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Sociodemographic factors associated with healthy eating and food security in socio-economically disadvantaged groups in the UK and Victoria, Australia

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Abstract

Objective: To investigate the associations between sociodemographic factors and both diet indicators and food security among socio-economically disadvantaged populations in two different (national) contextual settings.

Design: Logistic regression was used to determine cross-sectional associations between nationality, marital status, presence of children in the household, education, employment status and household income (four low income categories) with daily fruit and vegetable consumption, low-fat milk consumption and food security.

Setting: Socio-economically disadvantaged neighbourhoods in the UK and Australia.

Subjects: Two samples of low-income women from disadvantaged neighbourhoods: (i) in the UK, the 2003–05 Low Income Diet and Nutrition Survey (LIDNS; *n* 643); and (ii) in Australia, the 2007–08 Resilience for Eating and Activity Despite Inequality (READI; *n* 1340).

Results: The influence of nationality, marital status and children in the household on the dietary outcomes varied between the two nations. Obtaining greater education qualifications was the most telling factor associated with healthier dietary behaviours. Being employed was positively associated with low-fat milk consumption in both nations and with fruit consumption in the UK, while income was not associated with dietary behaviours in either nation. In Australia, the likelihood of being food secure was higher among those who were born outside Australia, married, employed or had a greater income, while higher income was the only significant factor in the UK.

Conclusions: The identification of factors that differently influence dietary behaviours and food security in socio-economically disadvantaged populations in the UK and Australia suggests continued efforts need to be made to ensure that interventions and policy responses are informed by the best available local evidence.

Keywords
Eating behaviours
Food security
Socio-economic position
Cross-national comparison

A nutritious diet is a key component that can assist with reducing the risk of being overweight or obese as well as reducing the risk of CVD, diabetes and some cancers[1–3]. A common indicator of healthy eating is fruit and vegetable intake, which is integral to a healthy dietary profile[4]. At population level, the consumption of fruit and vegetables is below recommended guidelines for the majority of the population in high-income countries including Australia[5], the USA[6], the UK[7,8] and other European nations[6,7,9].

Although adherence to nutritional guidelines remains a concern in most countries, for a significant proportion of the population of high-income countries the interrelated issue of food insecurity is an additional cause for concern. Being food secure entails having access to, and the means to acquire, sufficient food that is nutritious, of good quality, safe, meets cultural needs, and has been acquired in socially acceptable ways[10]. Those burdened by food insecurity tend to have less healthy diets[11,12], lower self-rated health[13], poorer mental health[14,15] and may be at greater risk of some chronic diseases[16]. Compared with wealthier households, low-income households are at an increased risk of food insecurity as they spend less money on food even though their food budget represents a higher proportion of their total income[17–19].

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A less than optimal dietary profile is more often observed among those experiencing socio-economic disadvantage at either the individual or the area level[7,20–26]. A lower income may restrict the ability to purchase healthy foods while living in a disadvantaged area may reduce an individual's opportunity to eat healthily if fresh produce, high-fibre and low-fat options are not readily available within stores in these neighbourhoods[27–29]. The combination of low income and neighbourhood disadvantage can lead to 'deprivation amplification'[30] whereby people with low levels of personal resources are further restricted in their ability to engage in healthy behaviours by living in disadvantaged neighbourhoods with low levels of healthy resources. It is important to acknowledge however that although the socio-economically disadvantaged are at increased risk of an unhealthy dietary profile and food insecurity, some manage to avoid such outcomes and identifying predictors of these healthier profiles could inform intervention efforts. Where this situation occurs, the degree to which socio-demographic factors are important correlates of health and healthy eating is likely to vary across nations as they may be dependent upon context-specific factors[31] such as national dietary recommendations, cultural differences in the way food is viewed and broader social differences (e.g. social norms around food-related practices such as consuming takeaway or convenience foods, social support for the unemployed, etc.).

In the present paper we use data from the UK and Australia to undertake a cross-national investigation of the sociodemographic correlates of eating behaviours and food security among women living in low-income households in socio-economically disadvantaged neighbourhoods. Studies involving more than one country are useful in that they help to elucidate the generalisability of findings across nations and can offer significant policy insights. In our study we undertook a cross-national comparison to better understand whether correlates of eating behaviours and being food secure are internationally transferable or context-specific. Although the data sets we used were not derived from precisely matched study designs, we have improved comparability by coding variables as similarly as possible. While international comparison studies of health behaviours and outcomes are common, relatively few have focused on eating behaviours[6,32] or on socio-economically disadvantaged populations. The focus on women is prudent because (i) women's diets are qualitatively and quantitatively different from those of men[33,34] and (ii) in many cases women remain the primary suppliers and preparers of food for households[35]. As the UK and Australia are both high-income nations with close historical ties and many connected cultural values, we hypothesised that factors associated with healthy eating and remaining food secure among disadvantaged women would be similar across nations.

Methods

We compared data from women living in low-income households in disadvantaged neighbourhoods across the UK and within the State of Victoria, Australia. Data were drawn from two cross-sectional studies: the 2003–05 Low Income Diet and Nutrition Survey (LIDNS) from the UK and the 2007–08 Resilience for Eating and Activity Despite Inequality (READI) survey from Australia. Data collection methods for these surveys are described briefly below, with further details reported elsewhere[36,37].

Study design

Low Income Diet and Nutrition Survey – UK

The sample for the LIDNS study was obtained from households across the whole of the UK during the period November 2003 to March 2005. Households were considered materially deprived if they were in approximately the bottom 15% of the population in terms of material deprivation, which was derived through numerous questions including receipt of benefits, household composition, car ownership and employment status (identified via a doorstep screening process)[36]. Data were collected via face-to-face computer-assisted personal interviews. Questions related to household food shopping practices were directed to the main household food shopper only. The final sample comprised 2430 households (72% of the eligible households) from which 3728 individuals completed the necessary survey data (55% response rate)[36]. Ethical approval for LIDNS was obtained from the London Multi-Centre Research Ethics Committee (MREC).

Resilience for Eating and Activity Despite Inequality – Victoria, Australia

The READI study was undertaken within the State of Victoria, in south-eastern Australia. Suburb disadvantage was classified by the Australian Bureau of Statistics' SocioEconomic Index for Areas (SEIFA) Index of Relative Socioeconomic Disadvantage (IRSD)[38] with sampled suburbs coming from the most disadvantaged tertile. From this sample, eighty suburbs (forty urban and forty rural) were randomly selected and, from each of these, 150 women aged 18–45 years were also randomly selected from the electoral roll (voting is compulsory for Australian citizens aged 18 years and over).

The sample participants were mailed self-report postal surveys between August 2007 and May 2008. These included questions on health behaviours such as eating practices and other individual-level health and socio-demographic characteristics. After excluding participants who were deemed ineligible (e.g. because they were outside the study age range or had moved to another suburb prior to completing the survey), the final READI sample consisted of 4349 women (response rate 39% of

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those eligible). Ethics approval for READI was obtained from the Deakin University Human Research Ethics Committee, the Victorian Department of Education and the Catholic Education Office.

Sample characteristics

As we wanted to be able to compare results from the UK and Australia, it was important to ensure that the study populations were as closely matched as possible. Key differences between the studies included that the Australian study was restricted to women, those aged 18–45 years and living within disadvantaged neighbourhoods, although this still captured some high-income households. Therefore, we restricted both samples to women, aged 18–45 years, with low household incomes and located in disadvantaged neighbourhoods. Because of different currencies between the two countries, it was important to ensure a consistent definition of low income. To make certain only lower-income households were included, we used a threshold of approximately 80 % of the national median household income (2004/05 UK median was £24 700 per annum (£475 per week)[39,40]; 2007/08 Australian median was $AU 66 890 per annum ($AU 1286 per week)[41]). The 80 % cut-off equates to a maximum weekly income of £360 in the UK and $AU 999 in Australia (Table 1). The next income response category for the READI study ($AU 1000–1499 per week) meant that households with incomes above the national median would have been included and therefore these were not considered low-income households. For the UK, neighbourhood disadvantage was defined as residing in an area that was among the two most socially deprived quintiles of wards (Index of Multiple Deprivation)[42] for their respective country (i.e. England, Scotland, Wales and Northern Ireland).

For both samples, respondents were excluded from the analysis when they had missing values for one or more key variables (LIDNS *n* 4; READI *n* 138). In eight LIDNS households, two eligible participants completed the survey; however for comparative purposes only the first respondent in these households was retained. Final analysis was based on 643 LIDNS participants (17 % of the sample); while for READI we had complete data on 1340 participants (31 % of the sample).

Dependent variables

All variables were coded to ensure consistency across the two studies.

Dietary outcomes

Fruit and vegetable consumption was captured in the two studies using different response scales. For the UK sample, consumption was measured on a monthly time scale whereas for the Australian study it was measured by the number of pieces eaten per day. To make the data as comparable as possible, we re-coded the measures for both studies to 'never or less than 1/d' and 'at least 1/d'. Although we recognise that consuming only one piece per day does not constitute meeting the dietary guidelines, these categories allow us to distinguish within-sample differences between those who consume more often compared with less frequent consumers and were comparable across data sets. We also explored the type of milk often consumed, as this may act as proxy for other healthy (low-fat) eating behaviours[43]. Responses were coded based on whether the healthier alternatives (e.g. low-fat milk) or regular options (e.g. full-fat milk) were consumed.

Food security

Frequency of running out of money to buy food was measured for both studies and was used as our measure of food security status (acknowledging it is only one indicator of food security, although such measures have been shown to differentiate between different socio-economic groups[44]). In the UK, the question asked was 'The food that I (we) bought just didn't last, and I (we) didn't have money to get more' with the response categories: 'often true'; 'sometimes true'; 'never true' (re-coded to: sometimes/often true; never true). For Australia, this was measured by asking 'In the last twelve months, were there any times that you ran out of food, and couldn't afford to buy more?' Responses options were listed as: 'never'; 'once per week'; 'once every two weeks'; 'once per month'; 'less than once per month'. For comparative purposes, all options in the Australian sample more frequent than never were reclassified sometimes/often true. Thus, for both samples, those who reported 'never' were classified as food secure according to this single indicator.

Table 1 Percentage of national median income for the income categories used in the present analysis

UK (median: £24 700 pa; £475 pw)		Australia (median: $AU 66 890 pa; $AU 1286 pw)	
LIDNS income categories	% of UK median income that category equates to	READI income categories	% of Australian median income that category equates to
<£120 pw	<25	<$AU 299 pw	<23
£120–≤180 pw	25–≤38	$AU 299–≤499 pw	23–≤39
£180–≤260 pw	38–≤55	$AU 499–≤699 pw	39–≤54
£260–≤360 pw	55–≤76	$AU 699–≤999 pw	54–≤78

pa, per annum; pw, per week; LIDNS, Low Income Diet and Nutrition Survey 2003–05; READI, Resilience for Eating and Activity Despite Inequality 2007–08.

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Independent variables and covariates

Age was categorised into five groups (18–<25 years; 25–<30 years; 30–<35 years; 35–<40 years; 40–45 years). Binary measures were created for the respondent's nationality (LIDNS)/country of birth (READI), coded as British (LIDNS)/Australian (READI) or other. Marital status was coded similarly for both studies (married; separated/divorced/widowed; never married). The presence of one or more children in the household was coded as a binary measure (yes/no). As this was measured differently in the two surveys, a child is classified as someone aged 17 years or below in the UK sample and as someone aged 18 years or below in the Australian sample. Education categories were created based on equivalent qualifications between the UK (no formal qualifications; low (O-levels/GCSE or equivalent); mid (A-levels or equivalent); high (higher education qualifications); and other) and Australia (no formal qualifications; low (Year 10 or equivalent); mid (Year 12 or equivalent/trade/apprenticeship/diploma/certificate); and high (higher education qualification)). The use of education categories was viewed as more comparable across the two countries than the number of years of education as years of education do not necessarily indicate educational attainment. For analysis, the mid and high education categories of education in the UK sample were combined due to the low numbers (<2%) with higher education qualifications. Employment status for both studies was coded as a binary variable: in employment/education; or not employed. Four household-level low income categories were used for each study to allow us to explore the impact of different levels of low income. These are presented in Table 1 along with the percentage of the median national income that the upper income figure of each category equates to.

Statistical analyses

Proportions were calculated for the dependent and independent variable response categories. Logistic regression analysis was undertaken to assess whether sociodemographic factors were associated with the indicators of healthy diet (daily consumption of fruits and vegetables, consuming low-fat milk) and being food secure. Results for the logistic regression are presented as odds ratios. All analysis was conducted using the Stata statistical software package version 11·2.

Each analytical model differed in terms of which covariates were adjusted for based on an *a priori* conceptualisation using existing literature[45,46]. The variables included were each considered a potential cause (not an effect) of both the predictor and outcome being modelled. This approach was used to avoid over-adjustment. For example, income is conceptualised as an effect of education, not a cause; thus in models where education was the predictor, income was not controlled for.

Results

Sociodemographic characteristics

Sociodemographic characteristics of the two samples are presented in Table 2. The UK sample was reasonably evenly spread across the age categories although a slightly higher percentage was observed in the youngest age group (24%). This differed from the Australian sample where only 14% fell into the youngest age group and a third of the sample were aged 40–45 years. Both studies contained a high proportion of respondents of local nationality/country of birth (93% British and 89% Australian). Only 15% of the UK sample was currently married while 29% were separated/divorced/widowed and the remaining 56% never married. In Australia 70% of the sample were currently married. Over 70% of households in both studies had a child present. No formal qualification was the most often reported education level in the UK (45%). In Australia this was the least reported option (6%), with over half the sample reporting mid-level education qualifications (54%) and a further 19% reporting high-level qualifications. Almost 80% of the UK participants reported they were currently not working while this was the case for only 40% of Australian participants. In the UK, 60% of the sample occupied the bottom two household income categories. Almost half of the Australian sample (46%) fell into the highest of the four low income categories.

Proportion of participants who reported eating healthy foods and being food secure

The diet and food security outcomes for the two samples are presented in Table 3. Large differences in the proportion of respondents eating fruit and vegetables daily were observed between the two samples, with less than one-quarter of the UK participants eating fruit (22%) and vegetables (24%) once daily or more. In the Australian sample, eating fruit daily was reported by 76% of the sample and eating vegetables daily by 93%. The proportion consuming healthy milk was similar for both studies (54% in the UK and 56% in Australia). The proportion of respondents stating that they were food secure was lower among the UK sample (60%) compared with the Australian sample (85%).

Sociodemographic associations

Associations between the sociodemographic factors explored and the dietary and food security outcomes are presented in Table 4.

Healthy eating

In the UK, non-British nationality was strongly associated with higher odds of daily fruit (OR = 2·97; 95% CI 1·56, 5·66) and vegetable consumption (OR = 4·69; 95% CI 2·48, 8·86), but lower odds of low-fat milk consumption (OR = 0·33; 95% CI 0·17, 0·65; Table 4). The presence of

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Table 2 Sample characteristics: low-income women from socio-economically disadvantaged neighbourhoods in the UK and Australia

	UK (LIDNS) (*n* 643)		Australia (READI) (*n* 1340)	
	Frequency	%	Frequency	%
Age group (range 18–45 years)				
18–<25 years	153	23·8	185	13·8
25–<30 years	100	15·5	176	13·1
30–<35 years	122	19·0	225	16·8
35–<40 years	137	21·3	313	23·4
40–45 years	131	20·4	441	32·9
Nationality				
British (LINDS)/Australian (READI)	600	93·3	1197	89·3
Other	43	6·7	143	10·7
Marital status				
Married	93	14·5	932	69·6
Separated/divorced/widowed	188	29·2	117	8·7
Never married	362	56·3	291	21·7
Children present in household				
No	173	26·9	375	28·0
Yes	470	73·1	965	72·0
Education				
No formal qualifications	289	45·0	82	6·1
Low	222	34·5	285	21·3
Mid	121	18·8	723	54·0
High	11	1·7	250	18·6
Work status				
Not working	512	79·6	532	39·7
In employment/education	131	20·4	808	60·3
Household income				
<£120 pw/<$AU 299 pw	190	29·5	131	9·8
£120–≤180 pw/$AU 299–≤499 pw	198	30·8	221	16·5
£180–≤260 pw/$AU 499–≤699 pw	178	27·7	378	28·2
£260–≤360 pw/$AU 699–≤999 pw	77	12·0	610	45·5

pw, per week; LIDNS, Low Income Diet and Nutrition Survey 2003–05; READI, Resilience for Eating and Activity Despite Inequality 2007–08.

Table 3 Proportion with healthy dietary indicators and food security: low-income women from socio-economically disadvantaged neighbourhoods in the UK and Australia

	UK (LIDNS) (*n* 643)		Australia (READI) (*n* 1340)	
	Frequency	%	Frequency	%
Fruit consumption				
Never or less than 1/d	503	78·2	325	24·3
Daily	140	21·8	1015	75·7
Vegetable consumption				
Never or less than 1/d	492	76·5	98	7·3
Daily	151	23·5	1242	92·7
Type of milk consumed				
Don't consume/regular option	294	45·7	593	44·3
Healthy option	349	54·3	747	55·7
Food security†				
Food insecure (sometimes/often true)	256	39·8	197	14·7
Food secure (never true)	387	60·2	1143	85·3

LIDNS, Low Income Diet and Nutrition Survey 2003–05; READI, Resilience for Eating and Activity Despite Inequality 2007–08.
†Whether in the last 12 months the woman ran out of food and couldn't afford to buy more.

children in the household reduced the likelihood of consuming low-fat milk (OR = 0·67; 95 % CI 0·45, 0·99). Mid/high education compared with no formal qualifications was associated with increased odds of vegetable consumption (OR = 2·29; 95 % CI 1·43, 3·67) and low-fat milk consumption (OR = 1·58; 95 % CI 1·02, 2·45). Being in employment or education was linked to higher odds of fruit consumption (OR = 1·57; 95 % CI 1·00, 2·44) and low-fat milk consumption (OR = 1·98; 95 % CI 1·30, 3·00).

In Australia, lower odds of daily fruit consumption were found among those with children in the household (OR = 0·66; 95 % CI 0·48, 0·91; Table 4). Conversely, higher

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Table 4 Results of logistic regression analysis of associations between sociodemographic factors and healthy eating and being food secure: low-income women from socio-economically disadvantaged neighbourhoods in the UK and Australia

	Daily fruit consumption		Daily vegetable consumption		Consume low-fat/skimmed milk		Food secure	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Nationality (adjusted for age)								
UK								
British	1·00	–	1·00	–	1·00	–	1·00	–
Other	2·97	1·56, 5·66***	4·69	2·48, 8·86***	0·33	0·17, 0·65***	0·67	0·36, 1·25
Australia								
Australian	1·00	–	1·00	–	1·00	–	1·00	–
Other	1·33	0·86, 2·06	0·80	0·42, 1·51	0·47	0·33, 0·67***	2·30	1·18, 4·46*
Marital status (adjusted for age and nationality)								
UK								
Married	1·00	–	1·00	–	1·00	–	1·00	–
Separated/divorced/widowed	0·82	0·45, 1·50	0·80	0·45, 1·42	1·09	0·65, 1·84	0·91	0·54, 1·55
Never married	0·79	0·45, 1·39	0·68	0·40, 1·18	1·20	0·73, 1·97	0·82	0·50, 1·34
Australia								
Married	1·00	–	1·00	–	1·00	–	1·00	–
Separated/divorced/widowed	0·74	0·48, 1·15	0·37	0·20, 0·69**	0·92	0·62, 1·37	0·57	0·34, 0·94*
Never married	0·82	0·59, 1·15	0·41	0·25, 0·69***	1·46	1·08, 1·98*	0·86	0·58, 1·28
Children present in household (adjusted for age, nationality and marital status)								
UK								
No	1·00	–	1·00	–	1·00	–	1·00	–
Yes	1·03	0·65, 1·64	0·75	0·48, 1·19	0·67	0·45, 0·99*	0·90	0·61, 1·33
Australia								
No	1·00	–	1·00	–	1·00	–	1·00	–
Yes	0·66	0·48, 0·91*	0·97	0·57, 1·67	1·78	1·31, 2·40***	1·00	0·67, 1·49
Education (adjusted for age, nationality, marital status and children in household)								
UK								
No formal qualifications	1·00	–	1·00	–	1·00	–	1·00	–
Low	0·93	0·59, 1·46	0·99	0·63, 1·58	1·19	0·82, 1·72	1·04	0·72, 1·50
Mid/high	1·50	0·92, 2·43	2·29	1·43, 3·67***	1·58	1·02, 2·45*	1·31	0·85, 2·03
P for trend		0·160		0·002		0·041		0·251
Australia								
No formal qualifications	1·00	–	1·00	–	1·00	–	1·00	–
Low	1·39	0·80, 2·40	1·66	0·75, 3·71	1·31	0·79, 2·16	0·79	0·38, 1·67
Mid	1·41	0·84, 2·35	2·37	1·11, 5·03*	1·59	0·99, 2·55	0·98	0·48, 2·00
High	2·55	1·41, 4·62**	3·79	1·51, 9·50**	2·31	1·37, 3·91**	1·75	0·78, 3·94
P for trend		0·003		0·002		<0·001		0·025
Work status (adjusted for age, nationality, marital status, children in household and education)								
UK								
Not working	1·00	–	1·00	–	1·00	–	1·00	–
In employment/education	1·57	1·00, 2·44*	1·17	0·73, 1·86	1·98	1·30, 3·00***	1·43	0·95, 2·15
Australia								
Not working	1·00	–	1·00	–	1·00	–	1·00	–
In employment/education	0·99	0·75, 1·32	1·27	0·79, 2·03	1·62	1·27, 2·07***	2·45	1·73, 3·47***

Table 4 *Continued*

	Daily fruit consumption		Daily vegetable consumption		Consume low-fat/skimmed milk		Food secure	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Household income (adjusted for age, nationality, marital status, children in household, education and work status)								
UK								
<£120 pw	1·00	–	1·00	–	1·00	–	1·00	–
£120–≤180 pw	0·94	0·57, 1·55	0·68	0·41, 1·15	1·00	0·65, 1·53	1·06	0·71, 1·60
£180–≤260 pw	0·89	0·52, 1·52	1·21	0·72, 2·03	0·86	0·55, 1·36	1·35	0·87, 2·11
£260–≤360 pw	0·95	0·48, 1·87	1·46	0·76, 2·82	0·70	0·39, 1·26	2·10	1·14, 3·87*
P for trend		0·757		0·156		0·243		0·017
Australia								
<$AU 299 pw	1·00	–	1·00	–	1·00	–	1·00	–
$AU 299–≤499 pw	0·97	0·58, 1·61	1·54	0·76, 3·11	0·95	0·60, 1·50	1·23	0·72, 2·09
$AU 499–≤699 pw	1·07	0·67, 1·73	1·79	0·90, 3·54	1·24	0·81, 1·90	1·99	1·18, 3·35**
$AU 699–≤999 pw	0·98	0·62, 1·56	1·82	0·94, 3·52	1·36	0·90, 2·05	2·82	1·69, 4·71***
P for trend		0·957		0·108		0·032		<0·001

pw, per week.
Association was statistically significant: $^{*}P<0·05$, $^{**}P<0·01$, $^{***}P<0·001$.

odds were reported among those with the highest education qualifications (OR = 2·55; 95 % CI 1·41, 4·62). Both mid and high education levels were also associated with higher odds of daily vegetable consumption (OR = 2·37; 95 % CI 1·11, 5·03 and OR = 3·79; 95 % CI 1·51, 9·50, respectively), while lower odds were observed among those not married (OR = 0·37; 95 % CI 0·20, 0·69 for separated/divorced/widowed and OR = 0·41; 95 % CI 0·25, 0·69 for never married). A higher odds of low-fat milk consumption was found among respondents born in Australia (OR = 0·47; 95 % CI 0·33, 0·67 for born outside Australia), those who never married compared with married (OR = 1·46; 95 % CI 1·08, 1·98), those with children present in the household (OR = 1·78; 95 % CI 1·31, 2·40), those with high education qualifications compared with no formal education (OR = 2·31; 95 % CI 1·37, 3·91) and those in employment/education (OR = 1·62; 95 % CI 1·27, 2·07).

Food security

In the UK, being food secure was more likely among those in the highest income group (OR = 2·10; 95 % CI 1·14, 3·87) compared with the lowest income group. Within Australia, being food secure was more likely among those born outside Australia (OR = 2·30; 95 % CI 1·18, 4·46), those employed (OR = 2·45; 95 % CI 1·73, 3·47) and those in the top two income categories (OR = 1·99; 95 % CI 1·18, 3·35 for $AU 499–≤699 per week and OR = 2·82; 95 % CI 1·69, 4·71 for $AU 699–≤999 per week). A lower odds for being food secure was found among those separated/divorced/widowed (OR = 0·57; 95 % CI 0·34, 0·94) compared with those who were currently married.

Discussion

In the present study we explored sociodemographic correlates associated with healthy eating and remaining food secure among vulnerable populations in two samples from the UK and Australia. By ensuring the variables were as closely matched as possible we were able to identify how sociodemographic factors were either similarly or differently related to diet indicators and food security in two different contextual settings. A key theme to emerge from our analysis was that, despite the odds conferred by their socio-economic disadvantaged status, certain sociodemographic characteristics may promote resilience against unhealthy outcomes and behaviours although some differences between the nations were observed.

Nationality and country of birth showed different relationships to our outcomes between the two nations. In the UK, non-British respondents had significantly higher odds of daily fruit and vegetable consumption while in the Australian sample being born outside Australia was found to be associated with being food secure. Although the measures of nationality/country of

birth are not a direct indicator of cultural background, they may relate to cultural characteristics, in which case these variations in fruit and vegetable consumption may be linked to variations in norms across different cultural groups. Interestingly, for both nations the likelihood of consuming low-fat milk was much lower in non-British and non-Australian respondents. It is unclear whether this was related to variations in taste and dietary preferences or the affordability and availability of low-fat milk options.

The household composition variables (marital status and presence of children) were more consistently associated with diet and food security in Australia than in the UK. In Australia, fruit consumption was less likely in households with children while vegetable consumption was less likely among those who were not married. It is plausible that the taste preferences of children and the search for more convenient meal options such as fast food[47] in single-occupant households contribute to these findings. In contrast, those who never married and those with children present were also most likely to consume low-fat milk. The findings related to milk differ from those in the UK setting where the presence of children was related to a lower likelihood of low-fat milk consumption and may be due to a number of plausible factors (e.g. provision of milk at school meaning only regular milk (the cheaper option) is bought for the home environment). Those separated/divorced/widowed were least likely to be food secure in Australia. A loss of household income may be a contributing factor for this, particularly given the association between higher income and food security which we observed. It is important that greater financial support be provided for women placed in this situation so that they do not find themselves not being able to afford food because a relationship has ended.

Our analysis indicated that healthier eating behaviours were associated with increased levels of education in both nations although some variance in the significance and magnitude of effect sizes between the two studies were observed. These may be attributable to a number of possible factors, including differences in the UK and Australian education systems (e.g. minimum leaving age and training opportunities for early school leavers). Prior work has identified education as an important contributor to diet quality[20,23]. While we cannot determine the causal pathways involved on the basis of the present results, it may simply be that education is a good marker for socio-economic position or alternatively it has been argued that education may act as a promoter of healthier eating behaviours through increasing one's knowledge and ability to understand nutrition and health[48,49].

Measuring work status for women is often problematic as typical measures of employment status do not fully acknowledge the combination of paid employment with parenting duties or difficulties re-entering the workforce after a significant time off during the early parenthood period[50]. In the UK employment was associated with a higher likelihood of daily fruit consumption while in both studies the odds of consuming low-fat milk were higher among those who were employed/in education. We found that low-fat milk consumption was not associated with income in either nation (although the trend for Australia suggests it is more likely among higher income earners). Nestle and colleagues propose a scenario where a behaviour change in a woman who wishes to change to skimmed milk is hindered by numerous barriers including the potential barrier of obtaining skimmed milk at work[51]. In the current study, it may be that the workplaces of employed women actually provided low-fat milk, thus removing price and availability barriers that may be faced by socio-economically disadvantaged women. In Australia we also observed that employment increased the odds of being food secure. Again, it may be that financial factors are at play here, although we cannot discount alternative explanations such as the possible provisions of food in workplaces, or the shared social norms and support generated by being employed. Variations observed here may be due to macro-level differences in policy and government support that exist between the UK and Australia with regard to welfare payments for women who are not in the workforce (either unemployed or having parenting duties).

With regard to income, we found no evidence that different levels of low income were associated with the examined eating behaviours. This is possibly because all participants were considered disadvantaged and therefore our small exposure gradient for income may have lowered the likelihood of detecting a graded effect as all individuals below a certain income threshold do not (or perceive they do not) have the financial resources to afford fruit, vegetables and healthier alternatives. Therefore this finding should not be interpreted as a case against considering subsidisation of healthy foods, since evidence suggests that improving the affordability of these items is likely to have population-wide benefits[52–54]. Furthermore, importantly we found among both samples that a higher level of income helped participants report being food secure. Previous research has demonstrated that at-risk populations are more likely to suffer from food insecurity[12,44,55]. Data from the most recent Australian Household Expenditure Survey (2009/10) show that across all of Australia, households spend approximately 12 % of their total weekly gross income on the purchasing of food and non-alcoholic beverages[19]. However, this percentage is as high as 28 % in the lowest income quintile, compared with just 8 % in the highest income quintile[19].

Despite a greater prevalence of food-insecure household in the UK sample, out of all the characteristics explored, only those in the highest income category differed in their likelihood of being food secure. This may

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well be because, of the two samples, the low-income sample in the UK appeared more socio-economically homogeneous (e.g. 80 % reported no formal or low educational qualifications) and therefore there may have been insufficient variability in socio-economic characteristics to detect factors correlated with food security.

An additional consideration in interpreting study findings is that, because the study samples were restricted to disadvantaged neighbourhoods, it may be assumed that all participants had reduced opportunities to purchase fruit and vegetables and low-fat options due to poorer local access to stores selling these products. While this may be the case in some contexts, such assumptions do not consistently hold for the UK and Australia[31] and as such we cannot make a firm conclusion related to deprivation amplification.

Strengths and weaknesses

The current study has a number of strengths. First, the use of data sets from two nations provides insights into whether associations between individual characteristics and eating behaviours and food security in low-income women are context-specific or transferable between nations. Second, the sampled population (women, aged 18–45 years, low household income, living in disadvantaged neighbourhoods) represents an important target group as, compared with those of higher socio-economic position, women with a lower socio-economic position have a worse profile of biomarkers of CVD and diabetes[56] and are therefore increasingly recognised as an important group for public health interventions[57,58]. All variables used in the analyses were coded as consistently as possible to ensure their comparability. Finally, analysis was strengthened by the inclusion of multiple outcomes and multiple socio-demographic characteristics, each of which contributes unique information as to possible mechanisms influencing dietary outcomes[59].

A number of limitations should be recognised. First, the data collection for the two studies was conducted in different years (2003–05 for LIDNS, UK; 2007–08 for READI, Australia). However, this discrepancy is unlikely to have altered the comparability of the data sets or our substantive findings as there is no reason to expect major shifts in the observed associations over a relatively short time period. Second, there were some key differences in the sampling strategies adopted in the two studies. The LIDNS sample was nationwide whereas the READI sample was restricted to eighty areas around the southern Australian State of Victoria. Thus, unlike LIDNS, it cannot be considered nationally representative despite providing a reasonable representation of low-income areas in this State (by including both urban and rural areas). Third, although inclusion criteria were the same for participants of both samples, it is important to recognise that a number of key differences remained in the sociodemographic characteristics. For instance, 45 % of participants in the UK sample reported no formal qualifications compared with only 6 % in the Australian sample. While these differences are likely due to a combination of factors including contextual differences in the educational systems and lower levels of inequalities in education outcomes in Australia, we must remain aware that these differences have the potential to bias estimates where small numbers exist within some subgroups. However these differences may also be an important finding in themselves as they suggest differences in social support for disadvantaged communities across the two nations. Additionally, although the present study was restricted to disadvantaged neighbourhoods, the levels of relative disadvantage and environmental exposures faced by individuals in these neighbourhoods may differ between the UK and Australia. The fourth limitation is that the comparisons may also be biased by the different modes of data collection (computer-assisted personal interviews *v.* postal survey) and the different time periods with which some variables were collected (e.g. fruit and vegetable consumption was collected daily *v.* monthly). Fifth, food security can be measured in numerous ways and we acknowledge we only have a single indicator of this. Finally, despite our best efforts to code data to maximise comparability, it is feasible that the different response options for the outcome measures between the two data sets may explain some of the between-country differences observed. Although this does not detract from the study's aim of assessing sociodemographic correlates in two nations, we recommend that future studies attempt to include standardised dietary measures so that future cross-country studies are directly comparable.

Conclusions

As health authorities worldwide struggle to curb the decline in healthy eating behaviours and the growing prevalence of food insecurity, it is essential to better understand the drivers of these, particularly among groups suffering socio-economic hardship. The present study explored sociodemographic correlates of healthy eating and food security among an at-risk population, low-income women living in socio-economically disadvantaged neighbourhoods. Findings revealed that dietary indicators and food security are each correlated with different sociodemographic factors and that while some of these correlates may be internationally transferable, others appear to be context-specific. Hence, it is advocated that unless findings have been replicated across different contexts, any policy responses are best informed by the best available local evidence. Stemming from the findings presented herein, policy makers from both nations may wish to focus on increasing minimum education levels while an increase in minimum wages may help low-income individuals avoid food insecurity.

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