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Original article

Do dietary patterns in older age influence the development of cancer and cardiovascular disease: A longitudinal study of ageing

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SUMMARY

Background: The association between diet and cancer, and diet and cardiovascular disease (CVD) is well established in younger adults, however limited evidence exists to demonstrate that these associations persist for older adults, particularly in the context of dietary patterns.
Aims: To investigate whether the dominant dietary patterns identified in a cohort of older adults are predictive of cancer or CVD development.
Methods: This study was a secondary analysis of data from the Australian Longitudinal Study of Ageing (ALSA). The ALSA is a multi-dimensional population based study of human ageing which commenced in 1992 with 2087 participants aged 65 years or more. Data from a 170-item food frequency questionnaire administered at baseline in 1992 to 1034 older adults free from cancer and CVD was explored using factor analysis to identify dominant dietary patterns, being those patterns which comprise foods commonly consumed by the sample. Pooled logistic regression from data available at baseline, 2 and 8 years of follow-up was used to determine whether any associations existed between dietary patterns and development of or death from cancer or CVD.
Results: Five dominant dietary patterns were identified and labelled 'discretionary choices and breads and cereals', 'vegetable and fruit', 'white meat and milk products', 'breads and cereals, sweet bakery goods and milk products' and 'red meat and protein alternatives'. None of the dominant dietary patterns demonstrated a significant overall trend for the development of or death from cancer or CVD with the exception of the 'red meat and protein alternatives' pattern where an increased risk of cancer development or death was observed with adjustment for age, gender, smoking, overweight and obesity and total number of comorbidities (tertile 2: OR 1.46, 95% CI 1.03–2.07; tertile 3: OR 1.28, 95% CI 0.87–1.90).
Conclusions: These results suggest that the development of or death from cancer and CVD may be independent of most dietary patterns in those who are free of either condition at age 70 years or older. Importantly, there was an association observed between the 'red meat and protein alternatives' pattern and cancer development and death. If these findings are confirmed then dietary guidelines for older adults may require further revision.

1. Introduction

Increasing life expectancy will see the proportion of the world's population aged over 60 years increase from 11% to 22% by 2050, whilst those aged over 80 years will increase fourfold [1]. Increasing age corresponds with increasing prevalence of chronic disease, including cancer and cardiovascular disease (CVD), thus posing critical challenges to health systems and policies [2,3]. Collectively these conditions contribute most (30%) to burden of disease in Australasia [4] and share common risk and protective factors [5,6]. A better understanding of the elements which contribute to the prevention of chronic disease and successful

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ageing in older persons is therefore warranted, with diet suggested to be a key influence on disease prevention and health maintenance.

The role of diet in health promotion and disease is complex to elucidate, as diet comprises a network of foods and nutrients [7]. A significant proportion of research has focused on individual nutrients, however, diet is multidimensional and encompasses various nutrient and non-nutrient interactions which occur as nutrients are eaten in combination. Multiple nutrients are also contained within the same foods, making isolation of their individual effects virtually impossible [8]. Furthermore, dietary composition can differ significantly between individuals and between populations hence dietary patterns, rather than individual nutrients, may better reflect the complexity of diet and its influential factors and may be more relevant when considering diet-disease associations.

There is sufficient evidence to support an association between diet and cancer, and diet and CVD in younger adults [9–11]. However, evidence to support the same associations in older people is limited. Existing evidence highlights that adherence to recommended dietary guidelines may positively influence quality of life and functional ability in older adults [12], however with respect to chronic disease it has been suggested that a diet inconsistent with recommendations from local dietary guidelines may not adversely influence risk in persons aged over 65 years [13,14]. Higher BMI has been associated with reduced mortality from chronic diseases including CVD in older people [15,16] and it has been suggested that a liberal diet may protect against malnutrition and frailty, whilst dietary restrictions advised for chronic disease management may confer increased risk [13,14]. A review by William and Kannel exploring associations between diet and CVD in older adults concluded that the rationale to support dietary restrictions for CVD prevention in older persons was undermined by a lack of evidence [17]. A similar review by Balducci et al. [18] highlighted the lack of evidence to suggest the effectiveness of dietary modification for prevention of cancer in the aged. Both reviews encompassed literature exploring diet in the form of nutrients only and are now almost 30 years old however very little research has been undertaken in this area since that time.

Given the paucity of evidence concerning associations between dietary patterns and chronic disease in older populations, the aims of the present study were to explore the dominant dietary patterns of older adults participating in the longest and largest Australian cohort study and to investigate whether dominant dietary patterns were predictive of cancer or CVD development.

2. Subjects and methods

2.1. Study design

The study was a secondary analysis of data from the Australian Longitudinal Study of Ageing (ALSA). The ALSA is a multidimensional population based study of human ageing that has generated longitudinal data over 12 waves of data collection since original recruitment in 1992 [19]. For the purpose of this study, baseline data collected at wave 1 in 1992 was used. Follow up data collected at wave 3 in 1994 and wave 6 in 2000 was used to ensure adequate time for disease development and mitigate against attrition due to age related mortality. Ethical approval for the study was obtained from the Southern Adelaide Clinical Human Research Ethics Committee. Written informed consent was obtained from all participants as part of the ALSA. The analyses in this study were conducted using data from waves 1, 3 and 6 of the ALSA which were sourced from the Centre for Ageing Studies at Flinders University (available at http://www.flinders.edu.au/sabs/fcas/home.cfm).

2.2. Subjects

The ALSA cohort was randomly selected from the database of the South Australian Electoral Roll. Participants were aged over 70 years on entry to the ALSA. Spouses of primary respondents aged over 65 years and other household members aged over 70 years also were invited to be included in the study. Males and females over 85 years were deliberately over sampled in order to compensate for the expected higher mortality rates of this group. A total of 2087 persons participated at wave 1 of the study. For the purpose of this secondary analysis, only those participants ($n = 1034$) who had completed a food frequency questionnaire (FFQ), were free of the chronic conditions of interest at baseline (cancer and CVD) and provided data at both the 2 and 8 year follow up were included, as illustrated by Fig. 1.

2.3. Dietary exposure

Dietary intake was measured at baseline using the 170-item FFQ 'You and Your Diet'. The FFQ is a validated self-completed survey used to determine a participant's usual food intake [20,21]. Food frequency questionnaire analysis occurred with assistance from the Commonwealth Scientific and Industrial Research Organisation and all data were independently double entered to minimise error [20]. The nutrient intake of individual foods were ascertained using the NUTTAB database which contains nutrient data for a wide variety of foods available in Australia [22]. In the absence of NUTTAB data McCance and Widdowson food tables and USDA (US Department of Agriculture) data was used [23,24]. Where a new food was introduced to the market, data sourced from manufacturers and product labels were used if necessary.

2.4. Food grouping

In order to aid interpretability and minimise individual variations in intakes of food items, intakes of the 170 food and beverage items were reclassified into 18 food groups (see Table 1) to use as input variables for principal components analysis (PCA), a form of factor analysis. Given that the ALSA cohort comprises mostly Australian citizens, food groups were primarily defined according to recommendations by the current Australian dietary guidelines [25], so that any derived dietary patterns could be compared to dietary recommendations relevant to the cohort. Food groups were also further defined where necessary according to hypothesised or previously demonstrated associations between food items and major nutrient content of certain foods and cancer or CVD (e.g. fats and oils associated with CVD risk [26] and red meat associated with the risk of some cancers [27]).

2.5. Outcomes

The diseases of interest were all forms of cancer and CVD or death from either. Development of disease was determined by participant diagnoses reports (answered 'yes' to question 'do you suffer from this condition at present?' regarding conditions relevant to cancer and CVD). ALSA participants were excluded from further analyses pertaining to the development of cancer or CVD if they reported suffering from the relevant conditions at baseline. Cardiovascular disease was defined as all diseases of the heart and blood vessels as defined by the World Health Organisation (WHO) [28], and those who answered yes to suffering from a 'heart attack', 'heart condition', 'small stroke', 'stroke/CVA' or 'other vascular disease' were considered to have CVD. Participants were considered to have cancer if they answered yes to 'have you been diagnosed with cancer?' Deaths (date and cause) were systematically

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