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## RED MEAT AND DIFFERENT DIETARY PATTERNS AND CARDIOVASCULAR HEALTH - THE REVIEW

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### Summary

**Introduction:** Cardiovascular diseases are in a majority of health issues worldwide. Dietary habits have been extensively studied in the cardiovascular area since they are responsible for improvement or deterioration of that system condition. One of the most commonly mentioned product is red meat, both processed and unprocessed.

**Brief description of the state of knowledge:** The aim of this review was to present currently available knowledge in the online database PubMed about consumption of red meat and cardiovascular health. The article covers scientific papers which indicate to the risk factor, which is intake of processed and unprocessed meat, and eventually incidents of CVD. It is also claimed that effects of consumption that group of protein may be dependent of its dosage.

**Conclusions:** The review support an assumption that dietary patterns, in this case red meat, processed and unprocessed, play a significant role in being CVD risk factors. Besides, that influence should be measured more precisely and new scientific tools for tracking dietary habits should be input.

**Key words:** cardiovascular disease, red meat, processed meat, unprocessed meat

## INTRODUCTION

The term ‘red meat’ encircles beef, veal, pork, lamb and mutton. Processed red meat (ham, sausages, frankfurters, salami) meat undergoes operations such as smoking, salting or adding chemical preservatives as opposed to unprocessed meat.[1] Meat consumption is increasing globally, especially from 1980s to today. By avoiding ingesting fats from red meats and meat products cardiovascular diseases (CVD) derived of fats consumption could be prevented.[2] Cardiovascular diseases burden is growing on account of majority of populations is elderly and represents one of the main health issues. Dietary patterns have been broadly studied in the cardiovascular area. [3]

Worldwide, because of chronic disease, 46% deaths (or 17.5 million) are related to cardiovascular disease (CVD). [4] It is foreseen that by 2030 CVD will have been the main global cause of mortality with 23 million deaths. [5] This number has been linked to daily lifestyle, such as high consumption of processed foods, low consumption of vegetables and fruits and inactive spending leisure time. [6] The dietary guidelines should be adapted to country depending on the present dietary practice and the proportion of intake.[32] It is because dietary habits have been claimed to influence several biologic pathways - lipoprotein and cholesterol metabolic processes, blood pressure, insulin resistance, inflammation and in general cardiovascular risk. [7]

Red meat has been referred to higher CVD risk by reason to its saturated fatty acids (SFAs) content. [3] Even so, the association between meat content of SFA and cardiovascular risk is still inconsistent. There were many investigations of SFA action on lipid profile. One suggested mechanism focuses on oxidation of LDL (ox-LDL). SFA are commonly resistant to oxidation. But the presence of heme group in red meat catalyzes promotion to the ox-LDL. Stearic acid, red meat includes, was highly associated with risk of CHD. [8] In the contrary the introduction of lean beef in a study about AHA diet contributed to diminishing total cholesterol (total-C) and LDL-C. [9] That may led to asking further questions on this topic.

Eating red meat may prevent organism from iron deficiency. However, patogenesis of CVD is associated with excessive reactive oxygen species production. [10] Unfortunately, only a few paperworks present such dependence. To sum up, authors described greater risk of MI in the group of men with a higher intake of heme iron, which mainly came from meat consumption. [11] Different study from the same year showed an opposite connection

between iron serum level and women's MI risk. What is more, an inverse relationship in both sexes between serum iron and CHD was revealed. According to the same authors, dietary iron could not explain increasing MI and CHD risk.

Higher risk of CVD is linked to the usage of preservations in red meat. Mostly processed meats contain sodium in the amount of four times more than unprocessed meat and 1.5 times more nitrates.[31] Sodium is responsible for higher blood pressure and peripheral vascular resistance and diminishing arterial compliance. [12] Moreover, nitrates and their products (for instance peroxynitrite) have been showed to cause endothelial dysfunction and atherosclerosis development. Additionally, they have been used as biomarkers of endothelial dysfunction. Insulin resistance may also be caused by nitrates and as a consequence lead to CVDs and act for a biomarker of impaired glucose metabolism. [13][14]

## **2. STATE OF KNOWLEDGE**

### **2.1 Red Meat and CVD**

In cohort study Victor W. Zhong et al. analyzed individual-level data of adults with a number of 29 682 participants in 6 prospective cohort studies in the United States processed meat intake was statistically significantly associated with incident CVD. What is more they claimed that higher intake of processed meat or unprocessed red meat was significantly associated with a small increased risk of all-cause mortality. [15] The associations of IHD risk with statistically calibrated increments in intake red and processed meat combined, the HR was 1.19 (95% CI, 1.06–1.33) for a 100-g/d increment. Additionally, the risk of IHD might be caused by the influence of these foods with risk factors for IHD such as cholesterol fractions and systolic blood pressure. [16] Stephen Bovalino B.Sc. Et al. examined the impact of red and processed meat on cardiovascular disease risk. They included two separate female cohorts, one from an Internet-based health survey (n = 13 59, age range 30–74) and the other from a longitudinal epidemiological study (n = 176, age range 65–74). Results support an association between red and processed meat consumption and CVD risk in women and point to the statement that interrelation is stronger for processed meat alone. [17] Angela Bechthold et al. demonstrated 3 studies with 6,659 cases were included in the high vs. low intake meta-analysis for CHD, 7 studies with 10,541 cases for stroke, and 5 studies with 9,229 cases for heart failure. Every extra daily 100 g of red meat were positively associated with risk of CHD, stroke and HF. Positive association between red meat intake and stroke risk was not seen in studies. Whereas, there was proof of a non-linear dose-response association between red meat and CHD and HF excluding stroke. The risk of CHD, stroke, and HF increased by approximately 10–20% with growing intake of red meat more than 100 g/d. [18] In contrast, no association was found between the consumption of unprocessed red meat and CHD risk ( $RR_{\text{summary}} 1.00$ , 95% CI 0.81–1.23 per 100 g serving/day) in a three prospective cohorts and one case–control study including 56 311 participants and 769 incident events. [19] Another prospective studies are focused on American Indians with 4 years of follow-up, processed and unprocessed red meat consumption. It was associated with an increase in the existence of carotid plaques in hypertensive individuals. However there was no link between processed and unprocessed

red meat intake and LVM. Moreover, processed meat intake was related to an increase in left atrial size in male hypertensive participants. In nonhypertensive participants, red meat consumption there was no evidence for noticing changes in cardiac parameters or with measures of carotid atherosclerosis. [20] Laila Al-Shaar et al. has checked 1 023 872 person years of follow-up, 4456 incident CHD events were detected and 1860 were fatal. They established that unprocessed and processed red meat intake were each associated with a modestly higher risk of CHD (hazard ratio for one serving per day increment: 1.12 (95% confidence interval 1.06 to 1.18) for total red meat, 1.11 (1.02 to 1.21) for unprocessed red meat, and 1.15 (1.06 to 1.25) for processed red meat. [21] Costa Rican adults were being inspected for metabolic syndrome, which may be correlated with incidents of CVD. Scientists noticed highly positive relationship between total red meat consumption and MetS (PR for highest compared to lowest quintile: 1.21; 95% CI: 1.03, 1.42;  $P$  for trend = 0.0113) but not for unprocessed or processed red meat consumption when analyzed alone. [21] Itziar Abete et al. conducted cohort studies of CVD mortality, among others. It showed a positive associations with CVD mortality and risk estimates as to the highest v. the lowest consumption category of processed meat (RR 1.18; 95 % CI 1.05, 1.32;  $I^2 = 73.5$ ,  $P = 0.002$ ) and red meat (RR 1.16; 95 % CI 1.03, 1.32;  $I^2 = 82.5$ ,  $P < 0.001$ ). [22] Four articles from the NHS indicate to high risks of CHD incidence and CVD mortality as well as plasma concentrations of inflammatory substances with a greater consumption of red meat, especially processed one. This relationship is also caused by high levels of saturated fatty acids and heme iron in red meats. [23] Another two prospective cohort studies also highlight the fact that intake of processed meat increase the risk of CVD. Moreover, greater risk of CVD mortality is linked to higher consumption of unprocessed red meat. [24] Kun Cui et al. Observed a significant connection between processed meat intake and heart failure was identified among the Europeans (RR = 1.33, 95% CI = 1.15–1.54), but not the Americans. Yet a couple of important association was found between HF risk and red meat intake (RR = 1.04, 95% CI = 0.96–1.12). [25] Also Robin W.M. Vernooij detected that eating habits aimed at consumption of red and processed meat were also linked to lower risk for cardiovascular mortality. [26]

## 2.2 Mediterranean and vegetarian diet

A Mediterranean eating pattern is related to low amount of red meat. One of the randomized study, containing 41 individuals, resulted in a conclusion that by introducing a Mediterranean Pattern with or without reducing red meat intake improves CMD risk factors on the condition that red meat is lean and unprocessed. [27] Karen Rees et al. in their review has presented a great number of studies and they claimed that the effect of a Mediterranean diet is still uncertain when it comes to clinical endpoints and CVD risk factors for both primary and secondary prevention. [28] Another study shown a prospective evidence to support profitable influence of the MedDiet on cardiovascular health. In addition, that diet has effectively undergone necessary tests and it presents the best standard for cardiovascular health. [29] In a review presented by Hana Kahleova et al. there are plenty of establishments how vegetarian diet influences on cardiovascular condition. [30]

## CONCLUSIONS:

Together, these findings indicate that intake of red meat, processed or unprocessed, is one of a risk factor of CVD. As consumption of red meat is constantly increasing, greater emphasis should be put on educating people about its unfavorable influence on cardiovascular health. What is more, diet pattern is a modifiable risk factor that is why individuals should be well-informed about the possibility of composing meals without excessive consumption of red meat.

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