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Socioeconomic differences among Australian adults in consumption of fruit and vegetables and intakes of vitamins A, C and folate.

Keywords for index: fruits, vegetables, socioeconomic position, vitamin A, vitamin C, folate.

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Abstract

Objective: To determine whether socioeconomic groups differ in their food intakes for fruit and vegetables, their consumption of fruit and vegetables dense in vitamin A, folate and vitamin C, and their nutrient intakes of vitamin C, folate and vitamin A.

Methods: The 1995 Australian National Nutrition Survey collected food intake data from 8883 adults aged 18-64 years using a 24-hour dietary recall. Fruit and vegetable was measured as amount (g) consumed. Intakes of nutrients were estimated from the 24-hour dietary recall data. Participants were categorised whether or not they consumed fruits or vegetables high in vitamin A, folate and vitamin C. Gross annual household income was used to measure socioeconomic position.

Results: Participants from low-income households consumed a smaller quantity of fruits and vegetables. They were also less likely to consume fruits and vegetables high in vitamin C, folate and vitamin A. Consistent with these findings, men and women from disadvantaged socioeconomic groups had lower intakes of vitamin C and folate compared to their more affluent counterparts. These differences were small to moderate in magnitude. Vitamin A intakes were not significantly related to income.

Conclusion: As well as promoting healthy dietary practices, nutrition-promotion strategies should target improving the nutrient intakes of lower socioeconomic

groups. These programs should focus on improving the quantity and choice of fruits and vegetables consumed by people from low-income households.

Introduction

Dietary behaviours have long been established as risk factors for a number of chronic diseases. The most prevalent diet-related chronic diseases in Western countries are cardiovascular diseases (CVD) and cancer (Krebs-Smith & Scott Kantor, 2001; Smith & Baghurst, 1992). Population-based nutrition messages, such as dietary guidelines, have focussed on improving intakes of total fat, saturated fat, anti-oxidant vitamins and folate to decrease the incidence of these diseases (National Health and Medical Research Council, 1992). In Western countries such as Australia, the United States and Britain, these guidelines almost universally recommend the consumption of a diet low in fat and saturated fat, and encourage increased consumption of fruits and vegetables (Krebs-Smith & Scott Kantor, 2001).

Studies in these countries have shown that morbidity and mortality from diet-related chronic diseases vary by socioeconomic position, with the highest rates being seen among people from disadvantaged backgrounds (Bennett, 1996; Blane *et al.*, 1996; Davey Smith & Brunner, 1997; Turrell & Mathers, 2000). Socioeconomic differences in diet are thought to be significant contributors to these inequalities (Davey Smith & Brunner, 1997; James *et al.*, 1997).

There has been some speculation as to which dietary factors contribute to disease inequalities. Studies have shown that total fat and saturated fat intakes are only weakly associated with socioeconomic position (Davey Smith & Brunner, 1997; Smith & Baghurst, 1993). However, intakes of

micronutrients, specifically anti-oxidant vitamins (vitamins C and A) and folate, have been shown to differ markedly between socioeconomic groups (Davey Smith & Brunner, 1997; Smith & Baghurst, 1993). These findings suggest that micronutrients are possibly the most important nutritional influences on health inequalities. Consumption of fruits and vegetables, which contribute a large proportion of the population's daily intakes of anti-oxidant vitamins and folate (approximately 70% of daily intakes of vitamin C and 40% of folate and vitamin A) (Mc Lennan & Podger, 1998), is thought to play an important role in chronic disease inequalities (Davey Smith & Brunner, 1997; James *et al*., 1997). The analyses presented in this study pertain to three nutrients thought to be implicated in the aetiology of chronic disease such as CVD and some cancers, namely, intakes of vitamin C, folate , and vitamin A.

In Australia, there is no population-wide estimate of nutrient intake inequalities between socioeconomic groups. Previous studies have used sampling procedures and dietary intake methodologies that have under-represented low socioeconomic groups (Turrell & Najman, 1995) and have not incorporated participants from both urban and rural areas. Additionally, few studies have examined the differences in food intakes that contribute to inequalities in nutrient intakes. This is important, as nutrition promotion strategies aimed at decreasing socioeconomic differences are most effective if they frame their messages in terms of foods, as people choose foods and not nutrients (Crotty *et al.*, 1991).

Despite a lack of evidence in Australia, many programs and policies have advocated for improvement in the dietary behaviours of people from disadvantaged backgrounds (Lester, 1994: Health Targets and Implementation Committee, 1988; Commonwealth Department of Health, 1987; National Public Health Partnership, 2001). The aims of this study are to determine whether there are socioeconomic differences among Australian adults in the amount and quality (in terms of vitamin A, folate and vitamin C content) of fruit and vegetables consumed, and whether such differences translate to inequalities in intakes of vitamin C, folate and vitamin A.

Materials and methods

The data were collected by the Australian Bureau of Statistics (ABS) as part of the 1995 National Nutrition Survey (NNS), a cross-sectional study of the dietary intakes of the population. These data were used with permission from the ABS. Detailed information on the sample selection, scope and coverage, data collection and processing of the NNS have been published elsewhere (McLennan, 1998). Only a brief overview is provided here.

Participants

The NNS was conducted on a sub-sample of participants from the 1995 Australian Health Survey (AHS), with selected AHS participants giving consent to be re-contacted for the NNS. Sampling for the NNS was based on a multi-stage area sample of households, ensuring adequate representation of urban and rural areas across all States and Territories of Australia. Two people per household in urban areas and three in rural areas were selected to

participate. After excluding refusals, non-contacts and other non-responding groups, the total sample size for the survey was 13858 (McLennan, 1998). Adults between 18 and 64 years were selected from the NNS data file for this study.

Data collection

Data were collected in face-to-face interviews by qualified dietitians. For participants who could not be interviewed due to mental or physical handicap, a suitable proxy knowledgeable of their dietary intake, such as a care-giver, parent or sibling, was interviewed on their behalf.

A 24-hour recall and a questionnaire containing items on demographic characteristics, food habits and perceptions were administered at the interview. The 24-hour recall collected information on all foods and beverages consumed on the day prior to the survey, from midnight to midnight. The multiple-pass 24-hour recall procedure used in the US Continuing Survey of Food Intakes of Individuals (McLennan, 1998) was used in the NNS to ensure accurate recall and description of items consumed. Interviews were conducted on all days of the week throughout a 12-month collection period, to account for seasonal and day-of-the-week variation in dietary behaviour.

Fruit and vegetable consumption

Fruit and vegetable consumption was obtained from the 24-hour dietary recall and measured as the amount (grams) consumed. Participants estimated portion sizes using standardised measuring guides (such as cups, teaspoons,

tablespoons, diagrams and photographs). In this study, fruits included pure fruit juices and raw, cooked, canned, frozen or dried fruits. Vegetables included all raw, cooked, canned, frozen or dried vegetables and legumes. Similar to other studies examining fruit and vegetable intakes by socioeconomic position (Billson *et al.*, 1999; Thompson *et al.*, 1999; Roos *et al.*, 1996), potatoes were excluded from the vegetable category. Lower socioeconomic groups generally eat more potatoes than higher socioeconomic groups, however, potatoes are lower in protective factors, and are often eaten in higher-fat dishes, and therefore may not be as preventive of chronic diseases as other vegetables (Krebs-Smith & Scott Kantor, 2001). Fruits and vegetables in mixed dishes were also excluded from the analyses, similar to previous studies (Billson *et al*., 1999; Magarey *et al.*, 2001). Fruits and vegetables in mixed dishes contribute less than 5% of total daily intakes of vitamin C, folate and vitamin A (Mc Lennan & Podger, 1998). Additionally, the nature of the data set made it impossible to determine the amount of fruits and vegetables in these dishes.

Fruits and vegetables were classified as to whether they had a high content of vitamin C, folate and vitamin A using the AUSNUT nutrient composition database (Table 1) (Australian and New Zealand Food Authority, 1999). For the purpose of this ranking, their raw (uncooked) nutrient contents were used. The only exception was legumes, in which case nutrient composition data were only available for cooked legumes. When fruits and vegetables had an edible peel (such as apples or carrots) their unpeeled nutrient contents were used. Tertiles of vitamin C, folate, and vitamin A content per 100g were

calculated for each of these nutrients for both fruits and vegetables. Fruit or vegetables in the third tertile of nutrient content were classified as being high in vitamin C, folate, or vitamin A. Participants were categorised as being 'consumers' or 'non-consumers' of fruits or vegetables with a high content of these nutrients.

TABLE 1 ABOUT HERE

Nutrient intakes

Nutrient intakes were ascertained from the 24-hour dietary recall, including all foods and beverages. Data were converted to nutrient intakes using a nutrient composition database specially developed for this survey by the Australian and New Zealand Food Authority (ANZFA). The primary source of information for foods in this database was the Composition of Foods Australia (Cashel, 1989). Other sources that were consulted were British, United States and New Zealand food tables, as well as food industry data and unpublished food composition data from ANZFA (McLennan, 1998). The analyses presented in this study pertain to three nutrients thought to be implicated in the aetiology of chronic disease such as CVD and some cancers, namely, intakes of vitamin C (mg) , folate (μg), and vitamin A (μg). Vitamin A intake included both retinols and carotenoids.

Measures of socioeconomic position

Household income was the measure of socioeconomic position (SEP) used in this study, as it effects the amount and type of food purchased, as well as

resources such as transport to supermarkets to purchase foods and microwave ovens and freezers for preparation and storage of foods (Galobardes *et al.*, 2001).

Questions about household income related to cash income, and excluded non-cash receipts such as income in-kind, capital transfers and capital gains and losses. Participants 15 years of age or older were asked about income received from their own business, investments, wages or salary, government, family and insurance payments, superannuation and any other sources over the last financial year before tax was deducted. This was summed for each member of the household, and coded into seventeen income categories prior to the release of the NNS data file. In this study these were grouped into quintiles based on the income distribution of all participants in the survey (AUS$) $0-22499; $22500-37499; $37500-52499; $52500-74999; $75000+.

Statistical analyses

Of the 13858 participants in the original NNS sample, those aged 17 years or younger (n=2872, 21%) and 65 years or older (n=1960, 14%) were excluded from the analyses. Participants whose household income was negative (n=111, 0.8%) or were pre-coded as ‘not applicable’ on the data file (n=32, 0.2%) were also excluded. The resulting sample size was 8883 participants.

General linear models were used to examine the associations between nutrient intakes, the amount of fruits and vegetables consumed and income. Logistic regression was used to examine household income differences in the

consumption of fruits and vegetables high in vitamin C, folate and vitamin A. The highest income quintile was used as the referent category in these analyses. All analyses were adjusted for age and total energy intake (available on the data set as categorical and continuous variables, respectively). The analyses were adjusted for total energy intake as energy intakes were significantly different between the socioeconomic groups. Analyses were conducted using SPSS Version 10.0 (SPSS Incorporated, 2000). Differences were considered to be statistically significant if $p \leq 0.05$ (two tailed).

Results

The response rate for the NNS was 61% (McLennan, 1998). Table 2 shows the demographic characteristics of the sample and their fruit and vegetable dietary behaviour. Women consumed significantly more fruits than men ($p<0.01$), however men reported eating marginally more vegetables than women ($p=0.03$). A lower proportion of men consumed fruits that were high in vitamin C ($p<0.01$), folate ($p<0.01$) and vitamin A ($p<0.01$). Men were less likely to report eating vegetables that were high in vitamin C ($p<0.01$) and folate ($p<0.01$), however there was no gender difference in the consumption of vegetables high in vitamin A ($p=0.20$).

TABLE 2 ABOUT HERE

Table 3 shows that fruit intake increased linearly with household income, with participants from lower-income households consuming smaller quantities of

fruits and of vegetables. Men and women from the most disadvantaged groups consumed only half the quantity of fruit compared to those from the most affluent households. Socioeconomic differences in vegetable consumption were smaller than was demonstrated for fruit; differences were mainly between the highest income group in comparison to all other groups. Participants from lower income backgrounds consumed about 25% fewer vegetables in comparison to those from the highest income households.

TABLE 3 ABOUT HERE

Participants from disadvantaged households were less likely to consume fruits high in vitamin C, folate and vitamin A (Table 4). The most affluent groups were twice as likely to have consumed nutrient-rich fruits than the lowest income groups. Socioeconomic differences in the quality of vegetable choices were not as large as was demonstrated for fruit choices (Table 5). Men from high-income backgrounds were more likely to have eaten vegetables high in vitamin A and vitamin C. Women from affluent households were also more likely to have eaten vegetables high in vitamin A than women from lower-income households. However, there were no socioeconomic differences in the consumption of vitamin C-rich vegetables among women, or folate-rich vegetables among either men or women.

TABLES 4 AND 5 HERE

Vitamin C intake was significantly associated with household income among men and women, and rose with increasing income (Table 6). Socioeconomic differences in vitamin C intake were moderate in magnitude, with the most disadvantaged groups consuming approximately 20% less vitamin C than the most affluent groups. Folate intakes were also significantly lower among men and women from disadvantaged households, and increased linearly with income. Participants from low-income households consumed approximately 10% less folate than their more affluent counterparts. Vitamin A consumption was lowest among men from disadvantaged households, and increased marginally with increasing income. However, this trend did not reach statistical significance and was less evident among females.

TABLE 6 ABOUT HERE

Discussion

The results of this study demonstrate large socioeconomic differences in intakes of fruits and vegetables. Socioeconomic groups also differed in the types of fruits and vegetables they consumed, in that low-socioeconomic groups were least likely to have eaten fruits or vegetables high in vitamin C, folate or vitamin A. Consistent with these trends, people from less affluent backgrounds reported lower intakes of vitamin C and folate overall, compared to their more wealthy counterparts. These findings are congruent with the higher rates of diet-related chronic disease among disadvantaged groups (Davey Smith & Brunner, 1997; James *et al*., 1997).

Previous Australian and international research has shown lower vitamin C and folate intakes among adults in disadvantaged socioeconomic groups (Hulshof *et al.*, 1991; Roos *et al*., 1996; Smith & Baghurst., 1993; Rutishauser, *et al.*, 1994; Stallone, *et al.*, 1997; Tillotson, *et al.*, 1997). While disadvantaged groups have been shown to have lower nutrient intakes in these studies, their intakes still remain above recommended levels for deficiency diseases (National Health and Medical Research Council, 1987). There are no widely used recommendations for intakes of vitamin C, folate and vitamin A for the reduction of chronic diseases such as CVD and cancer. Most research has shown linear trends of vitamin A consumption with SEP (Bolton-Smith *et al.*, 1991; Roos *et al*., 1996; Rutishauser *et al*., 1994; Smith & Baghurst, 1993) however, some studies have found no differences (Stallone *et al*., 1997; Tillotson *et al*. , 1997). The different measures of SEP used in these studies may account for the discrepancies in their findings.

Similar to this study, previous research has also illustrated linear relationships between fruit and vegetable consumption and SEP (Billson *et al*., 1999; Bolton-Smith *et al.*, 1991; Hoglund *et al.*, 1998; Lowry *et al.*, 1996; Roos *et al*., 2001; Steele *et al.*, 1991; Thompson *et al*., 1999). The fruit and vegetable intakes of all socioeconomic groups in this present study did not reach Australian recommended intakes. The fruit intakes of all groups were less than half of the recommended daily intake of 300 grams per day (National Health and Medical Research Council, 1995). Additionally, vegetable intakes were also less than half of the minimum recommendation of 300g per day (including potatoes) (National Health and Medical Research Council, 1995),

however potatoes were not included in the calculation of vegetable intake in this study. No known studies have investigated whether the type of fruits and vegetables consumed by different socioeconomic groups contributes to their concomitant differences in nutrient intakes. A number of possible explanations may account for these socioeconomic differences.

Firstly, disadvantaged groups are more likely to perceive barriers to consuming fruit and vegetables, with price reported as the most influential barrier (Cotunga *et al.*, 1992; Giskes *et al.*, 2002; Reicks *et al.*, 1994; Treiman *et al.*, 1996). Fruits and vegetables may be perceived as being expensive in comparison to more energy-dense food groups, such as cereals and dairy products. Fruit may also be perceived as being expensive because they generally do not form part of the main meal structure and are only consumed as desserts or snacks. Therefore, with a more limited food budget, low socioeconomic groups may forgo fruits and vegetables in preference to more energy-dense and satisfying foods. Lower socioeconomic groups are also more likely to report storage as a barrier to consuming more fruits and vegetables (Giskes *et al*., 2002), and this may be because of limited space in smaller refrigerators, and the shorter shelf-life of fruit and many vegetables in comparison to other foods.

Secondly, lack of awareness of dietary recommendations and nutrition knowledge may contribute to the dietary inequalities demonstrated in this study. Previous research has shown that low socioeconomic groups are the least knowledgeable about the aetiology of chronic diseases, such as CVD

and cancer, and the dietary risk factors that are associated with these (Cotunga *et al*., 1992; Crawford & Baghurst, K., 1990; Heimbach, 1985; Hill *et al.*, 1991; Pierce *et al.*, 1984). Because lower socioeconomic groups may be less aware of the diet-disease link, they may not see any reason for increasing the quantity of fruits and vegetables they consume, and consuming fruit and vegetables high in vitamin C, folate and vitamin A. Studies have also shown that lower socioeconomic groups are less knowledgeable about the recommended dietary strategies to decrease the risk of chronic disease (Finnegan *et al.*, 1990; Fullmer *et al.*, 1991). Therefore, they may not be aware of the recommendations in the Dietary Guidelines, or other food-based guidance strategies, such as the food pyramid or the Australian Guide to Healthy Eating (Kellett *et al*., 1998), that encourage increased consumption of fruits and vegetables. It has also been shown that disadvantaged groups are less informed about the food sources of various nutrients (Fullmer *et al.*, 1991; Levy *et al.*, 1993), and therefore may be less knowledgeable about which fruits and vegetables are high in vitamin C, folate and vitamin A.

Other factors may also contribute to disadvantaged groups being less likely to consume fruits and vegetables high in vitamin C, folate and vitamin A. Previous analyses of these survey data demonstrated that the variety of fruits and vegetables consumed decreased with household income (Giskes *et al*., 2002). Therefore, disadvantaged groups may not consume fruits and vegetables dense in vitamin C, folate and vitamin A because they only eat a limited variety of fruits and vegetables. Additionally, many of the nutrient-rich

fruits in Table 1 are exotic fruits or fruit juices, which possibly may not be affordable on a limited food budget.

Before the broad implications of this study are discussed, a number of limitations need to be acknowledged. Firstly, the response rate of this survey (61%) is relatively low compared to other national Australian studies. Since non-respondents were more likely to be unmarried, unemployed, or earning high incomes, it is likely that this study under-represented both the lowest and the highest socioeconomic groups (McLennan, 1998). Therefore, the socioeconomic gradients in the population may be steeper than those found in this study. Secondly, we looked at whether participants did or did not consume fruits and vegetables high in vitamin C, folate and vitamin A, however, we did not consider the quantities consumed. Thirdly, the 24-hour recall method relies on the respondents' ability to recall and quantify, in detail, all foods and beverages consumed in the 24-hours prior to the survey. Although the interviewers sought to obtain a consistent level of information at each interview, we are unable to ascertain how accurately each of the socioeconomic groups were in their recall and quantification of foods consumed. Some research has suggested that socioeconomic groups may differ in their recall-ability (Gallacher *et al.*, 1999) and literacy levels (Turrell & Najman, 1995). These factors may have also attenuated the socioeconomic gradients.

In addition to increasing fruit and vegetable consumption of all socioeconomic groups, population-based strategies to improve dietary behaviours should

specifically target disadvantaged groups. As well as promoting a healthful diet, these programs should focus on improving the amount and choices of fruits and vegetables of low socioeconomic groups. Specific strategies may involve addressing some of the barriers to consuming fruits and vegetables, such as, promoting inexpensive ways to increase fruit and vegetable consumption and storage methods to increase their shelf life. Other strategies may involve increasing awareness of the protective effects of fruits and vegetables for chronic disease, and improving knowledge of which fruits and vegetables are high in vitamin C, folate and vitamin A. Cooking skills and structural factors (availability in stores, accessibility to stores and affordability) should be examined in further research to explore whether these contribute to the lower intakes of fruits and vegetables among disadvantaged groups. Additionally, further research should explore current nutrition beliefs, knowledge and attitudes of all socioeconomic groups so that programs to decrease chronic disease inequalities can be more effective by acknowledging such factors.

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Table 1: Fruits and vegetables classified as high in vitamin C, folate and vitamin A[a, b]

	Fruit			Vegetables		
	Vitamin C	Folate	Vitamin A	Vitamin C	Folate	Vitamin A
Nutrient content[c] (per 100g)	≥ 37 mg	≥ 8 μg	≥ 20 μg	≥ 24 mg	≥ 65 μg	≥ 57 μg
	kumquat	pineapple juice	blueberry	zucchini	basil	cassava
	blackberry	fruit (NS)	orange	shallot	soy bean	tomato
	quince	lime juice	plum	squash	parsnip	plantain
	mixed fruit juice	lemon	fig	spinach	lima bean	broccoli
	berry (NS)	lemon juice	pepino	okra	haricot bean	silverbeet
	custard apple	strawberry	watermelon juice	chives	leafy green vegetables	green pea
	strawberry	banana	watermelon	broad bean	cabbage	snake bean
	lime juice	berry (NS)	blackberry	cassava	broccoli	endive
	mandarin	orange juice	tangelo	leek	bean (NS)	green bean
	lemon	mandarin	guava	sweet potato	spinach	leek
	lychee	fig	loquat	green pea	rocket	capsicum
	orange	mulberry	passionfruit	bitter melon	kohlrabi	vegetables (NS)
	orange juice	boysenberry	rockmelon	alfalfa	brussel sprouts	shallot
	lemon juice	date	persimmon	cabbage	chives	cress
	paw paw	grapefruit	pawpaw	snowpea	silverbeet	rocket
	grapefruit juice	orange	tamarillo	basil	parsley	vine leaf
	rambutan	tangelo	jackfruit	kohlrabi	cress	watercress
	kiwifruit	kumquat	apricot	cauliflower	endive	chives
	blackcurrant juice	raspberry		cress	snake bean	spinach
	guava	loganberry		parsley	borlotti bean	leafy green vegetables
		blackberry		watercress	asparagus	pumpkin
				broccoli	beetroot	basil
				brussel sprouts	seaweed	parsley
				capsicum	cow pea	sweet potato
					chick pea	carrot

a Further information about fruits and vegetables classified as having medium or low contents of these nutrients is available from the corresponding author on request.

b NS= not specified; further description of fruit/vegetable not provided. For example, berry (NS). Specific type of berry not specified.

c Nutrient contents were based on fruits and vegetables in their raw and unpeeled (for fruits and vegetables with an edible skin) state. The only exception was for all legumes, for which values of their cooked state (cooked in water, no salt or fat added) were used.

Table 2: Characteristics of the sample from the Australian National Nutrition Survey (1995)

	Men		Women		P-value	Total	
	N	%	N	%			%
Household Income (quintiles)[a]							
Don't know/not stated	547	13	641	14		1188	14
$0-22499	536	13	888	19		1424	16
$22500-37499	512	12	571	12		1083	12
$37500-52499	1001	24	1099	23		2100	24
$52500-74999	795	19	748	16		1543	17
$75000+	782	19	763	16		1545	17
Mean (sd) grams consumed in previous 24-hours							
Fruit	101	(10)	117	(9)	<0.01	109	(10)
Vegetables	122	(7)	110	(7)	0.03	115	(7)
In previous 24-hours consumed fruit high in (%):[b]							
Vitamin C	1188	28	1492	32	<0.01	2680	30
Folate	1650	40	2166	45	<0.01	3816	42
Vitamin A	600	14	850	18	<0.01	1450	16
In previous 24-hours consumed vegetable/s high in (%):[c]							
Vitamin C	1887	45	2288	48	<0.01	4175	46
Folate	1229	29	1521	32	<0.01	2750	31
Vitamin A	3062	72	3511	73	0.20	6583	74

a Excludes those in the 'not applicable' category (full time students, n=32), and those with a negative household income (n=111).

b Fruit containing ≥ 27mg vitamin C, ≥ 8 μg folate or ≥ 20 μg vitamin A per 100g based on raw and unpeeled (for fruits with an edible skin) weight were classified as having a high content of the given nutrient.

c Vegetables containing ≥ 24mg vitamin C, ≥ 65 μg folate or ≥ 57 μg vitamin A per 100g based on raw and unpeeled (for vegetables with an edible skin and/or edible in the raw state) weight were classified as having a high content of the given nutrient.

Table 3: Amount of fruits and vegetables consumed by men and women in the previous 24-hours by household income[a]

		Grams of **fruit** consumed (sd)		Grams of **vegetables** consumed (sd)	
		Men	Women	Men	Women
Household income (quintile)	NK/NS[b]	115 (11)*	135 (9)*	132 (7)	128 (6)
	1 (low)	69 (9)*	87 (9)*	118 (8)*	104 (7)*
	2	72 (10)*	97 (9)*	118 (7)*	102 (7)*
	3	96 (10)*	117 (9)*	117 (7)*	104 (7)*
	4	101 (11)*	110 (10)*	111 (7)*	105 (7)
	5 (high)	146 (11)	160 (9)	136 (7)	120 (7)
	P- value[c]	<0.01	<0.01	0.02	<0.01

a Intakes are adjusted for age and total energy intake.
b NK/NS= household income not known/not stated.
c P-value for significance of household income in overall model.
* Symbolises p≤0.05 in paired comparisons with the fifth (highest) income quintile.

Table 4: Odds ratios (95% confidence intervals) for not consuming fruits high in vitamin C, folate and vitamin A in the last 24-hours by household income[a]

		Did not consume high **vitamin C** fruits		**Did not** consume high **folate** fruits		**Did not** consume high **vitamin A** fruits	
		Men	Women	Men	Women	Men	Women
Household income (quintiles)	NK/NS[b]	1.4 (1.1-1.8)	1.3 (1.1-1.6)	1.6 (1.3-2.0)	1.3 (1.1-1.6)	1.3 (1.0-1.8)	1.2 (1.0-1.6)
	1 (low)	2.3 (1.8-3.0)	2.0 (1.6-2.4)	2.5 (2.0-3.2)	1.9 (1.5-2.3)	2.0 (1.4-2.7)	1.6 (1.2-2.1)
	2	2.0 (1.6-2.6)	2.0 (1.6-2.6)	1.9 (1.5-2.4)	1.9 (1.5-2.3)	1.7 (1.2-2.3)	1.4 (1.1-1.9)
	3	1.8 (1.5-2.2)	1.5 (1.2-1.8)	1.6 (1.3-1.9)	1.4 (1.2-1.7)	1.8 (1.3-2.3)	1.2 (0.9-1.5)
	4	1.5 (1.2-1.8)	1.3 (1.0-1.6)	1.5 (1.2-1.9)	1.3 (1.1-1.6)	1.2 (1.0-1.6)	1.4 (1.0-1.8)
	5 (high)	1.0	1.0	1.0	1.0	1.0	1.0
	P- value[c]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

a Odds ratios are adjusted for age and energy intake.
b NK/NS= household income not known/not stated.
c P-value for significance of household income in overall model.

Table 5: Odds ratios (95% confidence intervals) for not consuming vegetables high in vitamin C, folate and vitamin A in the last 24-hours by household income[a]

		Did not consume high **vitamin C** vegetables		**Did not** consume high **folate** vegetables		**Did not** consume high **vitamin A** vegetables	
		Men	Women	Men	Women	Men	Women
Household income (quintiles)	NK/NS[b]	1.2 (1.0-1.5)	0.9 (0.7-1.1)	1.0 (0.8-1.3)	0.8 (0.7-1.0)	1.1 (0.8-1.4)	0.8 (0.6-1.1)
	1 (low)	1.4 (1.1-1.8)	1.1 (0.9-1.3)	1.3 (1.0-1.6)	1.0 (0.8-1.2)	1.7 (1.3-2.1)	1.2 (1.0-1.5)
	2	1.3 (1.0-1.6)	1.0 (0.8-1.2)	1.1 (0.9-1.5)	0.9 (0.7-1.2)	1.4 (1.1-1.8)	1.3 (1.0-1.6)
	3	1.3 (1.1-1.5)	1.0 (0.9-1.2)	1.1 (0.9-1.4)	1.0 (0.8-1.3)	1.3 (1.1-1.6)	1.1 (0.9-1.3)
	4	1.2 (1.0-1.4)	0.9 (0.8-1.1)	1.0 (0.8-1.3)	0.9 (0.7-1.1)	1.3 (1.0-1.6)	1.1 (0.9-1.3)
	5 (high)	1.0	1.0	1.0	1.0	1.0	1.0
	P- value[c]	0.04	0.34	0.38	0.28	<0.01	<0.01

a Odds ratios are adjusted for age and energy intake.
b NK/NS= household income not known/not stated.
c P-value for significance of household income in overall model.

Table 6: Nutrient intakes of men and women in previous 24-hours by household income[a]

	Men Household income (quintiles)							Women Household income (quintiles)						
	NK/NS[b]	1 (low)	2	3	4	5 (high)	P-value[c]	NN/NS[b]	1 (low)	2	3	4	5 (high)	P-value[c]
Vitamin C (mg)	118*	106*	106*	114*	113*	129	<0.01	102	85*	88*	94*	97	105	<0.01
Folate (μg)	301*	285*	294*	296*	302*	306*	0.02	229	214*	206*	221	221	232	0.02
Vitamin A (RE μg)	973	863	925	916	916	973	0.08	773	692	679	628	742	728	0.47

a Intakes are adjusted for age and energy intake.
b NK/NS= household income not known/not stated.
c P-value for the association between household income and mean nutrient intake.
* Symbolises intakes that intakes are significantly different ($p \leq 0.05$) from the fifth (highest) income quintile.