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How well do Australian women comply with dietary guidelines?

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Abstract

Objective: To investigate the proportion of middle-aged Australian women meeting national dietary recommendations and its variation according to selected socio-demographic and behavioural characteristics.
Design: This cross-sectional population-based study used a food-frequency questionnaire to investigate dietary patterns and compliance with 13 commonly promoted dietary guidelines among a cohort of middle-aged women participating in the Australian Longitudinal Study on Women's Health.
Setting: Nation-wide community-based survey.
Subjects: A total of 10 561 women aged 50–55 years at the time of the survey in 2001.
Results: Only about one-third of women complied with more than half of the guidelines, and only two women in the entire sample met all 13 guidelines examined. While guidelines for meat/fish/poultry/eggs/nuts/legumes and 'extra' foods (e.g. ice cream, chocolate, cakes, potatoes, pizza, hamburgers and wine) were met well, large percentages of women (68–88%) did not meet guidelines relating to the consumption of breads, cereal-based foods and dairy products, and intakes of total and saturated fat and iron. Women working in lower socio-economic status occupations, and women living alone or with people other than a partner and/or children, were at significantly increased risk of not meeting guidelines.
Conclusions: The present results indicate that a large proportion of middle-aged Australian women are not meeting dietary guidelines. Without substantial changes in their diets, and help in making these changes, current national guidelines appear unachievable for many women.

Keywords
Dietary guidelines
Compliance
Women
Australia

Increasing knowledge of the role of diet in the aetiology of major causes of morbidity and mortality[1] has led, in many countries, to the development and promotion of dietary guidelines aimed at achieving specified dietary goals and improving the dietary habits and nutritional status of populations[2,3]. In Australia, for instance, the National Health and Medical Research Council has promoted evidence-based dietary advice to the public through the development of Australian dietary guidelines[3]. *The Australian Guide to Health Eating*[4] has also been used to encourage health-promoting food choices.

Regional studies conducted in Australia during the 1980s suggested, however, that relatively small percentages (less than 30%) of the population achieved Australian dietary guidelines[5–7]. For example, randomly selected Australian adults were asked whether they practised each of 11 specific health-promoting dietary activities[5]. About one-third claimed to be practising each of the activities, with women and tertiary-educated persons faring better than men and persons with lower education level. Over one-third of the sample did not practise any of the dietary activities.

A more recent study of young Australians found that substantial proportions were not meeting dietary guidelines for fat, saturated fat or fibre intake, or achieving Recommended Dietary Intakes for zinc, calcium, magnesium and iron[8]. However, this study used a relatively small, non-representative sample of 246 undergraduate students. Another Australian study[9] suggested that increased promotion of population-based dietary and health messages was associated with subsequent improvements in dietary behaviour in the direction of the dietary guidelines. However, that study used a small sample based in only one city (Brisbane) and hence could not take into account known regional variations in dietary intake established previously[10].

In order to monitor progress towards national dietary recommendations, food consumption should be assessed at the population level. However, the assessment of dietary intake in populations is complicated and expensive to conduct, and thus in many countries, including Australia, there are limited sources of comprehensive population data on diet and nutrition. The chief sources of data used for national food and nutrition

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monitoring among individuals and subgroups in Australia are the infrequently conducted national dietary and nutrition surveys[11–14]. Analyses of data from the two most recent national nutrition surveys in Australia, in 1983[11] and 1995[13,14], suggested that diets had changed significantly between the 1980s and 1990s in directions consistent with dietary recommendations (e.g. lower fat and sugar intakes, and higher consumption of cereal-based foods), although large proportions of the population, particularly in certain population subgroups (e.g. low socio-economic groups), still did not meet the recommendations[15,16]. However, data from these two surveys are based on 24-hour dietary recall, and hence may not represent habitual intakes. Presently there are no more recent (post-1995) published national population nutrition data in Australia with which to examine compliance with recently promoted dietary recommendations[3,4].

Middle-aged women are one population group at risk of not meeting dietary guidelines. Findings of the 1995 Australian National Nutrition Survey (NNS) showed that, among women aged 45–64 years, mean daily consumption of fruit and vegetables was 1.1 and 3.4 servings, respectively, well below the two fruit and five vegetable servings recommended[14]. Mean daily consumption of dairy foods such as milk, yoghurt and cheese was below one standard serving per day, short of the recommended two or more daily servings. Consumption of other food groups that adults are encouraged to consume regularly, including breakfast cereals and fish, was also low among women in the NNS, while saturated fat intake was above recommended levels.

The Australian Longitudinal Study on Women's Health (ALSWH) provides a new source of diet and nutrition data for a large, nation-wide, population-representative community sample of women. Currently, dietary data are available for women in the 'mid-aged' cohort (aged 45–50 years at Survey 1, in 1996). Distributions of food and nutrient intakes among the cohort of mid-aged women in the ALSWH at Survey 3 are reported in a separate paper (in preparation). The present paper describes the dietary habits of the mid-aged cohort of Australian women, in relation to the food-based dietary guidelines that were current at the time of the survey[17–20] and selected recommendations from *The Australian Guide to Healthy Eating*[4]. It also investigates how compliance with guidelines varies across sociodemographic subgroups.

Methods

Data used in the present study were derived from the mid-aged cohort of the ALSWH, for which full details of recruitment and methods are provided elsewhere[21]. Briefly, participants were selected at random from all over Australia, using the national Medicare health insurance database, with purposeful over-representation of women living in rural and remote areas. In 1996, 14 065 middle-aged women (53.5% of those selected) responded to the mailed Survey 1. The sample was reasonably representative of Australian women in this age group[21]. Subsequent surveys for the mid-aged cohort were conducted in 1998 (Survey 2) and 2001 (Survey 3). The present study used data from Survey 3, which included a dietary component.

Study sample

The study sample for the present paper consisted of the 10 561 middle-aged women (50–55 years at Survey 3) who provided complete nutrient data in Survey 3. Of the total sample completing Survey 1 in 1996 ($n = 14\,099$), 383 women provided no contact details, 21 became too frail to respond and 102 died prior to Survey 3. Excluding these women, the overall response rate for Survey 3 ($n = 11\,202$) was 82% of Survey 1 respondents. These attrition rates are similar to those obtained in other longitudinal population-based cohort studies[22,23].

Dietary assessment

Diet was assessed using The Cancer Council of Victoria's food-frequency questionnaire (FFQ), full details of which are provided elsewhere[24,25]. This FFQ assesses usual consumption (on a 10-point scale from 'never' to 'three or more times per day') of 74 food and six alcoholic beverage items over the previous 12 months. These were converted to daily equivalents for statistical analyses. Photographs of different portion sizes are included in the FFQ to assist in calculating nutrient intakes, which were computed using software developed by The Cancer Council of Victoria based on the NUTTAB95 nutrient composition[26]. The FFQ has been validated against weighed food records and found to be useful in the assessment of habitual intake in the Australian population[25]. For alcohol intake, an additional question asked 'Over the last 12 months, on days when you were drinking, how many glasses of beer, wine and/or spirits altogether did you usually drink?' The response options ranged from '1' up to '10 or more' and were assigned the corresponding code from 1 to 10 for analysis.

'Compliance' with a number of dietary guidelines and nutrient recommendations was assessed using indicators that described key aspects of food and nutrition relevant to current guidelines[16]. The guidelines assessed, and the indicators used for each of these, are shown in the Appendix. It was not possible to assess all guidelines currently promoted in Australia. For instance, 'Enjoy a wide variety of nutritious foods' was considered impossible to assess quantitatively. For the guideline 'Eat only a moderate amount of sugars and food containing added sugars', data were not available on intakes of sugars added during processing by the food industry. For guidelines 1–6, daily equivalent consumption of items in each of the food groups (e.g. fruits) were summed to give a total

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number of servings per day; for example, two slices of bread or one bread roll is counted as one serving. The FFQ did not permit calculation of exact serving sizes for all foods and hence, by necessity, these six guidelines were based on the assumption that each eating occasion involved consumption of one serving. For guideline 7 (alcohol), the indicator was the product of the number of glasses of alcoholic drinks consumed on days when alcohol was consumed and the frequency (expressed as a daily equivalent) of alcohol consumption. The latter was calculated as the sum of the consumption frequencies of six types of alcoholic beverage (up to a maximum limit of consuming alcohol every day). For guidelines 8–13, nutrient estimates were used as indicators. For the indicators of fat and sugar intake, percentage energy intake derived from these nutrients was calculated by converting grams to kilojoules (1 g fat = 37 kJ; 1 g sugar = 16 kJ). The FFQ does not include intakes of *added* salt, so the reported sodium intakes are likely to be conservative. Since dietary guidelines are intended to be considered as a coherent set of advice, rather than individual guidelines in isolation, the present study also assessed overall 'compliance', examining the proportions of women who met at least half (i.e. seven or more) of the 13 guidelines.

Sociodemographic and behavioural characteristics

Area of residence was classified as urban, rural or remote based on an index of distance to the nearest urban centre[27]. Occupation was classified as manager; professional; associate professional/trades person; advanced sales, clerical or personal service; intermediate sales/clerical/service; intermediate production/elementary clerical; labourer/related; or no paid job/other[28]. Living arrangement was classified as living alone, with partner only, with children only, with partner and children, or with others (not partner/children).

Health-related variables included menopause status, which was defined on the basis of self-report of menstrual bleeding: no menstrual bleeding in the last 12 months (postmenopausal); menstrual bleeding in the last 12 months, but not in the last 3 months or with different menstrual frequency compared with the previous year (perimenopausal); menstrual bleeding in the last 3 months and in the last 12 months and with the same frequency as in the previous year (premenopausal); and women who had undergone a hysterectomy. Body mass index (BMI) was calculated from self-reported height and weight (as weight in kg divided by the square of height in m). BMI was categorised as underweight (BMI $< 20\,kg\,m^{-2}$), healthy weight (BMI $= 20–25\,kg\,m^{-2}$), overweight (BMI $> 25–30\,kg\,m^{-2}$) or obese (BMI $> 30\,kg\,m^{-2}$)[29]. Physical activity scores were derived from self-reported duration and intensity of activity[30]. Scores were categorised as none, low, moderate or high levels of physical activity in the last week. Cigarette smoking status was defined as never smoker, ex-smoker, and light, moderate or heavy smoker (<10, 10–20 and >20 cigarettes day^{-1}, respectively).

Statistical analysis

Chi-square tests were used to analyse differences in proportions of women meeting each of the guidelines, by sociodemographic and health variables. Logistic regression modelling was used to estimate crude and adjusted odds ratios (95% confidence intervals) for women who met at least seven of the 13 guidelines. In the final model, odds ratios were adjusted for sociodemographic, biological and behavioural characteristics (occupation, area of residence, living arrangement, menopause status, BMI, smoking status and physical activity level).

Results

Table 1 shows the sociodemographic, biological and behavioural characteristics of the women in Survey 3. More than half of the women (53–92%) met the dietary guidelines for vegetables/legumes, fruit, meat/fish/poultry etc., 'extra' foods, alcohol, sugar, sodium and calcium (Tables 2 and 3). In contrast, less than one-third met the guidelines for bread/cereal-based foods, milk/yoghurt/cheese, total/saturated fat intake and iron intake.

Compliance with many of the individual recommendations varied significantly across sociodemographic, biological and lifestyle variables. Among occupation groups, women who worked as labourers were less likely to meet recommendations for vegetables/legumes, fruit, 'extra' foods, low fat and saturated fat and sodium. Managers were less likely to meet the milk/yoghurt/cheese recommendation. Professionals were most likely to meet the highest number of guidelines. Women living in urban areas were least likely to meet the vegetables/legumes recommendation, whereas women living in rural and remote areas were least likely to meet guidelines for fruit, total fat and saturated fat and sodium. Women living alone, or with people other than a partner and children, were less likely to meet recommendations for vegetables/legumes and meat consumption, and calcium intake. However, those living alone were more likely to meet guidelines with respect to consumption of 'extra' foods, and total/saturated fat and sodium intake. Women living with a partner and children were most likely to meet guidelines for vegetables/legumes and meat consumption, and sugar intake.

Compliance was also found to vary by health-related factors. For example, women who had undergone a hysterectomy were more likely to meet the vegetables/legumes guideline. Current smokers, particularly moderate and heavy smokers, were least likely to comply with dietary guidelines, except those for sodium intake, which did not vary by smoking status, or for sugars, which they were most likely to meet. Women in the healthy-weight

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Table 1 Sociodemographic and behavioural characteristics of middle-aged women at Survey 3 in 2001

Sociodemographic or behavioural characteristic	Percentage*
Occupation	
Manager	8
Professional	20
Associate professional/trades person	10
Advanced sales, clerk or personal service	10
Intermediate sales, clerk or personal service	13
Intermediate production, elementary clerical service	5
Labourer	8
No paid job/other	26
Area of residence	
Urban	38
Rural	57
Remote	5
Living arrangement	
Alone	9
With partner only	50
With children only	8
With partner and children only	31
With others (not partner/children)	2
Marital status	
Married/*de facto* relationship	76
Separated/divorced/widowed	20
Single	4
Menopause status	
Premenopausal	14
Perimenopausal	24
Postmenopausal	33
Hysterectomy	29
Body mass index	
Underweight ($<20\,kg\,m^{-2}$)	5
Healthy weight ($20–25\,kg\,m^{-2}$)	39
Overweight ($>25–30\,kg\,m^{-2}$)	32
Obese ($>30\,kg\,m^{-2}$)	24
Smoking behaviour	
Never smoker	58
Ex-smoker	27
Light smoker (<10 cigarettes day^{-1})	5
Moderate smoker ($10–20$ cigarettes day^{-1})	5
Heavy smoker (>20 cigarettes day^{-1})	5
Physical activity in the last week	
None	18
Low	37
Moderate	20
High	25

*Out of a maximum total of 10 561 women, although numbers varied slightly for some variables due to missing values.

range were more likely to meet guidelines for fruit consumption, and saturated fat and sodium intakes. Conversely, obese women were least likely to meet these guidelines and that for milk/yoghurt/cheese consumption. Women who did no physical activity were less likely to meet all individual guidelines except those for alcohol and sodium intake, which did not vary by activity level, and sugars, which they were most likely to meet.

Approximately 41% (4290/10 561) of women met at least half (seven or more) of the guidelines examined (i.e. 'overall compliers'). Results of the fully-adjusted multiple logistic regression model showed the likelihood of overall compliance to differ significantly by occupation, living arrangement, BMI category, smoking behaviour and physical activity (Table 4). Compared with women in professional occupations, women in all other occupational groups were less likely to be overall compliers. Compared with women living with a partner only, those living with 'others' were less likely to be overall compliers. Both smoking and physical activity showed strong positive associations with the likelihood of compliance, with women who were heavy smokers and those doing no physical activity least likely to be overall compliers.

Discussion

This paper describes key aspects of the diets of Australian women in relation to current Australian dietary guidelines and policy on healthy eating[4]. It provides data on recent food habits and dietary intakes in a large community-based sample of middle-aged Australian women, since the development and promotion of *The Australian Guide to Healthy Eating*[4].

It should be acknowledged that it was not possible to assess precise numbers of food servings in the present study. Nevertheless, based on statistical analyses of frequency of daily consumption, most women (92%) from the ALSWH appeared to meet the dietary guideline for consumption of meat/fish/poultry etc. (i.e. expected to have adequate protein intake), while 71% met the guideline for 'extra' foods. However, for every other dietary guideline examined, large percentages of women (ranging from 32% for alcohol to 88% for bread/cereals) did not meet the recommendation. When the dietary recommendations investigated here were considered as a whole, only 41% of women met at least one-half (seven or more). Further analyses (not shown) demonstrated that the diets of only two women in the entire sample of 10 561 met all 13 recommendations.

It is not known how many women in this sample were aware of or actively trying to consume a diet consistent with dietary guidelines. None the less, these findings suggest that current recommendations may be unachievable for many women. Much more effort must be directed towards understanding the reasons why Australian women's diets fall short of meeting dietary recommendations, and facilitating improvement of their diets. Such efforts may also involve the revision of existing guidelines and the development of more realistic 'intermediate' guidelines as a stepwise approach to achieving the recommendations currently promoted for good health[31].

Certain sociodemographic subgroups of women, particularly those who worked in labouring occupations and those who lived with persons other than a partner or children, were least likely to follow dietary recommendations, either individually or when assessed as 'overall compliance'. These findings are consistent with previous Australian and international evidence of poorer dietary quality or compliance with guidelines among individuals in lower-status occupations[7,32] and among those living alone

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Table 2 Percentage of middle-aged women meeting Australian dietary recommendations and guidelines for food consumption, by selected sociodemographic, biological and behavioural characteristics

Characteristic	Guideline (number of servings per day)*						
	Bread, cereals, rice, pasta, noodles (≥4)	Vegetables, legumes (≥5)	Fruit (≥2)	Milk, yoghurt, cheese (≥2)	Meat, fish, poultry, eggs, nuts, legumes (≥1)	'Extra' foods (0–2.5)	Alcohol (≤2 drinks)
Overall %	12	61	58	32	92	71	82
Occupation (*P*-value)†	(0.003)	(0.0008)	(<0.0001)	(<0.0001)	(0.2)	(0.0009)	(<0.0001)
Manager	10	64	60	27	91	69	83
Professional	14	63	65	36	93	75	87
Associate professional/trades person	9	59	60	29	93	72	86
Advanced sales, clerk or personal service	11	58	59	29	94	73	83
Intermediate sales, clerk or personal service	12	59	59	34	94	74	83
Intermediate production, elementary clerical service	12	57	55	31	92	70	84
Labourer	11	57	53	33	90	66	79
No paid job/other	11	63	55	32	92	69	81
Area of residence (*P*-value)†	(0.9)	(<0.0001)	(0.009)	(0.2)	(0.5)	(0.2)	(0.1)
Urban	12	57	60	31	92	72	83
Rural	12	63	57	32	92	71	82
Remote	11	68	58	33	91	73	82
Living arrangement (*P*-value)†	(0.08)	(<0.0001)	(0.02)	(0.1)	(<0.0001)	(0.001)	(0.08)
Alone	12	51	60	34	85	77	83
With partner only	11	63	58	31	93	71	82
With children only	12	53	54	34	89	74	80
With partner and children only	13	63	60	33	94	70	83
With others (not partner/children)	10	51	53	29	87	71	78
Menopause status (*P*-value)†	(0.5)	(0.0009)	(0.02)	(0.005)	(0.2)	(0.5)	(0.0007)
Premenopausal	12	57	55	29	93	70	84
Perimenopausal	12	60	61	35	93	70	84
Postmenopausal	12	61	59	32	91	72	82
Hysterectomy	11	64	57	31	92	72	81
Body mass index (*P*-value)†	(0.6)	(0.2)	(<0.0001)	(0.0005)	(0.02)	(0.1)	(0.6)
Underweight (<20 kg m^{-2})	11	57	56	36	89	69	82
Healthy weight (20–25 kg m^{-2})	12	61	61	34	92	73	82
Overweight (>25–30 kg m^{-2})	12	62	60	31	93	72	83
Obese (>30 kg m^{-2})	12	60	54	29	92	70	83
Smoking behaviour (*P*-value)†	(<0.0001)	(<0.0001)	(<0.0001)	(0.01)	(0.02)	(0.05)	(0.0002)
Never smoker	13	61	62	33	93	71	84
Ex-smoker	12	64	59	32	92	74	80
Light smoker (<10 cigarettes day^{-1})	8	59	55	30	89	73	81
Moderate smoker (10–20 cigarettes day^{-1})	3	54	39	29	90	72	80
Heavy smoker (>20 cigarettes day^{-1})	4	50	32	26	91	68	79
Physical activity in the last week (*P*-value)†	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.005)	(0.003)
None	9	51	43	26	89	70	80
Low	11	60	57	31	93	70	84
Moderate	14	65	64	36	94	72	83
High	13	67	67	35	93	74	83

* See 1–7 in Appendix.

† Chi-square test for the association between sociodemographic or behavioural characteristics and meeting Australian dietary recommendations and guidelines for food consumption. Values in the table are percentages out of a maximum total of 10561 women, although numbers varied slightly for some variables due to missing values.

Table 3 Percentage of middle-aged women meeting Australian dietary recommendations and guidelines for nutrient intakes, by selected sociodemographic, biological and behavioural characteristics

	Guideline*					
Characteristic	Total fat <30% total energy	Saturated fat <10% total energy	Sugars <20% of energy	Sodium <2300 mg day^{-1}	Calcium ≥800 mg day^{-1}	Iron 12–16 mg day^{-1}
Overall %	27	18	59	62	53	23
Occupation (*P*-value)†	(<0.0001)	(0.0002)	(0.01)	(0.0005)	(0.007)	(0.06)
Manager	28	18	64	62	52	24
Professional	31	21	56	63	57	26
Associate professional/trades person	28	20	60	65	51	22
Advanced sales, clerk or personal service	30	18	58	65	52	23
Intermediate sales, clerk or personal service	30	18	59	62	55	25
Intermediate production, elementary clerical service	25	14	56	61	50	22
Labourer	21	14	57	56	54	23
No paid job/other	24	17	60	61	54	22
Area of residence (*P*-value)†	(<0.0001)	(<0.0001)	(0.7)	(0.002)	(0.2)	(0.09)
Urban	30	21	58	64	53	22
Rural	25	17	59	60	54	24
Remote	25	16	59	63	50	22
Living arrangement (*P*-value)†	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.002)	(0.002)
Alone	31	22	53	69	50	20
With partner only	29	19	58	63	52	23
With children only	24	17	60	59	55	21
With partner and children only	25	16	61	58	56	25
With others (not partner/children)	24	19	60	62	45	18
Menopause status (*P*-value)†	(0.8)	(0.7)	(0.01)	(0.2)	(0.1)	(0.6)
Premenopausal	27	17	62	64	52	23
Perimenopausal	28	18	59	61	55	24
Postmenopausal	27	18	59	62	53	23
Hysterectomy	27	18	56	60	53	23
Body mass index (*P*-value)†	(<0.0001)	(0.0002)	(<0.0001)	(<0.0001)	(0.001)	(0.1)
Underweight (<20 kg m^{-2})	24	18	57	65	52	21
Healthy weight (20–25 kg m^{-2})	29	20	56	66	52	22
Overweight (>25–30 kg m^{-2})	30	19	58	62	53	24
Obese (>30 kg m^{-2})	24	15	63	55	57	24
Smoking behaviour (*P*-value)†	(<0.0001)	(<0.0001)	(<0.0001)	(0.07)	(<0.0001)	(0.0002)
Never smoker	27	15	56	61	56	24
Ex-smoker	31	21	61	62	52	23
Light smoker (<10 cigarettes day^{-1})	28	17	62	62	51	19
Moderate smoker (10–20 cigarettes day^{-1})	17	9	68	67	47	19
Heavy smoker (>20 cigarettes day^{-1})	17	10	72	60	43	19
Physical activity in the last week (*P*-value)†	(<0.0001)	(<0.0001)	(<0.0001)	(0.15)	(<0.0001)	(0.006)
None	20	11	65	60	47	20
Low	26	16	59	62	53	23
Moderate	31	21	56	62	58	24
High	33	23	54	63	55	25

* See 8–13 in Appendix.
† Chi-square test for the association between sociodemographic or behavioural characteristics and meeting Australian dietary recommendations and guidelines for food consumption. Values in the table are percentages out of a maximum total of 10561 women, although numbers varied slightly for some variables due to missing values.

Table 4 Odds ratio (95% confidence interval (CI)) for women who met at least seven of 13 Australian dietary recommendations and guidelines for food consumption and nutrient intake

Characteristic	% of women*	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)†
Occupation			
Professional	51	Reference	Reference
Manager	40	**0.6 (0.5–0.8)**	**0.7 (0.6–0.9)**
Associate professional/trades person	42	**0.7 (0.6–0.8)**	**0.8 (0.6–0.9)**
Advanced sales, clerk or personal service	42	**0.7 (0.6–0.8)**	**0.7 (0.6–0.8)**
Intermediate sales, clerk or personal service	42	**0.7 (0.6–0.8)**	**0.7 (0.6–0.9)**
Intermediate production, elementary clerical service	37	**0.6 (0.5–0.7)**	**0.6 (0.4–0.7)**
Labourer	31	**0.4 (0.4–0.5)**	**0.5 (0.4–0.6)**
No paid job/other	37	**0.6 (0.5–0.7)**	**0.6 (0.5–0.7)**
Area of residence			
Urban	42	Reference	Reference
Rural	40	0.9 (0.8–1.0)	1.0 (0.9–1.1)
Remote	39	0.9 (0.7–1.0)	0.9 (0.8–1.2)
Living arrangement			
With partner only	41	Reference	Reference
Alone	41	1.0 (0.9–1.2)	1.0 (0.9–1.2)
With children only	39	0.9 (0.8–1.1)	0.9 (0.8–1.2)
With partner and children only	42	**1.1 (1.0–1.2)‡**	1.0 (0.9–1.1)
With others (not partner/children)	33	**0.7 (0.5–1.0)‡**	**0.7 (0.5–1.0)‡**
Menopause status			
Premenopausal	39	Reference	Reference
Perimenopausal	44	**1.2 (1.1–1.4)**	**1.3 (1.1–1.5)**
Postmenopausal	41	1.1 (0.9–1.2)	1.2 (1.0–1.3)
Hysterectomy	39	1.0 (0.9–1.1)	1.1 (0.9–1.3)
Body mass index			
Underweight ($<20\,kg\,m^{-2}$)	43	Reference	Reference
Healthy weight ($20–25\,kg\,m^{-2}$)	40	0.9 (0.7–1.1)	0.9 (0.7–1.1)
Overweight ($>25–30\,kg\,m^{-2}$)	43	1.0 (0.9–1.1)	1.1 (0.9–1.2)
Obese ($>30\,kg\,m^{-2}$)	37	**0.8 (0.7–0.9)**	**0.9 (0.8–1.0)‡**
Smoking behaviour			
Never smoker	43	Reference	Reference
Ex-smoker	42	1.0 (0.9–1.1)	0.9 (0.8–1.0)
Light smoker (<10 cigarettes day^{-1})	34	**0.7 (0.6–0.9)**	**0.6 (0.5–0.8)**
Moderate smoker (10–20 cigarettes day^{-1})	30	**0.6 (0.5–0.7)**	**0.6 (0.5–0.8)**
Heavy smoker (>20 cigarettes day^{-1})	26	**0.5 (0.4–0.6)**	**0.5 (0.4–0.7)**
Physical activity in the last week			
None	28	Reference	Reference
Low	39	**1.6 (1.4–1.8)**	**1.5 (1.3–1.7)**
Moderate	47	**2.2 (2.0–2.5)**	**1.9 (1.7–2.2)**
High	48	**2.3 (2.0–2.6)**	**2.0 (1.8–2.4)**

*Of the 10 561 women, 4290 met at least seven of 13 Australian dietary recommendations and guidelines for food consumption and nutrient intake.
† Adjusted for all sociodemographic, biological and behavioural characteristics listed above.
‡ Confidence limits do not exactly cover the value 1.0. Statistically significant odds ratios ($P < 0.05$), obtained by logistic regression, are presented in bold typeface.

or with others, as opposed to living with a partner/spouse[33,34] and/or children[35]. Interestingly, the only dietary recommendation that did not vary across occupation group, area of residence, menopause status or BMI category related to iron intake. Less than one-quarter of the sample met the recommendation for iron intake. This finding demonstrates that sub-optimal iron intake is widespread among middle-aged Australian women, despite 92% meeting the guideline for the consumption of meat/fish/poultry etc., with all sociodemographic groups at risk.

Women who currently smoked (particularly moderate and heavy smokers), those who reported low levels of physical activity and, for several guidelines, those who were obese were also at greatest risk of non-compliance with dietary guidelines. These findings support the notion of a 'clustering' of poor health behaviours that has been reported previously[36,37]. These findings are of particular concern, since the risk of nutrition-related health problems among those women with the poorest diets is likely to be compounded by increased risk of morbidity and mortality associated with their smoking[38], physical inactivity[39] and obesity[40].

The findings of subgroup variations for the guideline on sugar intake deserve some consideration. Unlike many of the other guidelines, women who were smokers, obese and inactive were more likely to meet this guideline. This is likely to be related to the inability

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in the present study to distinguish natural sugars (e.g. those found in fruit) from refined/processed sugars, the latter being the target of this guideline. The higher likelihood of these particular groups to meet the guideline of $<20\%$ total energy intake from sugar may reflect their lower likelihood to consume fruit, and hence their lower intake of natural sugars. To further examine the unexpected findings for sugar, supplementary analyses investigated responses to an additional question on daily consumption of *added* (refined) sugar, for instance in tea, coffee or on breakfast cereals (results not shown). Smokers and inactive women, as well as women in labouring occupations and women living in remote locations, were found to be most likely to consume added sugar. This supports the hypothesis that the findings for the guideline on total sugar relate to variations in the intake of natural rather than processed/added sugar.

Previous studies of Australian diets have concluded that intakes have improved over recent decades in directions consistent with many of the dietary guidelines. For example, a comparison of 1983 and 1995 national nutrition surveys in Australia showed notable increases in intakes of calcium and iron[15], two nutrients introduced into the guidelines. Data from earlier regional and national dietary surveys[11,13,41–43] also suggest a decrease in total fat intake in the Australian population, from around 40% of total energy intake in the late 1970s to 32–34% in the early 1990s, as well as consistent decreases in saturated fat intakes.

While these trends are promising, the present findings suggest that Australian women are still a long way from consuming diets considered optimal for health. This is consistent with previous Australian[13,14,44] and international[31,35,45] findings. For example, the 1995 NNS[13,14] also showed that dietary intakes of large percentages of the population were not congruent with the dietary recommendations. For instance, 78% of women responding to the NNS ate less than four servings of vegetables and 45% ate less than two servings of fruit/fruit-containing foods per day. Mean/median intakes of fat, saturated fat and sugars were above recommended levels, and calcium and iron intakes below recommended levels. No national data exist on salt intake for Australians, although a Tasmanian study of 194 adults showed that only 36% of women had sodium intakes below the recommended daily maximum level of 2300 mg[44]. In the USA, data from the second National Health and Nutrition Examination Survey (NHANES II) showed that only 10% of the sample consumed the recommended five or more servings of fruit and vegetables daily[45].

Several strengths of the present study lend credence to the findings. These include the use of a comprehensive, previously validated FFQ[24,25] and the large, representative population sample of middle-aged women from a range of sociodemographic backgrounds. However, the generalisability of the findings to other age groups and to men is unknown. The inability of the FFQ method used in this study to provide a precise assessment of number of servings, and the potential for dietary underreporting to affect estimates of food consumption and nutrient intake, is acknowledged.

The present findings demonstrate that a considerable disparity exists between Australian dietary recommendations and the actual diets of middle-aged Australian women. It remains for future studies to determine the reasons for this gap. Speculatively, both cognitive and structural factors (e.g. knowledge/awareness, poor access to fresh foods) may act as barriers to compliance with dietary guidelines. A recent American study found that consumer knowledge and understanding of dietary guidelines was quite poor, with on average less than two-and-a-half of a total of 13 guidelines recalled and participants having difficulties with their interpretation[46].

Mechanisms underlying subgroup differences in diet also require further investigation. A recent Australian study showed that financial and storage problems were key barriers to achieving adequate fruit and vegetable consumption among people of lower socio-economic status[47]. Women of lower socio-economic status may also be less aware of the guidelines. In terms of differences by living arrangements, women living with a partner and/or children may make more effort to comply with guidelines since they are responsible for the diets of other family members. A better understanding of the reasons for different women not meeting dietary guidelines is crucial for informing public health programmes and policies, and for the setting of future guidelines – possibly incorporating a stepwise approach[31] – aimed at improving women's nutrition and health.

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Appendix – Dietary recommendations/guidelines for adults and indicators used*

Recommendation/guideline		Indicator
1	Eat plenty of bread and cereals: at least four servings per day are recommended by *The Australian Guide to Healthy Eating*	Any four or more items selected from: bread, breakfast cereal, porridge, muesli, pasta, noodles, rice, crackers/crispbread/dry biscuits
2	Eat plenty of vegetables (including legumes): five or more servings daily	Any five or more items selected from: potatoes cooked without fat, fresh or tinned tomatoes, tomato sauce, tomato paste or dried tomatoes, capsicum, lettuce, cucumber, celery, beetroot, carrots, cabbage, Brussels sprouts, cauliflower, broccoli, silverbeet, spinach, peas, green beans, alfalfa sprouts, baked beans, soybeans/soybean curd/tofu, other beans, pumpkins, onion, leeks, garlic, mushrooms, zucchini
3	Eat plenty of fruit: two or more servings daily	Any two or more items selected from: oranges/citrus fruit, apples, pears, bananas, watermelon, rockmelon, honeydew melon, pineapple, strawberries, apricots, peaches/nectarines, mango, paw paw, avocado, tinned or frozen fruit, fruit juice
4	Milk/yoghurt/cheese: eat two or more servings daily	Any two or more items selected from: milk/flavoured milk, yoghurt, cheese
5	Meat/fish/poultry/eggs/nuts/legumes: eat one or more servings daily	Any one or more item(s) selected from: beef, veal, lamb, pork, bacon, ham, chicken, processed meat, sausages, fish – steamed, grilled or baked, fish – tinned, nuts, peanut butter/paste, baked beans, soybeans/soybean curd/tofu, other beans
6	'Extra' foods: two-and-a-half or fewer servings daily	Two-and-a-half items selected from: ice cream, sweet biscuits, chocolate, cakes, sweet pies, tarts, other sweet pastries, corn chips, potato crisps, Twisties™ etc., potatoes roasted or fried, fish fried including take-away fish, pizza, hamburger, meat pies, pasties, quiche and other savoury pastry, soft drinks, beer (full-strength or low-alcohol), wine (red or white), fortified wines, port, sherry, spirits, liqueurs, etc.
7	If you drink alcohol, limit your intake (two or fewer drinks per day)	Fewer than two standard drinks selected from: beer (full-strength or low-alcohol), wine (red or white), fortified wines, port, sherry, spirits, liqueurs, etc.
8	Eat a diet low in fat (<30% total energy)	Calculated from nutrient estimates
9	Eat a diet low in saturated fat (<10% total energy)	Calculated from nutrient estimates
10	Eat only a moderate amount of sugars and foods containing added sugars (no levels specified for adults, but an average intake of 15–20% of energy as sugar is suggested for older adults)	Calculated from nutrient estimates
11	Choose low-salt foods and use salt sparingly (<2300 mg sodium day^{-1})	Calculated from nutrient estimates
12	Eat foods containing calcium (≥800 mg day^{-1})	Calculated from nutrient estimates
13	Eat foods containing iron (12–16 mg day^{-1})	Calculated from nutrient estimates

Sources of dietary recommendations/guidelines: 1–6, ref. 4; 7, 12 and 13, refs 17 and 20; 8 and 9, refs 18 and 20; 10 and 11, ref. 20.
* Although the food-based Australian Dietary Guidelines have recently been updated[3], these analyses focus on those guidelines that were current at the time of the survey[4,20]. The key features of these guidelines have not changed substantially with the recent revisions.

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