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Vegetables and Artichokes Production and Cardiovascular and Cerebrovascular Diseases Mortality: An Ecological Study

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Abstract:

Cardiovascular disease (CDV), including cerebrovascular disease (CED) and ischemic heart disease (IHD) are multifactorial etiology. Several epidemiological approaches could be employed to prevent morbidity and mortality. With an ecological design, we analyzed mortality of CVD, CED, and IHD from 8 municipalities of Castellon's province with more than 20,000 inhabitants, in the Valencia Community (Spain) during the period 1991-2011, to estimate if the vegetables and artichokes production may be associated with lower CVD mortality. A municipality, Benicarló, highlighted the higher production of vegetables and artichokes, where artichokes are the main agricultural product (variety Cynara scolymus). In a multilevel linear regression analysis adjusted for potential confounding factors, vegetables and artichokes production was associated with reduced CED mortality and, to a lesser extent, CVD mortality. No significant effect on IHD mortality was found. In biological research, artichokes reduce total cholesterol, low-density lipoprotein cholesterol, triglyceride levels, and blood pressure. However, among other limitations, we postulated vegetables and artichoke production as a proxy of their consumption. In conclusion, the study found an inverse association between vegetables and artichoke production and CVD and CED mortality, and new studies are needed to confirm these results.

Keywords: *Cardiovascular disease; Cerebrovascular; Vegetables; Artichoke; Production; Ecological design*

Introduction

The International Classification of Diseases, 10th revision, addresses the conditions of the circulatory system or cardiovascular disease (CVD) as the principal causes of CVD death. It includes cerebrovascular disease (CED) and ischemic heart disease (IHD). These diseases have a chronic course, physiologic and metabolic complexity, and multifactorial etiology, from genetic, demographic, and socioeconomic to psychological, lifestyle and environment, including medical care and diet.

To prevent CVD morbidity and mortality: How to study a multifactorial etiology?

Several approaches could be employed. An epidemiological approach is the cohort study prospective or retrospective. The Framingham Heart Study was the first prospective cohort of CVD, and its excellent results continue today [1,2], and other cohort studies have left their mark [3,4]. The method consists of following a population free of CVD during years, detecting the new cases of CVD, and estimating associations with different factors (risk or protective factors). This methodology is expensive, time-consuming, and effective. If the potential factors are well measured, cause-effect relationships may be established, and many associated CVD factors were found [5, 6]. However, many uncertainties remain considering the dynamic nature of CVD and geographic and cultural differences.

Another epidemiological approach is the ecological design. It is supported by preview information from different sources and a good knowledge of the terrain. It is non-expensive, rapid, and only permits a generation and evaluation of the hypothesis, the first stage of scientific research. Our study [7] analyzed mortality of CVD, CED, and IHD from 8 municipalities of Castellón's province with more than 20,000 inhabitants, in the Valencia Community (Spain) during the period 1991-2011, to estimate if the vegetables and artichokes production may be

associated with lower CVD mortality. The eight municipalities are located in a maxim of 100 km from the North-South in the Mediterranean coast and share a common genetic, cultural, and climatic experience. However, some differences may be observed, highlighting the agricultural production of vegetables and artichokes in a municipality, Benicarló, where artichokes are the main agricultural product (variety Cynara scolymus). Multilevel linear regression was used to study the association between this production as a proxy of vegetables and artichokes consumption and mortality of CVD, CED, and IHD considered smoothed standardized mortality ratio and age-adjusted mortality rate for a sensitivity analysis. An analysis adjusted for potential confounding factors (including sex, age, foreign-born population, household income, and municipality) by directed acyclic graphs, vegetables, and artichokes production were associated with lower CVD and CED mortality. We studied other potential confounders like unemployment, air pollution (PM10, NO2 concentration), coastal proximity, and drinking water hardness. The results suggested that vegetables and artichokes production reduced CED mortality and, to a lesser extent, CVD mortality. No significant effect on IHD mortality was found.

Our results align with studies of cohorts of diet and CVD mortality where high vegetable consumption was associated with lower CVD mortality [8,9]. Still, more specific studies of types of plants could be substantial to increase vegetable consumption of the population [10]. Artichokes, a plant of the Asteraceae family, has several beneficial human health properties, including antioxidant, anti-inflammatory, and hepatoprotective [11]. Artichoke affects CVD risk factors, including reducing total cholesterol, low-density lipoprotein cholesterol, triglyceride levels, and low arterial hypertension [12, 13]. The chemical composition of artichoke contains polyphenols, carotenoids, chlorophylls, and organic acids [14]. In laboratory studies, wild artichoke (Cynara cardunculus) improves aortic relaxation when added to an incubation bath [15]. Wild artichoke is a traditional Christmas dish in the North of Spain (Navarra, Aragon, La Rioja, and Soria).

Our study has several limitations, including the design ecologic with the risk of bias. Not considering co-morbidity or family history of CVD, a retrospective approach, few socioeconomic data, residual confounding are also limitations. Another limitation is that we postulated that vegetables and artichoke production as a proxy of their consumption. Further studies that could replicate our research in a geographic area with a high artichokes production and consider CVD mortality to support our results are needed to prove it. A survey in the eight municipalities may be helpful to know vegetables and artichokes consumptions and CVD risk factors with a representative sample of 8 towns, followed by a prospective cohort study with the participants in the survey.

Conclusion

The study found an inverse association between vegetables and artichoke production and CVD and CED mortality. New studies are needed to confirm these results.

Conflicts of Interest

The authors declare no conflict of interest.

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