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Intake of red and processed meat on the incidence of cancer: Are the risks really relevant?

The conclusions of a meeting aimed at evaluating the carcinogenicity of the consumption of red meat and processed meat, which was held in October of 2015 at the International Agency for Research on Cancer in Lyon (France), were published in December 2015 (Bouvard et al., 2015). Twenty-two scientists (Working Group) from 10 different countries participated in that meeting. These scientists assessed more than 800 epidemiological studies on the association of cancer with the consumption of red meat and processed meats. The Working Group classified the consumption of processed meats as carcinogenic to humans (Group 1) and the consumption of red meat as probably carcinogenic to humans (Group 2A). Extensive details on the evaluations, as well as the consequent decisions, were published in 2018: Red Meat and Processed Meat, IARC Monographs on the Evaluation and Carcinogenic Risks to Humans, Volume 114.

In 2017, we published in this Journal a short-review (Domingo and Nadal, 2017) covering the scientific articles published between October 2015 and February 2017. Between February 2017 and today, a number of investigations on the carcinogenicity of consumption of red meat and/or processed meats have joined the already exhaustive scientific literature. The results of the studies by De Vries et al. (2017), Alsheridah and Akhtar (2018), Behrens et al. (2018), Mafiana et al. (2018), Salter (2018), Bradbury et al. (2019), Czaderny (2019), Ganjavi and Faraji (2019), Imad et al. (2019), Lourenço et al. (2018) and Saliba et al. (2019), have all agreed -to a greater or lesser extent-that the consumption of red and processed meat is associated with an increased risk of colorectal cancer (CRC). Various recent reviews have also corroborated the IARC decision (Fardet et al., 2017; van Zutphen et al., 2017; Givens, 2018; Zhao et al., 2019), mainly with respect to the risks of CRC. In contrast, only a few studies have not reached the same conclusion. Thus, Ruan et al. (2019) only found a small -but meaningful-cancer burden associated with red and processed meat consumption, while Pramual et al. (2018) did not find an association between a positive fecal immunochemical test and meat consumption.

On the other hand, since our previous review (Domingo and Nadal, 2017), a number of studies have investigated potential mechanisms for cancer risks derived from the consumption of red and processed meats. It has been suggested that DNA adduct formation can contribute to red meat related CRC risk (Hemeryck et al., 2018), while the frequency of red meat intake (in non-smokers) increases the risk of CRC in the case of GST gene polymorphisms (Klusek et al., 2019). The potential role played by environmental factors and gut microbiota (Song and Chan, 2019), as well as the gene polymorphisms of metabolic enzymes (Doaei et al., 2018) has been discussed. The role of certain chemical substances such as heterocyclic aromatic amines and polycyclic aromatic hydrocarbons, formed during the heating process of meats, and that of N-nitroso compounds, formed during the curing of meats, has been also investigated and discussed (Chiang and Quek, 2017; Domingo, 2017; Jeyakumar et al., 2017; Kruger and Zhou, 2018; Turesky, 2018; González et al., 2019; Khosravi-Darani et al., 2019). Another possible reason for the association between red meat consumption and CRC could be the adverse effects exerted by the heme iron contained in red meat, which would promote the formation of mutagenic and carcinogenic agents by affecting homeostasis and colonic epithelial cell renewal (Kruger and Zhou, 2018; Sasso and Latella, 2018a,b).

In contrast to the above evidences, in October 1, 2019, the journal Annals of Internal Medicine has published a series of 5 review-articles focused on the possible effect of red and processed meat on the incidence of cancer and cardiometabolic diseases. These publications are part of NutriRECs (Nutritional Recommendations and accessible Evidence summaries Composed of Systematic reviews), the goal of which is to develop trustworthy guideline recommendations on nutrition (Johnston et al., 2018, 2019). Three of these reviews were specifically focused on cancer. The main conclusions were the following: "*the possible absolute effects of red and processed meat consumption on cancer mortality and incidence are very small, and the certainty of evidence is low to very low*" (Han et al., 2019); "*low- or very-low-certainty evidence suggests that dietary patterns with less red and processed meat intake may result in very small reductions in adverse cardiometabolic and cancer outcomes*" (Vernooij et al., 2019), and "*low-to very-low-certainty evidence suggests that diets restricted in red meat may have little or no effect on major cardiometabolic outcomes and cancer mortality and incidence*" (Zeraatkar et al., 2019). Based on this, anyone could think that the recent recommendations on the reduction of the intake of red and processed meats are unnecessary, as the benefits on the prevention of cancer (mainly CRC, but also stomach and others) would be rather irrelevant.

The conclusions of these very recent reviews have immediately reached the generalist media. As usual on health issues, there is nothing worse for the public opinion in general, and for family doctors and specialists in particular, receive such contradictory messages. We must expect that the IARC -and other international organisms-will give a prompt and conclusive clarifying response to this.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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