Chapter 7
Red Meat and Health:
Evidence Regarding Red Meat, Health, and Chronic Disease Risk

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ABSTRACT

Despite its nutritional benefits, there is an increasing body of evidence to suggest that regular consumption of red meat may negatively impact health and disease risk, including the risk of most common chronic diseases. This chapter reviews the current evidence linking red and processed meat intakes with chronic disease, obesity and mortality risks and discusses possible mechanisms to explain these associations. Research on the health benefits of diets low in red meat, including vegetarian, vegan, Mediterranean and other plant-based diets, is also reviewed.

INTRODUCTION

While red meat is a good source of protein and other nutrients including iron, zinc and vitamin B12, there is an increasing body of evidence to suggest that higher intakes of red meat may negatively impact health and disease risk.

Epidemiological studies have found a positive relationship between intakes of red meat and processed meats and disease risk including risk of obesity (Wang & Beydoun, 2009; R1osell, Appleby, Spencer & Key, 2006; Vergnaud et al., 2010; Rizzo, Jaceldo-Siegl, Sabate & Fraser, 2013), type 2 diabetes (Micha, Michas & Mozaffarian, 2012; Pan et al., 2011; Pan et al., 2013; Aune, Ursin & Veierod, 2009; Feskens, Sluik & van Woudenbergh, 2013), coronary heart disease (Micha et al., 2012; Clifton, 2011; Micha, Wallace & Mozaffarian, 2010; Bernstein et al., 2010), stroke (Chen, Lv, Pang & Liu, 2013; Kaluza, Wolk

& Larsson, 2012; Micha et al., 2010) and some types of cancer (particularly colorectal cancer) (Abid, Cross & Sinha, 2014), independent of other lifestyle factors. All-cause mortality, and cardiovascular and cancer mortality, are also increased with higher intakes of meat, and in particular processed meat (Larsson & Orsini, 2014; Sinha, Cross, Graubard, Leitzmann & Schatzkin, 2009; Pan et al., 2012; Rohrmann et al., 2013; Abete, Romaguera, Vieira, Lopez de Munain & Norat, 2014).On the other hand, plant-based diets which exclude or contain low intakes of red meat, including vegan, vegetarian, Mediterranean, Portfolio and DASH (Dietary Approaches to Stop Hypertension) diets, are associated with improved health outcomes (McEvoy, Temple & Woodside, 2012; Sievenpiper & Dworatzek, 2013).

There are a number of possible explanations for the association between intakes of meat and chronic disease risk. In particular, typical nutrients and other compounds present in red meat including saturated fatty acids, dietary cholesterol, animal protein, haem iron, Advanced Glycation End Products (AGE's), trimethylamine-N-oxide (TMAO), L-carnitine, Neu5Gc, nitrates and nitrosamines in processed and cooked meats are likely to play a role (Uribarri et al., 2010; Feskens et al., 2013).

This chapter reviews the evidence linking high intakes of red meat with chronic disease risk and mortality and discusses the possible mechanisms underlying these associations. It also explores the health benefits of dietary patterns low in red meat. With an increased interest in lower carbohydrate high protein and hunter-gatherer 'paleo' style diets, this is a timely review of the evidence into red meat and health.

BACKGROUND

Chronic diseases including heart disease, stroke, cancer and diabetes, are the leading causes of mortality, contributing to 60% of all deaths worldwide (WHO, 2014b). Cardiovascular disease (CVD) is the leading cause of death with an estimated 17.3 million people dying from CVD in 2008 (30% of all deaths worldwide) a figure that is expected to increase to 23.3 million by 2030 (WHO, 2014b). Of these deaths, the majority were due to coronary heart disease (CHD) (7.3 million) and stroke (6.2 million). Diabetes currently affects an estimated 347 million people worldwide and in 2012 was the direct cause of 1.5 million deaths (WHO, 2014c). The World Health Organisation (WHO) projects that diabetes will be the 7th leading cause of death in 2030. Cancer is also a leading cause of death worldwide, accounting for 8.2 million deaths in 2012, with lung, liver, stomach, colorectal and breast cancers causing the most cancer deaths each year (WHO, 2014a). The WHO estimates that annual cancer cases will rise from 14 million in 2012 to 22 million within the next two decades (WHO, 2014a).

Lifestyle factors, particularly diet, play a significant role in the risk of chronic diseases and diet related chronic disease is one of the most preventable causes of morbidity and mortality worldwide. For example, behavioural risk factors (including an unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol) are responsible for about 80% of coronary heart disease and cerebrovascular disease (WHO, 2011). The World Cancer Research Fund (WCRF) estimates that about a third of the most common cancers are preventable through a nutritious diet, maintaining a healthy weight and regular physical activity (WCRF, 2014). The same lifestyle changes are known to reduce the risk of type 2 diabetes, with studies showing lifestyle intervention programs combining diet, exercise and modest weight loss can reduce the risk of developing diabetes by 58% (Knowler et al., 2002; Tuomilehto et al., 2001). The dietary recommendations for prevention of these common chronic diseases are similar and are consistent with the WHO 2004 *Global Strategy on Diet, Physical Activity and Health* which recommends increasing consumption of fruits, vegetables, legumes, whole grains and nuts, and reducing meat intake (WHO, 2004).

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