

Consumer perceptions of fruit and vegetables serving sizes

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Abstract

Objective: To assess consumer understanding of fruit and vegetable serving sizes. **Design:** The Western Australian Health Department launched the Go for 2&5[®] campaign to promote fruit and vegetables in March 2002. The Health & Wellbeing Surveillance System surveyed 1108 adults, aged 16 years and over, between September and November 2002 about what constituted a serving of fruit and of vegetables, their usual daily fruit and vegetables intake, and their recall of the campaign.

Setting: The study was undertaken as a part of a public health intervention – social marketing campaign in Western Australia, which had a population of 1 927 000 in 2002.

Results: Forty-two per cent of respondents knew that the fruit serving size was one piece and only 14.5% reported the ½ cup vegetable serving size. The mean fruit intake was 1.8 (95% CI 1.7, 1.8) servings/d and the mean vegetable intake was 2.8 (95% CI 2.7, 3.0) servings/d. Vegetable intake was associated with being female ($P=0.006$), increasing age ($P<0.0001$), awareness of the campaign ($P=0.031$) and knowledge of standard serving size ($P=0.006$). Fruit consumption was associated with being female ($P=0.007$). Fruit and vegetable intakes were not associated with educational attainment or household income.

Conclusions: The Go for 2&5[®] campaign uses a prescriptive message to promote increased consumption of fruit and vegetables. Respondent's knowledge of the standard of serving sizes for fruit and vegetables suggests there is value in separating fruit and vegetable recommendations in messages to encourage increased consumption.

Keywords
Fruit
Vegetables
Serving size
Social marketing

Regular adequate fruit and vegetable intake contributes to good nutrition and general health and protects against common chronic diseases including CHD^(1–14), hypertension^(2,9,15), stroke⁽⁶⁾, diabetes^(16–21) and some cancers⁽²²⁾, as well as overweight and obesity and a number of other diseases⁽¹⁴⁾. The WHO and FAO have called for nations to increase fruit and vegetable consumption through targeted campaigns⁽¹⁴⁾. Multi-component approaches, addressing individual factors (e.g. knowledge, attitudes, skills, social influences and behaviours) as well as environmental factors (e.g. access, cost, quality and supply), appear to be more effective^(23–27). There is a lack of published information about the effectiveness of population-based interventions promoting fruits and vegetables⁽²⁴⁾.

Health communication has the capacity to create awareness, improve knowledge and induce long-term changes in individual and social behaviours⁽²⁸⁾. There is a need for effective educational messages to encourage the consumption of fruit and vegetables^(29,30). Knowledge of the recommended fruit and vegetable intake may be motivational, leading to self-evaluation of intake,

influencing social norms and increasing the expectation and approval for that level of consumption⁽³¹⁾. There might be agreement on the need to increase fruit and vegetable consumption; however, there are differences between countries in their classification, what constitutes a serving and the recommended servings⁽³²⁾, see Table 1.

The Australian recommendation of at least 675 g daily (including potatoes) is consistent with the minimum 400–600 g daily (excluding potatoes) recommended by health authorities to protect against disease^(14,22,33). Australian fruit and vegetable recommendations have been separate since 1994, based on the differing nutrient profiles of fruits and vegetables; the practical aspects of eating them; current household consumption levels; and food supply⁽³⁴⁾. Australia's food selection guide, The Australian Guide to Healthy Eating⁽³⁵⁾, is incorporated into Australian dietary guidelines^(36–38) and is used as the basis for most nutrition education initiatives.

Developing suitable messages to assist consumers to understand and accept the importance of healthy eating is complex. The way in which recommended food intake

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Table 1 Standard and recommended fruit and vegetables servings per day for good health in Australia, Canada and USA

Age (years)	2-3	4-8	9-13	14-18	14-18	19-50	19-50	51+	51+
Sex	Both	Both	Both	Female	Male	Female	Male	Female	Male
Country and one serving equivalent									
Australia	na	3-6*	4-7†	7-13‡	7-13‡	7-10§	7-12§	7-9	7-10§
Fruit: 1 medium piece (150 g) or 2 small pieces, or 1 cup canned or chopped fruit, or ½ cup (125 ml) 100% fruit juice or 30 g dried fruit. Vegetables: ½ cup (75 g) cooked and/or legumes (dried beans, peas or lentils), or one small potato, or 1 cup salad vegetables, or ½ cup or 125 ml 100% vegetable juice.									
Canada	4	5	6	7	8	7-8	8-10	7	7
Fruit: 1 fruit or ½ cup (125 ml) fruit or 100% fruit juice. Vegetables: ½ cup (125 ml) fresh, frozen or canned, leafy or 100% juice. Form: Fresh, frozen or canned with little or no added fat, salt or sugar. Leafy green (e.g. broccoli, romaine, lettuce and spinach), orange (e.g. carrot, sweet potato and winter squash).									
USA	na	5-6	7-5-8	8-10	10-12	9-10	10-11	8-9	9-10
Amount: Both: ½ cup raw/cooked or juice, 1 cup leafy salad greens. Form: Both: All fresh, frozen, canned, and dried and juices with no added sugars or fats. Vegetables: Dark green (e.g. broccoli, spinach, romaine, collard, turnip, and mustard greens), orange (e.g. carrots, sweet potato, winter squash, and pumpkin), starchy (white potatoes, corn, green peas) vegetables and all cooked dry legumes (cooked dry beans and peas and soyabean products).									

na, not applicable.

*4-7 years, †8-11 years, ‡12-18 years, §19-60 years, ||60+ years.

**Fig. 1** Go for 2&5[®] logo

amounts are presented, as number of servings or specified size, is often misinterpreted by consumers⁽³⁹⁾. Focus group research to assist the development of educational messages for the American MyPyramid Food Guidance System found people considered fruits and vegetables should be part of a healthy diet; however, they were confused about serving sizes and the recommended daily intake⁽³⁹⁾.

The '5-a-day' message has been used as part of campaigns to encourage increased fruit and vegetable consumption⁽⁴⁰⁻⁴²⁾. Consumer research suggests that the '5+ a-day' message is understood and appropriate to encourage increased frequency of consumption; however, consumers have a limited understanding of servings size^(40,41). The Western Australian Health Department (WAHD) developed the Fruit 'n' Veg with Every Meal social marketing campaign to encourage fruit and vegetable consumption in 1990. Evaluation found that although consumers were aware of the campaign and interpreted the message as needing to eat more fruit and vegetables, they were not prompted to action⁽⁴³⁾, suggesting that a message specifying an optimal intake was preferable to one saying 'just eat more'.

The Go for 2&5[®] social marketing campaign launched in March 2002 with mass media advertising (television, radio, press and point-of-sale), public relations, publications, website (www.gofor2and5.com), and school and community activities⁽⁴⁴⁾. The campaign increased awareness of the need to eat more fruit and vegetables by increasing knowledge of the recommended number of servings, with a corresponding increase in consumption⁽⁴⁴⁾. The Go for 2&5[®] logo mnemonic device reminded consumers of the target (Fig. 1).

The objective of the present study was to determine consumer understanding of what constitutes a serving and the relationship to current fruit and vegetable intake. The timing of the research, six months into a high-profile social marketing campaign, allows analysis of the association between serving size understanding and campaign awareness.

Methods

In March 2002, the WAHD commenced the Health & Wellbeing Surveillance System (HWSS) continuous data

collection system. Computer-assisted telephone interview was used to interview over 550 Western Australian people aged 16 years and over each month. The survey asked about a range of issues including health conditions, lifestyle risk factors, protective factors and socio-demographics. Monthly samples were extracted using the Electronic White Pages telephone numbers as the sample frame and stratifying by rural, remote and metropolitan areas. Within each stratum, random samples were selected. From mid-September until the end of November 2002, all respondents over 16 years (*n* 1108) were asked four additional questions relating to fruit and vegetable serving size and campaign awareness.

Respondents were asked, 'What do you think a serve of vegetables/[fruit] equals?'; no alternatives were given and there was no prompting. Responses were then coded into pre-designated categories (one piece, one type, e.g. apple or carrot, ½ cup, other amount [Specify], 'what I put on my plate' [vegetables], other [Specify] or don't know).

Next they were asked about their usual fruit and vegetable intake: 'How many serves of vegetables/[fruit] do you usually eat each day? A serve of vegetable is equal to ½ cup of cooked vegetables or 1 cup of salad' and 'A serve of fruit is equal to one medium piece, two small pieces of fruit or one cup of diced fruit'. They were then asked about awareness of the campaign; 'The Department of Health has recently conducted a campaign about fruit and vegetables. Do you recall hearing or seeing anything about this?'

Prevalence and mean estimates, with 95% CI, were calculated using the Statistical Package for the Social Sciences version 15.0.1 (SPSS Inc., Chicago, IL, USA). Generalised linear models analysis was conducted using the survey data analysis module⁽⁴⁵⁾ in STATA 10 (StataCorp, College Station, TX, USA). Differences were reported as statistically significant when the confidence intervals did not overlap, where they are reported. Inferential statistical analyses provide *P* values as the basis for statistical significance. The WAHD-approved research met standard social marketing research criteria.

Results

The final sample of adults aged 16 years and over represents 81% of contacts made. The data were weighted to correct for over-sampling in rural and remote areas and then adjusted to the age and sex distribution of the Western Australian Estimated Resident Population for 2002.

Knowledge of fruit serving size

Table 2 displays the self-reported serving size for fruit and vegetables. Most respondents, 83%, nominated a serving size for fruit. More men (22%) than women (12%) said they were unsure about the fruit serving size and there were no significant differences based on age. 'One piece' was the

Table 2 Perceived fruit and vegetable serving size, by gender and age, of persons aged 18 years and older, Western Australia, September to November 2002

Serving size*	<i>n</i>	An amount % (95% CI)					Unsure	What I put on my plate
		One piece	One type	Half a cup	Other	Other		
Fruit								
All persons	1108	41.9 (38.6, 45.2)	10.9 (9.1, 13.1)	5.8 (4.5, 7.5)	15.7 (13.2, 18.4)	9.1 (7.3, 11.2)	16.6 (14.3, 19.2)	na
Female	652	47.9 (43.7, 52.2)	11.9 (9.4, 15.1)	6.2 (4.5, 8.4)	12.9 (10.3, 15.9)	8.9 (6.7, 11.6)	12.2 (9.8, 15.2)	na
Male	456	34.4 (29.6, 39.5)	9.7 (7.3, 14.8)	5.4 (3.5, 8.3)	19.1 (15.0, 24.1)	9.4 (6.7, 12.9)	22.0 (17.9, 26.6)	na
Age (years)								
16-24	177	32.0 (24.7, 40.2)	12.1 (7.6, 18.9)	7.5 (4.1, 13.2)	25.2 (17.9, 34.1)	9.3 (5.6, 15.0)	14.0 (9.1, 20.9)	na
25-39	210	47.9 (40.8, 55.1)	8.8 (5.6, 13.6)	4.6 (2.5, 8.3)	16.3 (11.5, 22.5)	9.0 (5.5, 14.4)	13.4 (8.9, 19.7)	na
40-59	352	42.5 (37.1, 48.1)	10.0 (7.2, 13.6)	5.4 (3.3, 8.8)	14.6 (11.0, 19.1)	10.7 (7.8, 14.6)	16.8 (13.0, 21.3)	na
≥60	369	40.3 (34.9, 46.0)	14.4 (11.0, 18.7)	6.8 (4.6, 10.0)	9.5 (6.6, 13.3)	6.5 (4.3, 9.6)	22.5 (18.3, 27.5)	na
Vegetable								
All persons	1108	2.3 (1.6, 3.4)	4.0 (2.9, 5.5)	14.5 (12.4, 16.9)	27.7 (24.7, 30.8)	21.5 (18.9, 24.3)	23.0 (20.3, 26.0)	6.9 (5.3, 8.8)
Female	652	2.6 (1.5, 4.3)	4.5 (3.0, 6.6)	20.5 (17.3, 24.1)	27.7 (23.9, 31.8)	21.8 (18.5, 25.5)	18.8 (15.7, 22.3)	4.3 (2.9, 6.3)
Males	456	2.0 (1.1, 3.6)	3.5 (2.0, 6.1)	7.2 (4.9, 10.5)	27.6 (23.1, 32.6)	21.2 (17.3, 25.7)	28.2 (23.6, 33.3)	10.1 (7.3, 13.9)
Age (years)								
16-24	177	1.1 (0.3, 4.8)	3.8 (1.6, 8.9)	6.4 (3.3, 11.9)	32.2 (24.9, 40.6)	22.6 (16.7, 29.9)	28.4 (20.8, 37.5)	5.4 (2.6, 10.6)
25-39	210	2.2 (1.0, 5.0)	3.1 (1.3, 7.3)	10.0 (6.4, 15.2)	36.1 (29.5, 43.2)	20.3 (15.2, 26.6)	19.3 (14.0, 26.0)	9.0 (5.6, 14.3)
40-59	352	2.0 (0.9, 4.3)	4.7 (2.9, 7.6)	20.4 (16.3, 25.3)	23.2 (18.8, 28.3)	23.1 (18.6, 28.3)	20.5 (16.5, 25.3)	5.7 (3.6, 9.0)
≥60	369	3.8 (2.2, 6.6)	4.3 (2.6, 7.0)	17.1 (13.5, 21.6)	20.5 (16.2, 25.4)	19.4 (15.3, 24.3)	27.7 (23.0, 33.0)	7.1 (4.7, 10.7)

na, not applicable.

*The column headings refer to the categories for the questions asking what constitutes a serving of fruit or vegetables.

most commonly identified serving size for fruit (42%), with women (48%) more likely than men (34%) to suggest it. People aged 16–24 years were least likely to select ‘one piece’, 32% compared to 48% of 25- to 39-year-olds.

‘One type of fruit’ was identified as the serving size for fruit by 11% of respondents, with no significant difference based on gender or age. Other serving size amounts were specified by 16% of respondents.

Knowledge of vegetable serving size

Table 2 displays the self-reported serving size for vegetables. Most respondents, 78%, thought they knew the vegetable serving size. Significantly more men than women said they were unsure about the vegetable serving size, 28% and 19%, respectively. There were no significant differences based on age. Fourteen per cent of respondents, 20% of women and 7% of men identified ‘ $\frac{1}{2}$ cup’ (the standard vegetable serving size). People over 40 years old were more likely to identify ‘ $\frac{1}{2}$ cup’ than those who were younger. Twenty-eight per cent of respondents nominated a different amount for the vegetable serving size. Respondents less than 40 years old were more likely than those aged over 40 to specify a different amount. Men (10%) were more likely than women (4%) to identify ‘the amount I put on my plate’ as a serving of vegetables.

Fruit and vegetable consumption

Table 3 displays knowledge of standard serving size by the mean fruit and vegetable intake. The mean fruit intake was 1.8 (95% CI 1.7, 1.8) servings/d, with women consuming more than men, 1.9 (95% CI 1.8, 2.0) and 1.6 (95% CI 1.5, 1.7) servings/d, respectively. Those who knew the standard fruit serving size had higher intakes, 1.9 compared to 1.7 servings/d; however, the difference was not significant. Respondents who knew the standard serving size for fruit were more likely to eat the recommended two servings per day than who did not, 57.2% (95% CI 52.0, 62.2) compared to 46.3% (95% CI 42.0, 50.7).

The mean vegetable intake was 2.8 (95% CI 2.7, 3.0) servings/d. Women had higher intake than men, 3.1 (95% CI 2.9, 3.0) and 2.6 (95% CI 2.6, 2.8) servings/d, respectively. Men who knew the standard serving size had 1.1 servings more than those who did not. Respondents who knew the standard serving size for vegetables were more likely to have the recommended five servings per day than those who did not, 19% compared to 11%; however, the difference was not significant. Women who knew the standard serving size for vegetables were more likely to eat five or more servings daily than men who knew the standard serving size, 22% compared to

Table 3 Daily fruit and vegetable consumption, by serving size and gender, of persons aged 18 years and older, Western Australia, September to November 2002

Consumption levels* (servings)	n	Standard serving†	Incorrect‡	Unsure
			% (95%CI)	
Fruit				
Females				
≥2 servings	652	64.2 (58.0, 70.0)	54.4 (47.7, 61.0)	49.3 (38.0, 60.7)
<2 servings		35.8 (30.0, 42.0)	45.6 (39.0, 52.3)	50.7 (39.3, 62.0)
Mean servings		2.0 (1.8, 2.2)	1.9 (1.7, 2.0)	1.7 (1.5, 2.0)
Males				
≥2 servings	456	45.2 (36.6, 54.1)	40.1 (32.6, 48.2)	38.6 (28.8, 49.4)
<2 servings		54.8 (45.9, 63.4)	59.9 (51.8, 67.4)	61.4 (50.3, 71.2)
Mean servings		1.7 (1.4, 1.9)	1.6 (1.4, 1.8)	1.4 (1.5, 2.0)
All persons				
≥2 servings	1102	57.2 (52.0, 62.2)	47.7 (42.5, 52.9)	42.8 (35.3, 51.0)
<2 servings		42.8 (37.8, 48.0)	52.3 (47.1, 57.5)	57.1 (49.0, 64.7)
Mean servings		1.9 (1.7, 2.0)	1.7 (1.6, 1.9)	1.5 (1.4, 1.7)
Knowledge of serving size		41.8 (38.6, 45.2)	41.5 (38.3, 44.9)	16.6 (14.3, 19.2)
Vegetables				
Females				
≥5 servings	652	22.3 (15.6, 30.9)	13.7 (10.4, 17.9)	15.9 (10.1, 24.2)
<5 servings		77.7 (69.1, 84.4)	86.3 (82.1, 89.6)	84.1 (75.8, 89.9)
Mean servings		3.5 (3.2, 3.8)	3.0 (2.8, 3.2)	2.8 (2.5, 3.1)
Males				
≥5 servings	456	8.7 (2.1, 30.4)	13.8 (9.9, 18.9)	6.6 (3.2, 13.0)
<5 servings		91.3 (69.6, 97.9)	86.2 (81.1, 90.1)	93.4 (87.0, 96.8)
Mean servings		3.2 (2.8, 3.6)	2.7 (2.4, 2.9)	2.1 (1.8, 2.4)
All persons				
≥5 servings	1102	19.3 (13.5, 26.8)	13.7 (11.1, 16.9)	10.8 (7.3, 15.7)
<5 servings		80.7 (73.2, 86.5)	86.3 (83.1, 88.9)	89.2 (84.3, 92.7)
Mean servings		3.5 (3.2, 3.7)	2.8 (2.7, 3.0)	2.4 (2.2, 2.6)
Knowledge of serving size		14.5 (12.4, 16.9)	62.5 (59.2, 65.7)	23.0 (20.3, 26.0)

*The consumption levels are equal to or above/below the recommended Australian guidelines of at least two servings of fruit and five servings of vegetables per day.

†One piece of fruit or $\frac{1}{2}$ cup of vegetables.

‡Another amount or ‘other’.

Table 4 Parameter estimates by number of servings of fruit (vegetables) consumed per day of persons aged 18 years and older, Western Australia, September to November 2002

Parameter	Coefficient	<i>t</i>	<i>P</i> >[<i>t</i>]	95% CI	
				Lower	Upper
Number of vegetable servings per day					
Gender	-0.41	-2.74	0.006	-0.71	-11.67
Age group	0.34	3.85	0.000	0.17	0.52
Knowledge of the campaign	0.33	2.16	0.031	0.03	0.64
Recognition of the vegetable face	0.12	-0.57	0.569	-0.52	0.29
Knowledge of serving size	0.52	2.77	0.006	0.15	0.89
Household income	0.05	0.86	0.388	-0.06	0.16
Education	0.56	1.02	0.308	-0.05	0.16
Number of fruit servings per day					
Gender	-0.29	-2.71	0.007	-0.50	-0.01
Age group	0.13	0.48	0.632	-0.16	0.26
Knowledge of the campaign	0.05	0.48	0.632	-0.16	0.27
Recognition of the vegetable face	-0.11	-365	0.516	-0.45	0.23
Knowledge of serving size	0.07	0.61	0.544	-0.16	0.29
Household income	0.06	1.56	0.119	-0.15	0.13
Education	0.03	0.72	0.474	-0.06	0.12

Analysis done using STATA 10 survey data analysis module, generalised linear models.

9%, respectively. Respondents who were aware of the campaign reported higher mean vegetable intake than those who were not, 3.0 (95% CI 2.8, 3.1) compared to 2.5 (95% CI 2.3, 2.7) servings/d, respectively. There was no significant difference for fruit consumption. Table 4 displays factors influencing fruit and vegetable consumption. Vegetable intake was significantly associated with being female ($P=0.006$), increasing age ($P<0.0001$), awareness of the campaign ($P=0.031$), and knowledge of standard serving size ($P=0.006$). Fruit consumption had a significant association with gender ($P=0.007$). There were no significant associations based on educational attainment or household income.

Discussion

Developing suitable messages to assist consumers to understand and accept the importance of healthy eating is complex. Knowledge gaps associated with the recommendation to eat more fruit and vegetables were evident in this study, particularly for vegetables. Knowledge of the recommended amount may reflect a key skill needed to perform the behaviour, it may serve a motivational function leading to a self-evaluation of intake, and it may provide a normative influence, increasing the expectation and approval for that level of consumption⁽³¹⁾. To understand dietary recommendations, consumers needed to know the type and amount of recommended foods, and to assess the adequacy of their current intake they needed to know what constituted a serving⁽³⁹⁾. Britten *et al.* (2006) found consumers could apply this information by mentally adding up the amounts they consumed at each meal and comparing it to daily recommendations⁽³⁹⁾. Overly optimistic assessment of current intakes results in complacency about the need to eat more fruit and

vegetables^(44,46,47). Respondents were more confident in assigning a serving size to fruit than to vegetables. The most common fruit serving size of 'one piece' supports the finding that consumers prefer recommendations expressed in pieces of fruit⁽³⁹⁾. Respondents reported vegetable serving sizes in 'amounts', consistent with previous findings that common household units or measures, for example a cup, were preferred for vegetables⁽³⁹⁾.

Many theoretical models can be used to guide food choice research^(48,49). The Go for 2&5[®] campaign used a model of adapted phases between knowledge and behaviour^(50,51) to examine behavioural beliefs, attitudes, influencers and intentions⁽⁴⁴⁾. How or whether consumers use serving size information to make their food choices is still not clear; however, the information may be useful to assist with the assessment of current intake. Policy recommendations and assessment of intervention effectiveness rely on accurate dietary assessment. The measurement method influences the proportion of the population categorised as meeting fruit and vegetable guidelines⁽⁵²⁻⁵⁴⁾.

The main strength of the present study is that it provides a quantified population-level snapshot of consumer understanding of fruit and vegetable serving sizes six months after the commencement of the Go for 2&5[®] campaign. The results are representative of the Western Australian population as a whole but may not represent subgroups within the population, such as Aboriginal people. There were also study limitations, the analysis did not distinguish amounts other than '½ cup'; other amounts, particularly for vegetables, are required. Additional questions relating to knowledge of recommended intake, or asking current intake before and after defining serving sizes are suggested; however, minimal additional questions can be added to an existing surveillance system. Knowledge of serving size or dietary behaviour may merely be a marker for a cluster of 'healthy lifestyle'

behaviours (e.g. smoking, exercise). Recent New Zealand research found little or no clustering of healthy behaviours, and refuted that fruit and vegetable consumption is merely a marker of healthy lifestyle⁽⁵⁵⁾. Further analysis to determine the influence of other lifestyle factors is suggested. More community education is required on serving size to maximise the impact of health promotion campaigns such as the Go for 2&5[®]. More research is required to establish the best method for this education.

Conclusions

Consumers differentiate between serving sizes for fruit and vegetables. Knowledge of the standard fruit and vegetable serving sizes is related to the consumption of the recommended amounts. Respondents' understanding of fruit and vegetable serving sizes suggests it is important to separate fruit and vegetable recommendations, using common household measures to convey serving sizes, and using prescriptive messages, for example Go for 2&5[®] to encourage fruit and vegetable consumption.

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Conflict of interest: Nil.

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