders, and 9%, miscellaneous other illnesses. Less than 5% of the cases and controls approached refused to participate.

Interviews were conducted in the hospital using a structured questionnaire, including information on socio-demographic factors, anthropometric variables, smoking, alcohol and coffee consumption, physical activity, other lifestyle habits, a problem-oriented medical history, and history of AMI in first-degree relatives. Cholesterol levels were obtained from clinical records. Information on diet referred to the 2 years preceding diagnosis and was based on a food-frequency questionnaire (FFQ), tested for reproducibility and validity [7, 8]. The FFQ included 78 foods, food groups or recipes, and allowed an estimation of energy intake. Among the items in the FFQ, two questions referred specifically to consumption of onion and garlic. For onion intake, we asked for the weekly frequency of consumption and usual portion size (small, intermediate, large), where an intermediate portion corresponded to 80 g of onion. A small portion was considered as 0.7-times an intermediate portion, and a large portion was considered as 1.3-times an intermediate portion. Frequencies of less than once per week, but at least once per month, were coded as 0.5 portions per week. For frequency of garlic use, we asked for the customary consumption as a qualitative variable, scored as 1 for non-use or low use (when garlic was used only for flavouring foods but it was not eaten), 2 for intermediate use (when garlic was used for flavouring foods and it was eaten occasionally) and 3 for high use (when garlic was used in many recipes and always eaten). No information on the type of garlic and onion consumed (fresh, powders or garlic supplements) and on manner of using was available (raw or cooked).

The ORs of AMI, and the corresponding 95% CIs, for different levels of onion intake (non-users, >0 to <1 portion per week, ≥1 portion per week) and garlic use (none or low, intermediate, high) were derived using unconditional multiple logistic regression models, including terms for age, sex, education, tobacco smoking, coffee, alcohol drinking, total energy intake, fish intake, vegetable intake, body mass index, physical activity, cholesterol levels, history of hypertension, diabetes and family history of AMI in first-degree relatives.

Results

Table 1 reports the distribution of cases of AMI and controls and the ORs and 95% CIs for subsequent

Table 1 Distribution of 760 cases of acute myocardial infarction (AMI) and 682 controls, with corresponding odds ratios (ORs) and 95% confidence intervals (CI), according to onion intake (portions/week) and garlic use

	Cases:controls	OR (95%CI)[a]	OR (95%CI)[b]
Onion intake (portions per week)			
Non-users	384:308	1[c]	1[c]
>0–<1	192:173	0.87 (0.67–1.13)	0.90 (0.69–1.21)
≥1	184:201	0.69 (0.54–0.90)	0.78 (0.56–0.99)
P for trend		0.006	0.05
Garlic use[d]			
None or low	290:252	1[c]	1[c]
Intermediate	330:315	0.90 (0.72–1.14)	0.84 (0.66–1.09)
High	139:114	1.10 (0.81–1.49)	0.94 (0.68–1.32)
P for trend		0.70	0.50

Milan, Italy, 1995–2003
[a]Estimates from multiple logistic regression models, including terms for age and sex
[b]Estimates from multiple logistic regression models, including terms for age, sex, education, tobacco smoking, coffee, alcohol drinking, total energy intake, fish intake, vegetable intake, body mass index, physical activity, cholesterol levels, history of hypertension, diabetes and family history of AMI in first-degree relatives
[c]Reference category
[d]The sum does not add up to the total because of some missing values

levels of onion intake and garlic use. Compared with non-users, the ORs of AMI, adjusted for sex and age, for the subsequent categories of onion intake were 0.87 (95% CI: 0.67–1.13) for less than 1 portion of onion per week and 0.69 (95% CI: 0.54–0.90) for 1 or more portions per week, with a significant trend in risk. After allowance for major confounding factors, the corresponding ORs of AMI were 0.90 (95% CI: 0.69–1.21) and 0.78 (95% CI: 0.56–0.99) with a significant trend in risk. For garlic, as compared to none or low use, the ORs were 0.84 (95% CI: 0.66–1.09) for intermediate and 0.94 (95% CI: 0.68–1.32) for high use.

Discussion

Several epidemiological studies indicated a protective effect of a variety of plant-based foods on the risk of cardiovascular disease [5]. Possible constituents in vegetables accounting for this protection are bioactive compounds, such as phenolic and organosulfur compounds. Onions are particularly rich in both, while garlic is rich in organosulfur, but not in phenolic compounds [4]. Phenolic compounds, including their subcategory, flavonoids, have antithrombotic and endothelial protective activity [10], which might explain the protective effect against coronary mortality found in several epidemiological studies [9, 10]. Consistently, the finding that onion consumption was protective on AMI risk could be explained by these biological mechanisms, as onions are one of the major sources of flavonoids in the Italian diet [14]. In the same Italian population, we found a favourable role of high intake of flavonoids, and in particular of anthocyanidins, on AMI risk [15].

We found no significant inverse relation between garlic intake and AMI risk. Several trials suggested possible small short-term benefits of garlic on the lipid and antiplatelet factors [1]. Much variability has been observed between different studies because of differences in duration of treatment with garlic, total quantity of garlic consumed, and lack of consistency when preparing garlic [1]. We collected information on garlic use by means of a score, and thus we could not estimate quantitatively the intake of garlic that, however, will certainly be lower than the dosage in clinical trials. Moreover, we have no information on the modalities of consumption, and there are important varietal differences in the composition, concentration, and beneficial activities of these bioactive compounds, for example by modalities of cooking, which could explain the inconsistent findings. We also have no information on intake of supplements, which however is uncommon in Italy.

A limitation of this study is that onion and garlic intake in Italy could be considered markers of a healthier lifestyle, which may include complex aspects of quantity and quality of diet, and in particular of a diet rich in cooked vegetables, that has been inversely associated with AMI [13]. In fact, in the Italian diet, onion and garlic are often eaten or cooked in combination with other foods, such as tomatoes and olive oil in salads and tomato sauces for pasta.

In this study, cases and controls were interviewed in the same hospitals, and they came from the same geographical area. We excluded from the comparison group all patients admitted for chronic conditions or diseases related to known or potential risk factors for AMI, diet-related conditions and long-term modifications of diet. The FFQ was satisfactorily valid and reproducible [7, 8]. Furthermore, the findings of our study cannot be due to a selectively higher response rate of health conscious control subjects, because participation was practically complete for both cases and controls. The potential confounding effect of several covariates associated with AMI risk in this study was allowed for in the analysis. Therefore, the current study, the first from Mediterranean countries, suggests that a diet rich in onions may have a favourable effect on the risk of AMI. However, additional epidemiological studies are needed to assess the association between allium vegetables intake and risk of cardiovascular disease.

Acknowledgments The authors thank Mrs. I. Garimoldi for her editorial assistance. The work of this paper was undertaken while C. La Vecchia was a senior fellow at the International Agency for Research on Cancer.

References

1. Ackermann RT, Mulrow CD, Ramirez G, Gardner CD, Morbidoni L, Lawrence VA (2001) Garlic shows promise for improving some cardiovascular risk factors. Arch Intern Med 161:813–824
2. Banerjee SK, Maulik SK (2002) Effect of garlic on cardiovascular disorders: a review. Nutr J 1:4
3. Briggs WH, Folts JD, Osman HE, Goldman IL (2001) Administration of raw onion inhibits platelet-mediated thrombosis in dogs. J Nutr 131:2619–2622
4. Cardelle-Cobas A, Moreno FJ, Corzo N, Olano A, Villamiel M (2005) Assessment of initial stages of Maillard reaction in dehydrated onion and garlic samples. J Agric Food Chem 53:9078–9082
5. Dauchet L, Amouyel P, Dallongeville J (2005) Fruit and vegetable consumption and risk of stroke. A meta-analysis of cohort studies. Neurology 65:1193–1197

6. Dausch JG, Nixon DW (1990) Garlic: a review of its relationship to malignant disease. Prev Med 19:346–361
7. Decarli A, Franceschi S, Ferraroni M, Gnagnarella P, Parpinel MT, La Vecchia C, Negri E, Salvini S, Falcini F, Giacosa A (1996) Validation of a food-frequency questionnaire to assess dietary intakes in cancer studies in Italy. Results for specific nutrients. Ann Epidemiol 6:110–118
8. Franceschi S, Negri E, Salvini S, Decarli A, Ferraroni M, Filiberti R, Giacosa A, Talamini R, Nanni O, Panarello G et al (1993) Reproducibility of an Italian food frequency questionnaire for cancer studies: results for specific food items. Eur J Cancer 29A:2298–2305
9. Knekt P, Jarvinen R, Reunanen A, Maatela J (1996) Flavonoid intake and coronary mortality in Finland: a cohort study. Br Med J 312:478–481
10. Kris-Etherton PM, Hecker KD, Bonanome A, Coval SM, Binkoski AE, Hilpert KF, Griel AE, Etherton TD (2002) Bioactive compounds in foods: their role in the prevention of cardiovascular disease and cancer. Am J Med 113(Suppl 9B):71S–88S
11. Lanzotti V (2006) The analysis of onion and garlic. J Chromatogr A 1112:3–22
12. Mennen LI, Sapinho D, de Bree A, Arnault N, Bertrais S, Galan P, Hercberg S (2004) Consumption of foods rich in flavonoids is related to a decreased cardiovascular risk in apparently healthy French women. J Nutr 134:923–926
13. Psaltopoulou T, Naska A, Orfanos P, Trichopoulos D, Mountokalakis T, Trichopoulou A (2004) Olive oil, the Mediterranean diet, and arterial blood pressure: the Greek European Prospective Investigation into Cancer and Nutrition (EPIC) study. Am J Clin Nutr 80:1012
14. Salvini S, Parpinel M, Gnagnarella P, Maisonneuve P, Turrini A (1998) Banca Dati di Composizione degli Alimenti per Studi Epidemiologici in Italia. Istituto Europeo di Oncologia, Milan
15. Tavani A, Spertini L, Bosetti C, Parpinel M, Gnagnarella P, Bravi F, Peterson J, Dwyer J, Lagiou P, Negri E, La Vecchia C (2006) Intake of specific flavonoids and risk of acute myocardial infarction in Italy. Public Health Nutr 9:369–374