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The impact of red and processed meat consumption on cardiovascular disease risk in women

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ABSTRACT

Objective: Recent studies suggest that red and processed meat consumption is strongly linked to cardiovascular disease (CVD), the leading cause of death in Australian women. The aim of this study was to examine the association of red and processed meat consumption with CVD using the Framingham score.

Methods: Included in the analysis were two separate female cohorts, one from an Internet-based health survey (n = 13 509, age range 30–74) and the other from a longitudinal epidemiological study (n = 176, age range 65–74). Information was available on red and processed meat consumption, exercise, and all parameters required for calculation of the Framingham score. Binomial regression was used to examine the association within the Internet-based cohort, whereas Kruskal-Wallis *H* tests and a Mann-Whitney *U* test were employed for analysis of the data in the epidemiological study.

Results: Consumption of red and processed meat 3 to 4 times and >5 times per week was associated with Framingham scores 1.064 ($P = 0.002$) and 1.108 ($P \leq 0.001$) times higher, respectively, compared with consuming <1 time per week (n = 13509). A similar pattern was observed in the more detailed cohort, where those in the highest quartile of processed meat consumption had a relative 28.5% increase in median Framingham scores compared with the lowest quartile, with a difference of 4.5 observed ($P = 0.043$). No relationship was observed when red meat was investigated exclusively.

Conclusion: The results of our analysis support an association between red and processed meat consumption and CVD risk in women and suggest that the association is stronger for processed meat alone.

Introduction

Despite improvements in recent times, heart disease/cardiovascular disease (CVD) remains the number one killer of women in Australia [1]. On average, CVD kills 29 women per day and 10 400 per year, with Australian women being four times more likely to die of CVD compared with breast cancer [1]. In 2012 alone, 43945 Australians died from some form of CVD, with 52% of those being women [2]. Evidence suggests that there is a marked and clear lack of awareness of CVD among Australian women. According to research conducted by the Australian Heart Foundation, only 3 in 10 women are aware that CVD is the leading cause of death and 2 in every 10 women indicate that they have not discussed CVD with their GP in the last 2 y [3]. This lack of awareness also extends into the medical profession itself, with studies showing that one in three primary care physicians are unaware that CVD is the leading cause of death in women [4]. The 2011 Australian Heart Foundation forum report on women and heart disease indicated that CVD in women is largely being undiagnosed and undermanaged, with a poorer prognosis, greater likelihood of disability, and higher rates of illness and death compared with men [3]. Procedures given to men and women admitted to hospital with heart disease differ, with women far less likely than men to undergo percutaneous coronary intervention (26% compared with 74%, respectively) [5]. Despite having a higher burden of disease, healthcare

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expenditure on women with CVD in 2004 to 2005 was 20% less per person compared with men on average ($261 and $322, respectively) [5].

Hypertension, blood lipids, smoking, diabetes, obesity, and physical inactivity are the six clearly defined factors that have a direct correlation with CVD development [6]. Diet directly impacts four of these six risk factors and hence should provide the cornerstone of management in the prevention and treatment of CVD. Research suggests that red and processed meat is strongly linked with CVD, with the results of recent systematic reviews and meta-analyses indicating a high consumption of red and processed meat being related to a significantly increased risk of coronary heart disease [7,8]. A thorough literature review was conducted in End Note utilizing the PubMed Database. MeSH terms "diet" "meat," and "cardiovascular disease" were used, with the Boolean operator "and" being specifically utilized. This yielded a total of 365 articles, of which 46 were identified to relate specifically to the role of general meat consumption in CVD, with 9 studies specifically investigating red and processed meat. Of these nine, eight studies considered the relationship in both men and women. One study, a prospective cohort analysis on over 37 000 participants, was made up entirely of men [9]. No studies specifically looked at the relationship in question within a cohort of women exclusively. The growing need for considering sex differences in health has been recently highlighted by NIH [10]. Personalized/precision medicine notes that sex differences are one of the most fundamental variables to understanding human health, with the CDC noting that patterns of morbidity and mortality differ significantly between men and women [11].

The majority of studies investigating the impact of red and processed meat on CVD chose to focus on disease end points, namely, mortality and morbidity. Only two of the nine studies looking directly at red/processed meat intake and CVD had "risk" as the outcome in question, and even still, one of these studies simply looked at individual risk factors of CVD and not total CVD risk itself [12,13]. None of the literature reviewed specifically relating to the impact of red/processed meat on CVD utilized a cardiovascular risk score as the end point in question. Given the chronic nature of cardiometabolic conditions, risk is a valuable tool used by practitioners to aid in the assessment of patients. By analyzing risk, end points established by this study hold the potential to impact recommendations and policy aimed at primary prevention of CVD, opposed to focusing on secondary prevention measures once a cardiac event has already occurred. The ability to align a direct numerical cardiovascular risk score with a given frequency of red or processed meat consumed is essentially a novel concept not yet published.

Methods

Participants

The Healthy Ageing Project cohort (n = 13509)

In total, 31120 Australian men and women completed an online Internet-based survey at baseline [14] (Table 1). Of these, 26960 were women and 17621 were found to be between the validated Framingham Risk Score (FRS) age range of 30–74. Of these 17621, a further 4112 participants were excluded from the analysis for at least one of the following reasons: missing a key variable required for FRS calculation (age, sex, systolic blood pressure [BP], body mass index [BMI], antihypertensive therapy status, smoking status, or diabetic status)

Table 1
Characteristics of the cohort for HAP and WHAP comparing key variables at baseline

HAP cohort				
	Excluded from the analysis (n = 4112)	Included in the analysis (n = 13 509)	Total (n = 17 621)	*P*
Age in years (mean)	44.5 (n = 4112)	49.2 (n = 13 509)	48.1 (n = 17 621)	**<0.001**
Women (%)	100	100	100	**n/a**
BMI (mean)	27.6 (n = 4070)	28.0 (n = 13 498)	27.9 (n = 17 568)	**<0.001**
Smokers (%)	10.9 (n = 3897)	7.8 (n = 13 509)	8.5 (n = 17 406)	**<0.001**
Diabetics (%)	2.5 (n = 3889)	4.8 (n = 13 507)	4.3 (n = 17 396)	**<0.001**
Systolic BP mm Hg (mean)	124.5 (n = 227)	124.6 (n = 13 509)	124.6 (n = 13 736)	0.963
Antihypertensive medication (%)	4.3 (n = 3875)	17.1 (n = 13 509)	14.2 (n = 17 384)	**<0.001**
Red and processed meat consumption per week (mean)	2.34 times per week (n = 3894)	2.34 times per week (n = 13 509)	2.34 times per week (n = 17 403)	0.953
Minutes/week moderate intensity exercise (mean)	108.1 (n = 3892)	118.0 (n = 13 504)	115.8 (n = 17 396)	**<0.001**
WHAP cohort (2012)				
	Excluded from analysis (n = 68)	Included in analysis (n = 176)	Total (n = 244)	*P*
Age in years (mean)	69.7 (n = 68)	71.2 (n = 176)	70.1 (n = 244)	**0.001**
Women (%)	100	100	100	n/a
HDL mmol/L (mean)	1.5 (n = 42)	1.8 (n = 176)	1.7 (n = 216)	**0.001**
Total cholesterol mmol/L (mean)	5.6 (n = 42)	5.8 (n = 176)	5.8 (n = 216)	0.156
Smokers (%)	10.7 (56)	6.3 (n = 176)	7.3 (n = 232)	0.264
Diabetics (%)	14.7 (68)	3.4 (n = 176)	6.6 (n = 244)	**0.001**
Systolic BP mm Hg (mean)	144.1 (n = 55)	139.2 (n = 176)	140.2 (n = 229)	0.105
Antihypertensive medication (%)	52.2 (n = 67)	39.4 (n = 175)	43 (n = 242)	0.072
Exercise times per month (mean)	12.0 (n = 41)	12.7 (n = 165)	12.6 (n = 206)	0.691
Education in year (mean)	11.1 (n = 61)	12.7 (n = 174)	12.3 (n = 235)	**0.002**
Red and processed meat consumption per week (mean)	8.1 times per week (n = 22)	6.8 times per week (n = 111)	7.0 (n = 133)	0.253
Red meat consumption per week (mean)	3.4 times per week (n = 47)	3.2 times per week (n = 168)	3.2 (n = 215)	0.462
Processed meat consumption per week (mean)	4.8 times per week (n = 23)	3.7 times per week (n = 114)	3.9 (n = 137)	0.240

BMI, body mass index; BP, blood pressure; HAP, Healthy Ageing Project; HDL, high-density lipoprotein; n/a, not applicable; WHAP, Women's Healthy Ageing Project
"n" denotes the number of participants with valid information
Significant values are bolded