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Review

Red meat consumption and ischemic heart disease. A systematic literature review

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ABSTRACT

Several lines of evidence attest that diet may strongly influence the cardiovascular risk. We performed an electronic search in Medline (with PubMed interface), Scopus and ISI Web of Science, to identify epidemiological studies on the association between red meat intake and the overall risk of ischemic heart disease (IHD). Eleven studies (8 prospective and 3 case–control) were finally selected for this systematic literature review. Although a larger intake of red meat was found to be a significant risk factor for IHD in four studies (2 prospective and 2 case–control), no significant association was found in five other trials (4 prospective and 1 case–control). We suggest that future diet recommendations for prevention of cardiovascular disease should take into account that the current literature data does not support the existence of a clear relationship between large intake of red meat and increased risk of myocardial ischemia.

Contents

1. Introduction

Several lines of evidence now attest that diet may strongly influence the cardiovascular risk (Parikh et al., 2005). Among the various nutrients, meat plays a substantial role in human's diet, since it is an important source of proteins, essential amino acids, vitamins, minerals and other micronutrients (Lafarga & Hayes, 2014), despite the fact that fat and fatty acid composition of red meat may be involved in enhancing the risk of cardiovascular disease (CVD) (McAfee et al., 2010). Conventionally, the term "red" is used to define a type of meat characterized by a red hue and which does not turn to white when cooked. The global market of red meat is as high as 184 million tonnes per year, thus largely exceeding that of poultry (109 million tonnes per year) and ovine products (14 million tonnes per year) (Food Agriculture & Organization of the United Nations, 2014). Such a large consumption of red meat, especially in high-income countries, has recently emerged as a public health care concern due to the potential association between red meat consumption and a number of human disorders, including diabetes and cancer (Walker, Rhubart-Berg, McKenzie, Kelling, & Lawrence, 2005). As regards CVD, the American Heart Association (AHA) has released specific recommendations aimed to reduce the risk of developing cardiovascular disorders, including statements that consumption of lean meats should be preferred over that of fat meat, the intake of processed meats high in saturated fat and sodium should be limited, and meat should be preferably consumed after grilling, baking or broiling (Lichtenstein et al., 2006). However, whether or not red met intake would represent a risk factor for CVD remains a matter of debate. A recent prospective cohort analyses including 11,116 subjects aged 18–75 years old and followed up for an average period of 6.6 years (Chen et al., 2013) concluded that a diet enriched in animal proteins may slightly increase the risk of heart

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disease mortality, especially among smokers (hazard ratio [HR], 1.20; 1.00–1.45). Interestingly, in another recent prospective study, including 448,568 subjects aged 35–69 years who were followed up for a median period of 12.7 years (Rohrmann et al., 2013), no association was found between larger consumption of total red meat and all-cause death (HR, 1.02; 95% CI, 0.98–1.06). Nevertheless, when the analysis was limited to subjects who died for CVD, a marginally significant association was found with total red meat intake (HR, 1.09; 95% CI, 1.00–1.18), especially with larger intake of processed meat (HR, 1.30; 95% CI, 1.17–1.45). At variance with this evidence, Whiteman et al. followed up for 9 years 10,522 subjects aged 35–64 years (5593 women and 4929 men) (Whiteman, Muir, Jones, Murphy, & Key, 1999), and found an inverse association between intake of fresh or frozen meat and mortality for CVD (relative risk [RR]; 0.71; 95% CI. 0.55–0.92).

The controversial evidence on red meat intake and cardiovascular mortality persuaded us to carry out a systematic literature review in order to establish whether or not red meat intake represents an additional risk factor for ischemic heart disease (IHD).

2. Methods

We performed an electronic search in Medline (with PubMed interface), Scopus and ISI Web of Science using the keywords "red" AND "meat" AND "coronary artery disease" OR "coronary heart disease" OR "acute coronary syndrome" OR "ischemic heart disease" OR "myocardial infarction" in "Title/Abstract/Keywords" and with no language or date restriction, to identify epidemiological studies on the association between red meat intake and the overall risk of IHD (i.e., fatal and non-fatal cases). The documents that could be identified were systematically reviewed by two authors (G.L. and C.M.) and the references were also hand-searched to identify other pertinent items.

3. Results

A total number of 53 documents could be identified after elimination of replicates among the three scientific databases and 3 additional studies could be detected from the relative references. Forty five items were excluded after accurate reading of title, abstract or full text (see Fig. 1). Therefore, 11 studies (8 prospective and 3 case–control) were finally selected for this systematic literature review (Table 1) (Ascherio, Willett, Rimm, Giovannucci, & Stampfer, 1994; Bernstein et al., 2010; Burke et al., 2007; Hu et al., 1999; Kabagambe, Baylin, Siles, & Campos, 2003; Kontogianni, Panagiotakos, Pitsavos, Chrysohoou, & Stefanadis, 2008; Nagao, Iso, Yamagishi, Date, & Tamakoshi, 2012; Oliveira, Lopes, & Rodriguez-Artalejo, 2010; Qi, van Dam, Rexrode, & Hu, 2007; Takata et al., 2013; Whiteman et al., 1999). Inter-rater agreement was 96% (kappa statistics, 0.90; $p < 0.001$). The different types of meat and the diagnostic criteria for IHD used in the single studies are provided in Table 2.

The first study that investigated the relationship between IHD and red meat consumption was published by Ascherio et al. (1994). The authors conducted a large prospective study, including 44,933 men with no previous history of CVD, who were followed up for 4 years. A total number of 844 incident cases of coronary artery disease (CAD) (249 nonfatal myocardial infarctions, 137 coronary disease fatalities and 458 bypass operations or angioplasties) were recorded on follow-up (rate of incident CAD: 1.9%). A slightly higher but non-significant risk of CAD was found in men consuming red meat (prevalently beef) ≥ 4 times per week compared to those reporting intake of ≤ 1 per month (RR, 1.38; 95% CI, 0.77–2.29). Interestingly, a slight but non-significant risk of CAD was also observed in subjects in the highest quintile of beef, chicken, liver and other processed meat consumption (RR, 1.18; 95% CI, 0.78–1.80).

In a following prospective study, 80,082 women were followed up for 14 years (Hu et al., 1999). A total number of 939 incident cases of major CAD events were recorded during follow-up (rate of incident CAD: 1.2%). In the fully-adjusted multivariate model, no association was found between larger consumption of red meat and higher risk of CAD (RR of increment of 1 serving per day, 1.09; 95% CI, 0.91–1.30; $p = 0.35$ for trend).

Whiteman et al. (1999) performed a prospective study including 10,522 subjects, who were followed up for 9 years. Overall, 144,939 incident cases of IHD were recorded during follow-up (rate of incident IHD: 1.4%). An inverse association was found between intake of fresh or frozen red meat and mortality for IHD (RR, 0.55; 95% CI, 0.31–0.99).

Kabagambe et al. (2003) performed a case–control study, including 485 survivors of a first acute myocardial infarction (AMI) who were matched for age, gender and area of residence with 508 healthy

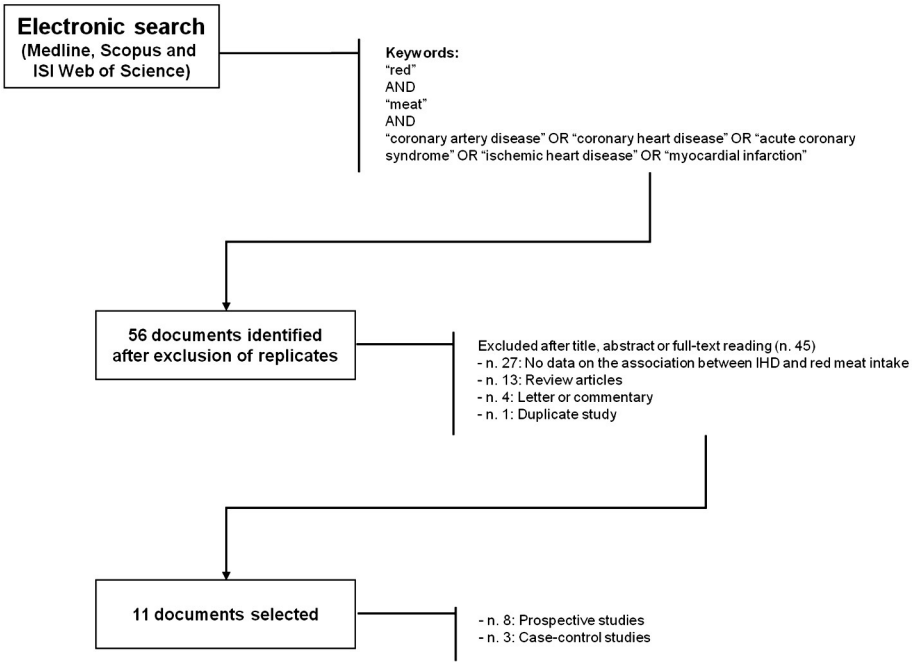

Fig. 1. Description of the search methodology.