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## Red meat's role in addressing 'nutrients of public health concern'

Kevin D. Cashman<sup>a,b,\*</sup>, Aoife Hayes<sup>a</sup><sup>a</sup> Cork Centre for Vitamin D and Nutrition Research, School of Food and Nutritional Sciences, University College Cork, Cork, Ireland<sup>b</sup> Department of Medicine, University College Cork, Cork, Ireland

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## ABSTRACT

The role of red meat, particularly lean cuts, in healthy eating guidelines has been highlighted in most developed nations. Despite this, the public have received some mixed messages in relation to meat. Nutrition claims in Europe and nutrient content claims in the US may have important roles in providing consumer confidence and a better appreciation of the importance of red meat to achieving nutrient adequacy. In particular, it is noteworthy that nutrition/nutrient content claims for red meat could be made for four out of the seven nutrients of public health concern as designated in the 2015–2020 Dietary Guidelines for Americans, namely sodium, potassium, iron, vitamin D, the intakes of which have also been shown to be problematic for European populations. While beef may already qualify to carry a 'Source of vitamin D' claim, other red meats do not. Vitamin D biofortification approaches may have the ability to enhance the vitamin D and/or 25-hydroxyvitamin content of red meat, facilitating additional nutrition/nutrient content claims.

## 1. Introduction

Red meat contains high biological value protein and micronutrients, all of which are essential for good health throughout life (Food and Agriculture Organisation, 1992). Internationally, a moderate intake of lean red meat is viewed as an important part of a healthy balanced diet (Wyness et al., 2011; and see Table 1). It should be noted however that distinctions are typically made between unprocessed red meats and processed meats in terms of associations with health outcomes (Binnie, Barlow, Johnson, & Harrison, 2014), overall dietary quality, and adherence to dietary advice (Cosgrove, Flynn, & Kiely, 2005).

In 2015, following a review of the scientific literature, a Working Group of the International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization, classified 'processed meat' as *carcinogenic to humans*, based on *sufficient evidence* in humans that excess consumption of processed meat causes colorectal cancer (Bouvard et al., 2015). The IARC Working Group classified the consumption of 'red meat' as *probably carcinogenic to humans*, based on *limited evidence* that excess consumption of red meat causes cancer in humans and *strong mechanistic evidence* supporting a carcinogenic effect (Bouvard et al., 2015). Klurfeld (2015) has reviewed the current research which underpins existing dietary recommendations for meat consumption and outlines the limitations of such observational studies inferring causality of red and processed meat consumption and the incidence of cancer as well as other chronic diseases. There has also been an ongoing debate as to whether dietary advice to limit red meat is

unnecessarily restrictive in light of the health outcomes evidence-base overall, which has been comprehensively reviewed elsewhere (Binnie et al., 2014; IARC International Agency for Research on Cancer, 2015; Wyness et al., 2011) and will not be the key focus of the present review.

Since the publication of the (IARC) International Agency for Research on Cancer (2015) Monograph, meat has been increasingly in the media spotlight with at times conflicting messages, which has contributed to major confusion by the public in relation to the role meat plays in a healthy diet. Ironically, even the IARC press release on the Monograph suggested that "At the same time, red meat has nutritional value" (IARC International Agency for Research on Cancer, 2015). The present review wishes to illustrate how 'nutrition labelling' and, in particular, 'nutrition claims' may help to provide the consumer with a means of trusted information in relation to the nutrient content of meat, and the industry sector with tools to highlight particular nutritional properties of meat. In particular, this review will focus on how moderate red meat consumption could contribute to several 'nutrients of public health concern'. The review will use the case of vitamin D as an exemplar.

## 2. Defining meat: Red versus white, processed versus unprocessed

While the findings of the (IARC) International Agency for Research on Cancer (2015), Monograph have been hotly debated, and are not the focus of the present review, they highlight the need for clarity in relation to how 'meat' is defined in the context of nutrition and health.

\* Corresponding author at: Cork Centre for Vitamin D and Nutrition Research, School of Food and Nutritional Sciences, University College Cork, Cork, Ireland.  
E-mail address: [k.cashman@ucc.ie](mailto:k.cashman@ucc.ie) (K.D. Cashman).

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**Table 1**  
International dietary guidelines for healthy eating in relation to meat consumption.

Country (Reference document)	Year published	Protein group no. of serving/day	Meat-serving size (g)	Other meat-related comments
US (Dietary guidelines for americans 2015–2020, 8th edition)	2015	~155 g/day from protein foods - as part of a healthy US style eating pattern (2000 cal level).	No specific reference to meat serving size	Recommend a variety of protein foods.  Lower intakes of meats, including processed meats; have often been identified as characteristics of healthy eating patterns. Specific recommendation to include ~225 g of seafood/week.
Canada (Eating well with Canada's food guide)	2011	Females: 2 servings/day; Males: 3 servings/day	75 g of cooked beef, pork or game-meat.	Meat and alternatives group provides important nutrients such as iron, zinc, magnesium, B vitamins, protein and fat.
Ireland (Healthy food for life – healthy eating guidelines and food pyramid)	2016	2 servings/day	50–75 g cooked - lean beef, lamb, pork, mince.	Lean red meat is good source of iron.  Limit processed salty meats such as sausages, bacon and ham - not every day.
UK (Eatwell guide)	2016	No protein food group serving recommendation	70 g/day red and processed meat - average daily consumption in the UK	If you eat > 90 g of red or processed meat per day, try to cut down to ≥ 70 g/day.

Thus, a few simple definitions at this stage may help set the context for the remainder of this review. At its basics, the Oxford dictionary has defined ‘meat’ as the flesh of an animal, typically a mammal or bird, as food (Oxford Living Dictionaries, 2017). Furthermore, they have defined ‘red meat’ as meat that is red when raw, for example beef or lamb, whereas ‘white meat’ is pale meat such as poultry, veal, and rabbit (Oxford Living Dictionaries, 2017). In slight difference, the IARC Working Group suggest that red meat refers to all types of mammalian muscle meat, such as beef, veal, pork, lamb, mutton, horse, and goat (IARC International Agency for Research on Cancer, 2015). We will adopt this definition of red meat for the remainder of this review.

In relation to ‘processed meat’, the IARC suggest this refers to meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation (IARC International Agency for Research on Cancer, 2015). They say that most processed meats contain pork or beef, but may also contain other red meats, poultry, offal, or meat by-products such as blood (IARC International Agency for Research on Cancer, 2015). The Food and Agriculture Organization (FAO) categorizes processed meat products into six broad groups according to the processing technologies used, treatment of raw materials and the individual processing steps, namely, 1) fresh processed meat products; 2) cured meat pieces; 3) raw-cooked products; 4) precooked-cooked products; 5) raw (dry) – fermented sausages; and 6) and dried meat (Food and Agriculture Organisation, 2007). Examples of processed meat include hot dogs (frankfurters), ham, sausages, corned beef, and biltong or beef jerky as well as canned meats and meat-based preparations and sauces (IARC International Agency for Research on Cancer, 2015). These classifications of processed meat should be considered with a level of pragmatism because there will be situations where slightly different interpretations are applied. For example, the UK and US-based food composition tables present meat, including processed meat, in slightly different ways. The ‘Meat and meat products’ food subgroup within the UK McCance and Widdowson's composition of foods integrated dataset encompasses 8 categories (Food Standards Agency, UK, 2008), while the United States Department of Agriculture (USDA)'s online Food Composition Databases lists 25 food groups seven of which are, or may be, meat-related (US Department of Agriculture, Agricultural Research Service [ARS], 2016) (see Box 1). National nutrition and health surveys also place meats into different categories, and even within a survey, ‘meat’ may be reported differently as it relates to supply of certain nutrients. For example, the National Adult Nutrition Survey (NANS) in Ireland report the percentage contribution that the ‘meat’ food group makes to the mean daily intake of a number of essential minerals and vitamins (IUNA Irish Universities Nutrition Alliance, 2011). NANS also reports the percentage contribution that the wider meat categories, namely ‘cured &

processed meats’ and ‘meat and meat dishes’, makes to the mean daily intake of sodium in the adult Irish population (IUNA Irish Universities Nutrition Alliance, 2011).

Cosgrove et al. (2005) used data from the North/South Ireland Food Consumption Survey of Irish adults to explore the impact of meat on dietary quality. They showed that a higher red meat consumption was associated with lower prevalence of inadequacy of zinc, riboflavin and vitamin C intakes, whereas increased processed meat intake was associated with lower compliance with dietary recommendations for fat, carbohydrate and fiber in men, as well as lower intakes of wholemeal bread, vegetables, fruit and fish in men and women. The authors concluded that it is important to distinguish between meat groups and that processed meat consumption is negatively associated with dietary quality and might therefore be a marker of poor dietary quality (Cosgrove et al., 2005). Thus, the focus of this review will be on red meat, and not processed meat, from a nutritional value perspective.

### 3. The role of meat in dietary guidelines internationally

Some dietary guidelines, in addition to making reference to red meat and processed meat, also mention ‘lean meat’ (see Table 1). Although there is no international definition, lean meat generally contains 5% to 10% fat (Williamson, Foster, Stanner, & Buttriss, 2005). The Food and Drug Administration (FDA) in the US suggest that in relation to game meat products, ‘lean’ refers to meats containing ≤ 10 g total fat per 100 g (Food and Drug Administration, 2013).

Examples of dietary advice on meat provided by four international bodies are provided in Table 1. In general, meat, particularly lean meat, is acknowledged as a nutrient dense food and is an important contributor to the protein food group. International dietary guidelines agree that lean meat should be the preferred choice when including meat as a source of protein in the diet. In terms of optimal quantity of meat within a healthy diet, the Canadian and Irish dietary guidelines suggest 50–75 g of cooked meat as a protein food group serving (Health Canada, 2011; Irish Department of Health, 2016). The US 2015–2020 Dietary Guidelines for Americans (US DGA) recommend ~155 g/day from the protein food group, but do not suggest a specific serving size for meat (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015). With the exception of the UK Eatwell guide with a recommendation to limit red and processed meat consumption to 70 g/day (Public Health England, 2016), the listed international bodies do not set a defined limit for daily lean meat consumption. However, there is collective agreement that a variety of protein sources in the diet is best, with particular emphasis on the inclusion of fish.

Suggestions to reduce meat intake by swapping for fish or non-meat

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