

## LEADING ARTICLE

# Two apples and five carrots a day keep the doctor away: Strategies to increase fruit and vegetable consumption

(See paper by Booth and colleagues, pages 115–120)

It would seem that one of the few, if not only, non-controversial issues in nutrition, is that fruit and vegetables are good for health, and generally the more, the better (with the possible exception of fruit juice and potatoes). World-wide, dietary guidelines of one sort or another include a message on fruit and vegetables. Such advice may range from a qualitative food-based dietary guideline approach, as commonly seen in developing countries (e.g. *Eat plenty of fruits and vegetables every day*; South Africa<sup>1</sup>), to a more quantitative approach that defines portion sizes and types, as the case for the American dietary guidelines ('Two cups of fruit and 2½ cups of vegetables per day are recommended for a 2000-calorie intake' and '... select from all five vegetable subgroups (dark green, orange, legumes, starchy vegetables, and other vegetables) several times a week'<sup>2</sup>).

The Global Burden of Diseases Project estimated that up to 2.6 million lives per year could potentially be saved if fruit and vegetable consumption was sufficiently increased.<sup>3</sup> International agencies have identified the level of evidence to be convincing for a reduced risk between fruit and non-starchy vegetable intake and cardiovascular disease<sup>4</sup> and probable for a reduced risk for some cancers, diabetes and obesity, as well as for the prevention of several micronutrient deficiencies.<sup>4,5</sup>

The DASH diet demonstrated, unequivocally, that a diet rich in fruit and vegetables significantly reduces systolic and diastolic blood pressure, in both normotensive and hypertensive individuals.<sup>6</sup> The follow-up DASH Sodium study investigated the additional benefits of salt restriction over and above the merits of the DASH diet.<sup>7</sup>

The paper of Booth and colleagues (page X)<sup>8</sup> has demonstrated that the WELL diet, which is based on their previous OZDASH diet,<sup>9</sup> resulted in a mean intake of 8.7 serves of fruit and vegetables per day at three months. What makes the findings of Booth *et al.*'s study even more impressive is that the study group comprised men who were healthy, and had normal blood pressure. In the parent paper to that of Booth *et al.* more detailed information is provided on the components of the intervention.<sup>10</sup> Participants were assisted by a trained dietitian to set goals for diet ( $\geq$ three goals) and exercise ( $\geq$ one goal) at each visit. The main difference between the control (low fat) diet and the WELL diet was that the WELL diet group was provided with specified targets for fruit, vegetable and dairy intake, and received individual feedback about adherence to these targets. The Booth paper raises four key questions relating to interventions aimed at increasing fruit and vegetable consumption: 'What targets should we be aiming for?', 'What is the most effective type of

intervention to change fruit and vegetable behaviour?', 'Are changes in fruit and vegetable consumption sustainable in the long term?' and 'Can a one-size-fits-all approach be adopted?'.

## DIETARY RECOMMENDATIONS FOR FRUIT AND VEGETABLE INTAKES

Current international recommendations propose the intake of a minimum of 400 g of fruit and vegetables per person per day, excluding potatoes and other starchy tubers.<sup>4</sup> Translation of the findings of the WELL diet,<sup>8</sup> which recommends at least four servings each of fruit and vegetables into dietetic practice, may result in confusion, both among the public and health professionals who have been exposed for a decade to the Australian Guide to Healthy Eating<sup>11</sup> and more recently, the Go for 2 & 5 campaign.

## EFFECTIVENESS OF INTERVENTIONS ON FRUIT AND VEGETABLE CONSUMPTION

### Population strategies

For several years now, many countries including Australia, UK, Nordic countries, Northern Ireland and USA, have adopted typically '5-a-day' type campaigns. There is evidence that the majority of these interventions lead to increased consumption, at least in the short term<sup>12–15</sup> by about 17% over that of control groups, representing an average increase of 0.6 servings per day.<sup>12</sup> In Australia, the recent evaluation of Western Australia's Go for 2 & 5 fruit and vegetable social marketing campaign, found that the campaign successfully reached the target audience, and increased awareness of the recommended serves of fruit and vegetables.<sup>16</sup> However, disappointingly, the population net increase in mean number of serves of fruit and vegetables per day over three years was only 0.8 (0.2 serves of fruit and 0.6 serves vegetables) and the increase was not significant for fruit.

Similarly to Western Australia, the national Go for 2 & 5 campaign has been successful in generating awareness, both among parents of 0–17 year olds and among children aged 9–12 years, and has increased knowledge in these groups.<sup>17</sup>

It has been estimated that in excess of \$15 million will have been spent on the Go for 2 & 5 campaign at the government level in the period through to June 2008.<sup>18</sup> This represents a leveraged investment of almost \$26 for every dollar spent in developing the framework of the campaign.<sup>18</sup>

Horticulture Australia Limited calculated that the national impact on demand over the nine-week period of the advertising campaign represented an increased consumption of 11 602 tonnes of fruit and vegetables, which would have generated over \$62 million in retail sales.<sup>18</sup>

The healthcare cost of colorectal, breast, lung and prostate cancer associated with low vegetable consumption in Australia is estimated to be \$58.8 million per year, while the healthcare cost of breast and lung cancer associated with low consumption of fruit is estimated to be \$29.4 million per year.<sup>19</sup> Increasing vegetable intake and fruit intake by one serve a day would save \$24.4 million and \$8.6 million per year, respectively, in health costs associated with breast and lung cancers. For cardiovascular disease, crude estimate of the Australian total healthcare costs associated with low consumption of fruit and vegetables (<400 g/day) is \$235 million per year.<sup>20</sup> Increasing vegetable and/or fruit intake in Australia by one serve per day would save \$156.8 million per year from the costs of cardiovascular disease.

### *Individual-level interventions*

A recent Cochrane systematic review<sup>21</sup> assessing the effect of dietary advice targeting increased fruit and vegetables intake found (for 8416 participants in 18 trials) an effect size of 1.25 servings/day (95% confidence interval = 0.7–1.81). The Booth *et al.* (pp. 115–120)<sup>8</sup> study highlighted the need for dietitians to provide dietary advice in a stepwise manner, at least for men. To achieve the reported outcomes, intensive follow-up is required (three times in the first month, and monthly thereafter for three months), as is structured guidance on defined amounts of foods, goal-setting and specific feedback on progress. For women, the strongest predictor of dietary change and maintenance in the longitudinal Women's Health Initiative Dietary Modification Trial (in which one of the dietary targets was  $\geq$ five serves fruit and vegetables per day) was attending intervention sessions and self-monitoring dietary intake.<sup>22</sup> A systematic review has found that dietitians are better than nurses or doctors in achieving expected goals associated with dietary counselling.<sup>23</sup> However, there are some promising examples of the use of non-traditional methods for dietary counselling that have been tested in various settings.<sup>24–26</sup>

## **ARE CHANGES IN FRUIT AND VEGETABLE CONSUMPTION SUSTAINABLE IN THE LONG TERM?**

The PREMIER trial was the first to investigate the feasibility of implementing the DASH diet in free-living persons. At 18 months of follow-up, an increased intake of fruits, vegetables and dairy was evident in the intervention group;<sup>27</sup> however, this did not reach levels consumed in the original DASH feeding studies. Follow-up of participants from the DASH-Sodium trial one year after discontinuation of the feeding intervention concluded that those who were provided with a DASH diet for 90 days maintained a higher

intake of fruits and vegetables, and had a lower intake of sweets, compared with those randomised to a control diet for the same period of time.<sup>28</sup> However, the sustained changes were less than one extra serving of fruit a day and less than one half serving of vegetables per day (four servings of both, compared with 2.7 at baseline). Another American study of a large cohort of women did not identify a single individual whose dietary intake was in perfect concordance with the DASH dietary guidelines.<sup>29</sup>

## **CAN A ONE-SIZE-FITS-ALL APPROACH BE ADOPTED OR WILL THIS MISS THOSE HARD-TO-REACH TARGET GROUPS?**

Diversity in the population, related to gender, age, ethnicity, socioeconomic and socio-cultural influences, may necessitate the targeting of nutrition messages. For example, the most important predictor of fruit and vegetable consumption is gender,<sup>30</sup> and this difference is evident in children as young as four years.<sup>31</sup> A Norwegian study in adolescents identified that the main reason boys eat less fruit and vegetables than girls is because they like them less;<sup>32</sup> however, reasons for this gender difference in food preferences are yet to be elucidated. In older adults, men's poorer nutritional knowledge explained about half the variation in fruit and vegetable intake associated with gender,<sup>33</sup> while in adult women, socioeconomic factors are key determinants of consumption.<sup>30</sup> Perceived barriers to changing fruit and vegetable intake identified by Western Australians during the planning of the Go for 2 & 5 campaign were lack of time, difficulty in preparation and incorrect perception about the adequacy of fruit and vegetables.<sup>16</sup> In New South Wales, people in lower socioeconomic groups and those living in more remote areas have fewer fruit and vegetable varieties available, and there is extensive variability in the cost of a healthy food basket both within and between geographical and demographic areas.<sup>34</sup>

This type of information has implications for the manner in which dietary strategies and policies are formulated and implemented. For example, an intervention that increases knowledge of health benefits of fruit and vegetables may result in behaviour change in older men, whereas in younger children and adolescents ways to improve the taste of vegetables in particular should be a primary focus.

As with all public health interventions, effective interventions for fruit and vegetable promotion will need to include: (i) individual-level interventions, conducted using targeted methods that result in long-term behaviour change in various high-risk and other subgroups; (ii) population-based strategies such as the Go for 2 & 5 campaign, as well as (iii) macro-level and environmental interventions that take into consideration issues of agricultural sustainability.

Karen E. Charlton, PhD, APD  
Senior Research Fellow, Smart Foods Centre  
University of Wollongong

## REFERENCES

- 1 Vorster HH, Love P, Browne C. Development of food-based dietary guidelines for South Africa – the process. *South Afr J Clin Nutr* 2001; **14** (3 Suppl.): S3–6.
- 2 U.S. Department of Agriculture (USDA). *Dietary Guidelines for Americans*. Washington, DC: Office of Disease Prevention and Health Promotion U.S. Department of Health and Human Services, 2005. (Cited 21 February 2008.) Available from URL: <http://www.healthier.us.gov/dietaryguidelines>
- 3 Lock K, Pomerleau J, Causer L, Altmann DR, McKee M. The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet. *Bulletin of the World Health Organization: the International Journal of Public Health* 2004; **83** (2): 100–8.
- 4 WHO/FAO. *Diet, Nutrition and the Prevention of Chronic Diseases*. Report of a joint FAO/WHO expert consultation. Geneva: World Health Organization, 2003 (WHO Technical Report Series No. 916).
- 5 World Cancer Research Fund. *Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective*. Washington, DC: American Institute for Cancer Research, 2007.
- 6 Appel LJ, Moore TJ, Obarzanek E *et al*. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *N Engl J Med* 1997; **336**: 1117–24.
- 7 Sacks FM, Svetky LP, Vollmer WM *et al.*, for the DASH-Sodium collaborative research group. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *New Engl J Med* 2001; **1**: 3–10.
- 8 Booth A, Nowson C, Worsley A, Margerison C, Jorna M. Dietary approaches for weight loss with intakes of fruit, vegetables and dairy products. *Nutr Diet* 2008; **65**: 115–120.
- 9 Nowson CA, Worsley A, Margerison C *et al*. Blood pressure response to dietary modifications in free-living individuals. *J Nutr* 2004; **134**: 2322–9.
- 10 Nowson CA, Worsley A, Margerison C, Jorna MK, Godfrey SJ, Booth A. Blood pressure change with weight loss is affected by diet type in men. *Am J Clin Nutr* 2005; **81**: 983–9.
- 11 Kellet E, Smith AS, Schmerlaib Y. *Australian Guide to Healthy Eating*. Canberra: Commonwealth Department of Health and Family Services, 1998.
- 12 Ammerman AS, Lindquist CH, Lohr KN, Hersey J. The efficacy of behavioural interventions to modify dietary fat and fruit and vegetable intake: a review of the evidence. *Prev Med* 2002; **35**: 25–41.
- 13 Ciliska D, Miles E, O'Brien MA *et al*. *The Effectiveness of Community Interventions to Increase Fruit and Vegetable Consumption in People four Years of Age and Older*. Hamilton: Public Health Research, Education and Development Program, 1999.
- 14 Contento I, Balch GI, Maloney SK. The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: a review of research. *J Nutr Educ* 1995; **27**: 277–418.
- 15 Burchett H. Increasing fruit and vegetable consumption among British primary schoolchildren: a review. *Health Educ* 2003; **103**: 99–109.
- 16 Pollard CM, Miller MR, Daly AM, Crouchley KE, O'Donoghue Lang AJ, Binns CW. Increasing fruit and vegetable consumption: success of the Western Australian Go for 2 & 5@ campaign. *Public Health Nutr* 2008; **11**: 314–20.
- 17 Elliott D, Walker D. Research report: evaluation of the national go for 2 & 5@ campaign. Prepared for Australian Government Department of Health and Ageing by Woolcott Research Pty Ltd., January 2007. (Ref: 2005/DH&A/BAHAA 2&5 Tracking Report).
- 18 Rowley C. *Building a National Approach to Fruit and Vegetable consumption. Future Activities and Past Success of the Go for 2&5@ Campaign*. Sydney: Horticulture Australia Limited (HAL), 2006.
- 19 Marks GC, Pang G, Coyne T, Picton P. *Cancer Costs in Australia—The Potential Impact of Dietary Change*. Canberra: Australian Food and Nutrition Monitoring Unit, Commonwealth Department of Health and Aged Care, 2001. (Cited 18 February 2008.) Available from URL: <http://www.sph.uq.edu.au/NUTRITION/monitoring/pdf/13cancer.pdf>
- 20 Miller M. Eat more fruit and vegetable. The case for a Five-year campaign to increase more fruit and vegetable consumption in Australia, 20 August 2002.
- 21 Brunner EJ, Rees K, Ward K, Burke M, Thorogood M. Dietary advice for reducing cardiovascular risk. *Cochrane Database Syst Rev* 2007; Issue 4. Art No. CD002128.
- 22 Tinker LF, Rosal MC, Young AF *et al*. Predictors of dietary change and maintenance in the Women's Health Initiative Dietary Modification Trial. *J Am Diet Assoc* 2007; **107**: 1155–66.
- 23 Thompson RL, Summerbell CD, Hooper L *et al*. Relative efficacy of differential methods of dietary advice: a systematic review. *Am J Clin Nutr* 2003; **77** (Suppl.): 1052S–7S.
- 24 Steptoe A, Perkins-Porras L, McKay C, Rink E, Hilton S, Cappuccio FP. Behavioural counselling to increase consumption of fruit and vegetables in low income adults; a randomised trial. *BMJ* 2003; **326**: 855–8.
- 25 Sacerdote C, Fiorini L, Rosato R, Audenino M, Valpreda M, Vineis P. Randomized controlled trial: effect of nutritional counselling in general practice. *Int J Epidemiol* 2006; **35**: 409–15.
- 26 Jackson C, Lawton R, Jenkinson J, Conner M. Increasing daily fruit and vegetable consumption: what changes do cardiac patients make? *J Hum Nutr Diet* 2005; **18**: 195–204.
- 27 Lin PH, Appel LJ, Funk K *et al*. The PREMIER intervention helps participants follow the Dietary Approaches to Stop Hypertension dietary pattern and the current Dietary Reference Intakes recommendations. *J Am Diet Assoc* 2007; **107**: 1541–51.
- 28 Ard JD, Coffman CJ, Lin P-H, Svetkey LP. One-year follow-up study of blood pressure and dietary patterns in dietary approaches to stop hypertension (DASH) – sodium participants. *Am J Hypertens* 2004; **17**: 1156–62.
- 29 Folsom AR, Parker ED, Harnack LJ. Degree of concordance with DASH diet guidelines and incidence of hypertension and fatal cardiovascular disease. *Am J Hypertens* 2007; **20**: 225–32.
- 30 Friel S, Newell J, Kelleher C. Who eats four or more servings of fruit and vegetables per day? Multivariate classification tree analysis of data from the 1998 Survey of Lifestyle, Attitudes and Nutrition in the Republic of Ireland. *Public Health Nutr* 2005; **8**: 159–69.
- 31 Wardle J, Sanderson S, Leigh Gibson E, Rapoport L. Factor-analytic structure of food preferences in four-year-old children in the UK. *Appetite* 2001; **37**: 217–23.
- 32 Bere E, Brug J, Klepp KI. Why do boys eat less fruit and vegetables than girls? *Public Health Nutr* 2008; **11**: 321–5.
- 33 Baker AH, Wardle J. Sex differences in fruit and vegetable intake in older adults. *Appetite* 2003; **40**: 269–75.
- 34 The Cancer Council NSW. *NSW Healthy Food Basket. Cost, Availability and Quality Survey*. Sydney: The Cancer Council, 2007. (Cited 22 February 2008.) Available from URL: <http://www.cancercouncil.com.au/foodbasket>

Copyright of Nutrition & Dietetics is the property of Blackwell Publishing Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.