

## Take Five, a nutrition education intervention to increase fruit and vegetable intakes: impact on attitudes towards dietary change

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To assess the response of low consumers of fruit and vegetables to a nutrition education intervention programme, data were collected from 104 adults on attitudinal variables related to 'eating more fruit, vegetables and vegetable dishes'. Questionnaires (based on the theory of planned behaviour) assessing perceived barriers to increasing fruit and vegetable consumption were administered before an action-orientated intervention programme and at the end of the intervention period (8 weeks). Questionnaire scores for belief-evaluations in the intervention groups pre- and post-study indicated that support of family and friends, food costs, time constraints and shopping practicalities (in order to increase intake of fruit, vegetable and vegetable dishes) were barriers to greater consumption of these foodstuffs. Perceived situational barriers to increasing intakes of fruits and vegetables were: limited availability of vegetables, salads and fruit at work canteens, take-aways, friends' houses and at work generally. Following the intervention the number of visits to the shops was perceived as a greater barrier for increasing intakes of fruit and vegetables. Perceived practical opportunities for increasing intakes highlighted drinking fruit juice, taking fruit as a dessert, having fruit as a between-meal snack and eating two portions of vegetables with a meal. About two-thirds of intervention subjects achieved the recommended fruit and vegetable target, but it is concluded that practical issues and situational barriers need to be addressed for the success of future public health campaigns.

### Dietary intervention: Fruit: Vegetables

In recent years there has been increasing publicity about the health benefits of consuming diets rich in fruits and vegetables, but little is known about the response of consumers to nutrition education interventions aimed at encouraging minimum intakes of five (approximately 80 g) portions of fruit and vegetables per day.

Data from the National Food Survey (Ministry of Agriculture, Fisheries and Food, 1997) indicate a current mean UK intake of fruits and vegetables of about 290 g/d (excluding potatoes). However, intakes vary by region, social class and sex (Ministry of Agriculture, Fisheries and Food, 1997). The reasons for low fruit and vegetable consumption in the UK (i.e. less than the 400 g minimum recommended by the World Health Organization, 1990) are complex and relate to educational, cultural and social aspects of demand and supply factors (Scottish Office, 1993; Forsyth *et al.* 1994). Structural problems relating to the availability of good quality produce at affordable prices in areas of urban deprivation and remote rural locations (Anderson *et al.*

1996) further hinder attempts to change dietary intake in line with current recommendations and this may be particularly true in areas where there are no street markets.

A previous study on barriers and incentives to increasing fruit and vegetable intakes (Anderson *et al.* 1993) showed that over 50% of respondents with low fruit and vegetable intakes (less than two portions per day) believed they were eating the right amount of these foods. Amongst the reported barriers to increased intakes, cost, lack of will-power and family influences feature highly. Recent work by Cox *et al.* (1996) in the UK suggests that increases in fruit and vegetable intakes might be assisted by incorporating consumer awareness of their low present consumption into health messages. In the USA, Krebs-Smith *et al.* (1995) have reported that only 8% of adults thought that '5-a-day' were needed for good health, again underlining the need for emphasis on portion goals. Attitudes to perceived barriers to fruit and vegetable intake have also been associated with intake and it is suggested that barriers

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should be identified and addressed in dietary change programmes (Dittus *et al.* 1995).

The aim of the current study was to examine the belief-evaluations, perceived practical barriers and perceived practical strategies for achieving '5-a-day' in consumers who participated in a nutrition education intervention programme designed to promote increased fruit and vegetable consumption. The specific objectives reported here are to assess the impact of nutrition education intervention on:

- (1) belief-evaluations relating to increasing intakes of fruit, vegetables and vegetable dishes;
- (2) perceived situational barriers to increasing intakes of fruit, vegetables and vegetable dishes;
- (3) perceived practical opportunities to increase intakes of fruit, vegetables and vegetable dishes.

The food and nutrient intake results pre- and post-intervention are presented elsewhere (Cox *et al.* 1998).

### Methods and subjects

Subjects were recruited at random through a market research agency in Reading, England and Glasgow, Scotland during June 1995. Adults were approached by street interviewers and invited to answer a brief screening questionnaire on current dietary habits, willingness to change these dietary habits using questions based on the stages of change model (Prochaska & DiClemente, 1986), vegetarian status and socio-demographic characteristics (age, sex, area of residence, employment status, household composition). Details are given in the accompanying paper by Cox *et al.* (1998).

Subjects who met the study criteria (Cox *et al.* 1998) were then contacted by the research team and invited to participate in a study of 'food intake'. Before intervention, subjects were not informed that the study focused on fruit and vegetables. Subjects were paid at the end of the study as compensation for recording data, and no financial incentives were provided to purchase more fruit and vegetables. The project was approved by the Greater Glasgow Community/Primary Care Local Research Ethical Committee and The Institute of Food Research Human Research Ethics Committee.

#### *Intervention study design*

During June and July 1995, 170 subjects were randomly allocated to one of two intervention groups or a control group. The intervention groups differed only in their dietary survey methods (Cox *et al.* 1998). All subjects were contacted by telephone or personal call to explain the requirements of the study in terms of recording food intake and completing questionnaires. The study consisted of four main elements as follows:

- (1) nutrition education intervention and self-monitoring, focusing on a minimum intake of five portions of fruit and vegetables per day over an 8-week period;
- (2) food intake records which were weighed (group A) or given as household measures (group B);
- (3) anthropometric measurements (heights and weights) were taken pre- and post-intervention;
- (4) barriers questionnaires. Two questionnaires addressing

barriers (e.g. high cost, poor taste) to increasing fruit and vegetable consumption were administered to the intervention subjects: a 'perceived barriers questionnaire' immediately before intervention and an 'actual barriers questionnaire' post-intervention. These questionnaires were designed and developed following face-to-face interviews, based on previous questionnaires on fruit and vegetables (Cox *et al.* 1996) and reduced-fat diets (Lloyd *et al.* 1993), and pre-tested with volunteer consumers. The content included items on socio-demographic details, behaviour beliefs, outcome evaluations, perceived situational barriers and perceived practical opportunities relating to increasing fruit and vegetable consumption.

*Socio-demographic information.* Details of age, sex, marital status, employment, income and household composition were collected, as well as information on related health behaviours (smoking, drinking, physical activity).

*Belief evaluations.* The framework used for behaviour belief and evaluation questions was based on the theory of planned behaviour (Ajzen, 1985). Fourteen behaviour belief items (regarding 'increasing fruit', 'increasing vegetables' and 'increasing vegetable dishes') were addressed, specifically relating to heart disease, weight control, cancer, overall health, protein intake, vitamin and mineral intake, nutritional value, family support, friend support, ease of shopping, cost of food, taste, preparation and cooking. Items were phrased in the following manner:

'What effect do you think eating more fruit would have on overall health?'

Answers were presented as seven-point category scales, and subsequently scored from -3 to +3 on a seven-point bipolar scale with a neutral mid-point scoring 0, and all answers were converted so that a positive score indicated a positive belief (Sparks *et al.* 1991). Matching outcome evaluation questions were phrased in the following manner:

'choosing foods which are good for overall health'

Responses were presented as seven-point category scales ranging from 'extremely unimportant' to 'extremely important' and subsequently scored 1-7. To calculate 'belief-evaluation scores' behaviour belief responses (-3 to +3) were multiplied by the outcome evaluation responses (1 to 7) thus scoring a possible -21 to +21 (Sparks *et al.* 1991).

*Perceived situational barriers.* Sixteen questions regarding 'eating more fruit' and 'eating more vegetables and salad' were addressed, specifically related to eating at the canteen at work, restaurants, take-aways, friends' houses, usual eating habits, eating from boredom, eating with children, eating with partner, partner's cooking, availability in local shops, availability at work, storage facilities, number of visits to shops, eating alone, eating a 'snack' lunch, taste). Items were presented as seven-point category scales, subsequently scored -3 to +3 ('extremely difficult' to 'extremely easy').

*Perceived practical opportunities.* Ten questions on practical opportunities (strategies) to eat fruit and vegetables in different ways were also included. These items matched those on the self-monitoring sheets and were

presented on a seven-point category scale, subsequently scored -3 to +3 ('extremely difficult' to 'extremely easy').

**Actual barriers questionnaire.** This questionnaire was designed to repeat the items in the perceived barriers questionnaire to assess the impact of intervention and experience. Thus the questions described previously were repeated but phrased as in the following example:

'What effect did the following (eating more fruit) have on the amount of time spent cooking and preparing food?'

Scoring was the same as previously described.

Four additional sections (a total of thirty-five questions) were included in the questionnaire, namely shopping behaviour, perceived changes in diet, perceived changes in health and lifestyle and ratings of the intervention components, and details of these will be presented elsewhere.

Control subjects completed questionnaires on socio-demographic background and perceived change in health and lifestyle (during the experimental period) at week 8, but did not complete barriers questionnaires as these focused directly on the fruit and vegetable intervention.

### Statistical methods

Differences between categorical variables (socio-demographic characteristics) were assessed by  $\chi^2$  test. Continuous variables (questionnaire items) were not normally distributed, thus differences in belief-evaluation scores, perceived situational barriers and perceived practical opportunities were tested by Wilcoxon matched pairs signed ranked tests. Differences in response between achievers and non-achievers of the '5-a-day' portions were tested by Mann-Whitney test. Means are presented with standard deviations unless otherwise indicated, and  $P < 0.05$  was used as the criterion for statistical significance.

## Results

### Subjects

A total of 170 adults entered the study and 135 completed it, returning all diaries, self-monitoring records and questionnaires at all points in the 8-week period. The socio-demographic profile of subjects who completed and failed to complete the study is presented in Table 1. Subjects who failed to complete the study were slightly younger than those who completed it, but the groups were otherwise similar in socio-demographic characteristics. All but two subjects who dropped out were traced and the main reason reported for failure to complete was vacation commitments. The subjects ranged in age from 18 to 64 years, were predominantly female and mainly from a non-manual background (11% were unemployed). Subjects were fairly evenly distributed across four income groups (Table 2).

### Belief-evaluation scores

The results for the intervention subjects who completed the questionnaire are presented in Table 3. In both pre- and post-intervention questionnaires the items which were

**Table 1.** Socio-demographic and health behaviour characteristics of subjects completing the study v. those not completing the study

	Completers (n 135)	Non-completers (n 35)
Age (years)	34.1 (SD 12.2)	28.4** (SD 9.3)
Sex:		
male (%)	30	31
female (%)	70	69
Social class:†		
non-manual (%)	71	63
manual (%)	18	29
unemployed (%)	11	8
Income (per annum):		
<£10 000 (%)	27	28
£10 000–£20 000 (%)	26	25
£20 000–£30 000 (%)	26	25
>£30 000 (%)	21	22
Smokers:		
yes (%)	23	24
no (%)	77	76
Regular exercise‡		
yes (%)	29	38
no (%)	71	62
BMI (kg/m <sup>2</sup> )	24.6 (SD 4.3)	24.8 (SD 4.4)

Mean value was significantly different from that for completers, \*\* $P < 0.01$ .

†Based on head of household (Office of Population Censuses and Surveys, 1980).

‡Classified 'yes' if vigorous exercise was taken three or more times per week.

scored highest related to health and nutrition whilst lowest scores for increasing fruit and vegetable consumption were related principally to practical aspects of procurement and preparation.

**Table 2.** Socio-demographic and health behaviour characteristics of participants

	Intervention groups A/B (n 105)	Control group C (n 29)
Age (years)	35.1 (SD 12.4)	30.2 (SD 11.1)
Sex:		
male (%)	26	45
female (%)	74	55
Social class:*		
non-manual (%)	68	86
manual (%)	21	4
unemployed (%)	11	10
Income (per annum):		
<£10 000 (%)	29	21
£10 000–£20 000 (%)	25	31
£20 000–£30 000 (%)	26	28
>£30 000 (%)	21	21
Smokers:		
yes (%)	21	31
no (%)	79	69
Regular exercise:†		
yes (%)	26	41
no (%)	74	59
BMI (kg/m <sup>2</sup> )	25.0 (SD 4.5)	23.2 (SD 3.4)

\*Based on head of household (Office of Population Censuses and Surveys, 1980).

†Classified 'yes' if vigorous exercise was taken three or more times per week.

**Table 3.** Significant changes in belief-evaluation scores amongst intervention subjects (*n* 104)\* †  
(Mean values and standard deviations)

	Pre-intervention		Difference (post-intervention – pre-intervention)		Significance level, ‡ <i>P</i> =
	Mean	SD	Mean	SD	
<b>Increasing fruit</b>					
Risk of cancer	6.4	6.6	+2.9	6.7	<0.001
Family support	5.9	6.5	–2.9	7.1	<0.001
Friends' support	2.9	4.2	–1.4	4.2	<0.01
Cost of food	–2.3	6.5	–2.0	7.0	<0.05
Ease of shopping	–0.2	4.8	–2.1	6.4	<0.01
Cooking time	4.0	7.4	–1.8	8.0	<0.05
Protein intake	0.9	6.2	+1.2	7.0	NS
<b>Increasing vegetables</b>					
Risk of cancer	6.3	6.7	+3.3	6.9	<0.001
Protein intake	1.4	6.6	+1.7	7.6	<0.05
Family support	6.3	7.0	–3.7	8.2	<0.001
Friends' support	2.8	4.2	–1.4	4.6	<0.01
Cost of food	–0.2	6.7	–1.7	7.5	NS
Ease of shopping	–0.4	4.8	–1.4	6.3	NS
Cooking time	–1.4	7.0	–0.7	7.9	NS
<b>Increasing vegetable dishes</b>					
Risk of cancer	4.2	6.0	+2.7	7.0	<0.001
Protein intake	–0.1	5.8	+1.6	7.3	<0.01
Family support	4.0	7.5	–2.8	8.7	<0.001
Friends' support	2.1	3.7	–1.2	4.4	<0.05
Ease of shopping	0.0	5.2	–2.3	5.5	<0.001
Cooking time	–0.9	6.7	–1.0	8.1	NS
Cost of food	3.0	6.1	–1.4	6.9	<0.05

\* One subject failed to complete all questions.

† Possible scores were –21 to +21. A positive score indicates that this response is viewed as a favourable outcome to increasing consumption. A negative score indicates a less favourable outcome to increasing consumption.

‡ Difference between pre- and post-testing.

The scores for increasing vegetable dishes were generally lower than for increasing vegetables or increasing fruit. The 'cost of food' was rated significantly ( $P < 0.001$ ) higher (i.e. more acceptable) in terms of increasing vegetable dishes compared with increasing fruits and increasing vegetables. 'Preparation and cooking time' was seen as significantly ( $P < 0.001$ ) higher (i.e. more acceptable) for increasing fruit intake compared with increasing vegetables and vegetable dishes.

To examine the impact of intervention on belief-evaluation scores, results for items relating to increasing fruit, vegetables and vegetable dishes were compared with pre-intervention scores and are presented in Table 3. Only scores for belief evaluation items relating to reducing risk of cancer had increased in all three food categories, although the belief-evaluation items on protein intake had significantly increased for vegetables and vegetable dishes.

There were, however, many significant decreases in belief-evaluation scores (Table 3). Scores for all three food category items on support of family and support of friends had significantly decreased. Scores for cost of food and ease of shopping had also decreased (indicating a more negative response) for both fruit and vegetable dishes and, for fruit, the score on cooking time had also decreased.

The differences between pre- and post-intervention scores were calculated and compared in 'achievers' and 'non-achievers' of '5-a-day' portions. In general, the post-

and pre-intervention scores changed in the same direction in both the 'achievers' (*n* 67) and 'non-achievers' (*n* 37) and no significant differences were detected between these subject groups.

#### *Perceived situational barriers to increasing intakes of fruits, vegetables and salads*

It was clear that certain situations were considered more favourable for increasing intakes of fruit and vegetables than others. Table 4 shows the pre- and post-intervention scores for the range of situation items addressed in the questionnaire for vegetable and salad consumption. The availability of vegetables and salads at the work canteen, take-aways, friends' houses, and at work scored the lowest scores (hardest situations) and were perceived as most problematic for increasing intakes, although eating out of boredom also scored low. There were significant differences in these scores pre- and post-intervention for number of visits to the shops and eating out at friends' houses.

For fruit (Table 5), the situation was similar, with the lowest scores (hardest situations) for increasing consumption being work canteens, restaurants, take-aways, friends' houses, and availability at work. Other situational factors which were rated poorly for increasing fruit intake were preference for other snacks and eating little or no breakfast. Like the response for vegetables the item on fruit for 'number of visits to shops' decreased significantly between

**Table 4.** Situational barriers to increasing vegetable and salad consumption amongst the intervention group (*n* 104)\*  
(Mean values and standard deviations)

	Pre-intervention		Difference (post-intervention – pre-intervention)		Significance level, <i>P</i> =
	Mean	SD	Mean	SD	
Availability of local vegetables	0.9	1.4	0.0	0.4	0.87
The taste	0.8	1.4	+0.2	1.5	0.15
Restaurants	0.6	1.1	−0.3	1.4	0.11
Usual eating habits	0.6	1.4	−0.1	1.3	0.34
Number of visits to shops	0.5	1.4	−0.4	1.7	0.03
Storing vegetables	0.6	1.3	0.0	1.4	0.96
Eating with partner	0.5	1.3	−0.1	1.5	0.66
Eating alone	0.4	1.4	0.0	1.5	0.91
Eating with children	0.2	1.2	−0.1	1.2	0.61
Eating what partner eats	0.5	1.3	−0.1	1.5	0.66
Eating a snack lunch	0.2	1.5	−0.2	1.4	0.17
Availability of vegetables at work	0.0	1.2	−0.3	1.7	0.16
Eating at friend's house	0.1	1.1	−0.2	1.3	<0.01
Eating at work canteen	0.0	1.2	−0.2	1.4	0.38
Eating out of boredom	−0.3	1.5	0.0	1.5	0.81
Take-away meals	−0.7	1.2	−1.0	1.1	0.30

\* A positive score indicates that this response is viewed as a favourable outcome to increasing consumption. A negative score indicates a less favourable outcome to increasing consumption.

pre- and post-intervention questionnaires. The item on 'eating at friends' houses' also decreased.

#### *Perceived practical opportunities*

The scores for perceived ease of eating fruit and vegetables are outlined in Table 6. Most scores decreased post-intervention reflecting the actual difficulties encountered with increased consumption, although the score for fruit juice increased significantly. Overall, a glass of fruit juice was rated the easiest option, followed by three familiar, practical

routes, namely fruit as a dessert, two portions of vegetables with a meal and fruit as a between-meals snack.

The differences between post- and pre-intervention scores were calculated and compared in 'achievers' and 'non-achievers' of '5-a-day' portions (Table 7). For three of these practical opportunity items the decrease in score post-intervention was significantly lower in non-achievers, indicating that eating fruit as a dessert, two portions of fruit with a meal and two portions of vegetables with a meal were perceived to be more difficult by the non-achiever group.

**Table 5.** Situational barriers to increasing fruit consumption amongst the intervention group (*n* 104)\*  
(Mean values and standard deviations)

	Pre-intervention		Difference (pre-intervention – post-intervention)		Significance level, <i>P</i> =
	Mean	SD	Mean	SD	
Availability of fruit locally	1.1	1.5	−0.2	1.5	0.25
The taste	1.0	1.3	+0.5	1.4	0.077
Eating with partner	0.9	1.1	−0.3	1.2	0.08
Eating with children	0.7	1.2	−0.3	1.3	0.09
Eating alone	0.7	1.2	0.0	1.5	0.98
Usual eating habits	0.7	1.4	−0.2	1.3	0.17
Eating a snack lunch	0.6	1.3	−0.1	1.8	0.51
Number of visits to shops	0.5	1.2	−0.5	1.5	<0.01
Storing fruit	0.3	1.2	−0.1	1.3	0.31
Eating what partner prepared	0.9	1.1	−0.3	1.2	0.89
Eating little or no breakfast	0.1	1.5	−0.3	2.0	0.07
Availability of fruit at work	0.0	1.5	−0.2	1.8	0.40
Work canteen	0.0	1.5	−0.3	1.8	0.16
Restaurants/café	−0.2	1.2	−0.2	1.4	0.11
Preferences for other snacks	−0.4	1.4	−0.1	1.4	0.79
Eating at friend's house	−0.3	1.1	−0.2	1.1	<0.01
Take-aways	−1.2	1.2	0.1	1.2	0.50

\* A positive score indicates that this response is viewed as a favourable outcome to increasing consumption. A negative score indicates a less favourable outcome to increasing consumption.

**Table 6.** Practical opportunities: perceived ease of intake\* reported by intervention subjects (*n* 104)  
(Mean values and standard deviations)

	Pre-intervention		Difference (post-intervention – pre-intervention)		Significance level, † <i>P</i> =
	Mean	SD	Mean	SD	
A glass of fruit juice	2.2	1.1	+0.2	1.3	<0.05
Fruit as a dessert	1.7	1.3	–0.2	1.5	0.20
Two portions vegetables with a meal	1.7	1.3	–0.5	1.5	<0.01
Fruit as a between-meal snack	1.4	1.5	0.0	1.6	1.00
Bowl of salad with meal	1.3	1.5	–0.5	1.5	<0.001
Fruit as a starter	1.0	1.5	–0.7	1.8	<0.001
Home-made soup	0.9	1.8	–1.0	1.9	<0.001
Chopped fruit with cereal	0.7	1.8	–0.2	1.9	0.19
Replacing meat dish with vegetables	0.7	1.6	–0.5	1.7	<0.05
Two portions fruit with meal	0.4	1.6	–0.4	1.5	<0.05

\* Possible score –3 to +3. A positive score indicates that this response is viewed as a favourable outcome to increasing consumption. A negative score indicates a less favourable outcome to increasing consumption.

† Pre-intervention *v.* post-intervention scores.

**Table 7.** Significant changes in practical opportunities score (post-intervention differences compared in achievers and non-achievers of '5-a-day')  
(Mean values and standard deviations)

	Achievers ( <i>n</i> 67)				<i>P</i> †	Non-achievers ( <i>n</i> 37)				<i>P</i> ‡	<i>P</i> §
	Pre-intervention score		Difference*			Pre-intervention score		Difference*			
	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
Fruit as a dessert	1.7	1.3	+0.1	1.4	0.45	1.7	1.2	–0.8	1.4	0.003	<0.01
Two portions of fruit with a meal	0.5	1.4	–0.02	1.4	0.36	0.3	1.9	–0.8	1.5	0.001	<0.05
Two portions of vegetables with a meal	1.7	1.4	–0.1	1.2	0.44	1.6	1.1	–1.1	1.7	0.0004	<0.01

\* Post-intervention score minus pre-intervention score.

† Significance of the difference between pre- and post-intervention values in achievers of '5-a-day'.

‡ Significance of the difference between pre- and post-intervention values in non-achievers of '5-a-day'.

§ Significance of the difference between the difference scores for achievers and non-achievers of '5-a-day'.

The proportion of fruits and vegetables measured by the validated self-monitoring records at week 8 revealed that approximately 70% of the daily portions of fruit and vegetables consumed by both achievers (4.6 portions/d) and by non-achievers (2.5 portions/d) were obtained by the four routes perceived as easiest (see Cox *et al.* 1998).

## Discussion

This intervention study provides novel data on the behavioural responses and perceptions of consumers participating in a nutrition education programme aimed at increasing intake of fruits and vegetables.

The subjects recruited may have been those most likely to change dietary habits in that they were predominantly female, reported 'contemplating change' before entry, and came mostly from non-manual backgrounds, all characteristics associated with a 'better' dietary intake (Anderson & Hunt, 1993). Previous work employing the 'stages of change' model in dietary behaviour has shown that 'contemplators' are more likely to be female and better educated than 'non-contemplators' (Curry *et al.* 1992; Glanz *et al.* 1994) and those at action or maintenance older than

contemplators. The low proportion of smokers and relatively high proportion of people taking regular exercise compared with the general population (Huppert & Whiclow, 1993) also suggests a fairly health-conscious sample. However, it is essential to remember that all volunteers were low consumers of fruit and vegetables (with no differences between achievers and non-achievers), and this was the main recruitment criterion. Although recruitment included adults aged 16–64 years there tended to be a greater proportion of recruits under 40 years, presumably reflecting the lower fruit and vegetable intake in younger age groups (Gregory *et al.* 1990).

The impact of the intervention on fruit and vegetable intake was impressive both in terms of gram weights and total portions, and is discussed in detail elsewhere (Cox *et al.* 1998).

### Belief evaluation

The differences in belief-evaluation scores pre- and post-intervention highlight a number of areas of interest. However, it should be noted that these results may reflect, to some extent, the large number of items used in the questionnaire. Follow-on work using this tool in a worksite

setting does show very similar results, suggesting that these are not entirely due to chance (Anderson *et al.* 1997).

The belief-evaluation scores show that most people contemplating increases in fruit and vegetable consumption recognize the importance of increasing fruit and vegetables for nutrition and health reasons, although this is weaker for vegetable-based dishes. Weight control was seen as a positive reason for increasing fruit and vegetable intake but was not rated as highly as other health and nutritional reasons. The belief in decreasing risk of cancer by increasing fruit and vegetable intake scored lower than the other health items pre-intervention but increased significantly post-intervention. This finding may reflect the fact that much less public health advice has focused on diet and cancer, and the intervention lecture may have had a specific effect on increasing knowledge in this area. Likewise, scores increased post-intervention for the item on achieving adequate protein intake with increasing fruit and vegetable intake, suggesting that before intervention subjects may have associated high vegetable intake with lowered protein intake.

Several negative beliefs about increasing intakes of fruit and vegetables were clearly identified. For fruit, food costs received the most negative pre-intervention rating, and this decreased even further after intervention. In contrast, the cost of food when increasing vegetable dishes was viewed positively. It seems appropriate that emphasis on balancing perceived higher costs of fruit with less expensive vegetable-based dishes may be an important practical aspect to encourage dietary change. These results also suggest that fruit, vegetables and vegetable dishes are viewed differently and this might be usefully applied in health promotion.

Other practical considerations which were scored negatively (i.e. more difficult) included ease of shopping (which also diminished post-intervention), and cooking time for both vegetable dishes and fruit. It is interesting that the item on cooking time was scored more negatively for vegetables than vegetable dishes, suggesting that vegetable dishes may have been largely perceived as pre-prepared (e.g. frozen vegetable lasagne). It is reasonable to conclude that issues of ease of shopping, costs and cooking time (fruit) were more problematic during the intervention than originally anticipated, and ways to address these problems may be beneficial for future programmes.

The other belief-evaluation items which changed significantly were related to support for dietary changes from family and friends. In all three food categories the scores were lower at the end of intervention relative to baseline, indicating much less support than anticipated. These results suggest that dietary changes which are not dependent on family or friends may be particularly useful e.g. eating an apple whilst alone. Alternatively, adopting strategies which are more acceptable to family and friends may be easier to comply with and have an effect on the eating habits of others e.g. providing fruit which can be easily shared and used in a similar way to existing snack foods, such as grapes as a substitute for crisps.

#### *Situational barriers*

The situational barriers which create most difficulty relate principally to eating out of the home. This was also

highlighted by Lloyd *et al.* (1993) for UK consumers attempting to adopt a reduced-fat diet. This may be a reflection of the limited types and the nutritional characteristics of foods available in many situations out of the home. For example, the National Food Survey (Ministry of Agriculture, Fisheries and Food, 1997) shows that meals consumed in the workplace contain an average of about 50% energy as fat. In addition, only 8.1% of vegetables and 4.2% of fruits are currently derived from meals and snacks eaten outside the home (Ministry of Agriculture, Fisheries and Food, 1997). It has also been suggested that there is little variety of fruit on offer in work canteens, and it is anecdotally recognized that vending machines at worksites more frequently stock soft drinks, confectionery and biscuits than fresh fruit or pure fruit juice. Published data by Jeffrey *et al.* (1994) show that fruit and salad sales can increase if greater provision is made at cafeteria sales points.

The barrier 'preference for other snacks' probably relates to the use of confectionery as a snack instead of fresh fruit. Qualitative data from Marshall *et al.* (1995) support this finding and suggest that fruit suffers as a between-meals snack in that it fails to be perceived as 'filling'. The barrier 'lack of breakfast' as a problem for increasing fruit intake is interesting and offers an opportunity for health promotion. Fresh fruit was reportedly consumed by 20% of the population at breakfast during 1990 (Taylor-Nelson, 1990) and fruit juice has enjoyed similar popularity. The addition of fruit to breakfast cereal (as fresh, canned or dried) offers one of the simplest opportunities to increase intake, and of course this can be consumed at any time of day. Recent work (A Hobbs, personal communication) also suggests that breakfast is considered a good practical opportunity for increasing fruit intake.

#### *Practical opportunities*

A wide range of serving methods of fruits and vegetables were considered acceptable by the respondents. A glass of fruit juice was clearly deemed the easiest strategy and notably so after the intervention, followed by a series of other familiar routes. These results are similar to those reported by Treiman *et al.* (1996) in the USA who identified fruit juice in the morning, fruit as a snack, salad for lunch, two vegetables with dinner and eating fruit as a dessert as the most acceptable opportunities for promoting increased fruit and vegetable consumption. The decrease in perceived ease scores indicates the actual, as opposed to expected, barriers experienced, and may arise due to factors such as time constraints, weather conditions and availability. The significant reduction in perceived ease scores of non-achievers relates principally to fruit.

#### **Conclusions**

These data on specific belief-evaluations, perceived barriers and perceived practical opportunities from consumers who have undergone an educational intervention aimed at increasing fruit and vegetable intake, make it clear that, even with well-motivated, well-informed consumers, facilitatory factors such as availability and cost are likely to influence consumption.

Future public health programmes might benefit from specific targeting of salient beliefs relating to reducing cancer risk and the nutritional adequacy of a diet rich in fruit and vegetables. It is apparent that there is a wide range of environmental settings which limit fruit and vegetable intake, particularly the workplace and social settings. Targeting increased consumption of fruit juice, a selection of vegetables with main meals and fruit as both a snack and main meal item may be more acceptable and effective for UK consumers than promoting a vast range of untested suggestions.

Promotion of increased fruit and vegetable consumption is an area that local food and health policy implementation teams could focus on for specific action, perhaps in collaboration with the catering industry. However, greater availability of fruit and vegetables will only help to increase intake if the acceptability of eating these foods in different meal and snack settings is maintained, promoted and encouraged.

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### References

- Ajzen I (1985) From intentions to action: a theory of planned behaviour. In *Action Control: From Cognition to Behavior*, pp. 11–39 [J Kuhle and J Beecham, editors]. Heidelberg: Springer.
- Anderson AS, Cox DN, Eley S, Lean MEJ & Mela D (1997) Changing nutrition for the 21st century – lessons from a work-site intervention programme. In *Lifestyle 2000; Consumer Issues Towards the Millennium – Conference Proceedings*. Dundee: University of Dundee School of Management and Consumer Studies.
- Anderson AS, Ellaway A, Macintyre S, McColl K, Callander R & Oswald J (1996) *Community Food Initiatives in Scotland*. Edinburgh: Health Education Board for Scotland.
- Anderson AS & Hunt K (1993) Who are the healthy eaters? Eating patterns and health promotion in the West of Scotland. *Health Education Journal* **51**, 3–10.
- Anderson AS, Lean MEJ, Foster A & Marshall D (1993) Ripe for change: fruit and vegetables in Scotland – current patterns and potential for change. *Health Bulletin* **52**, 51–64.
- Cox DN, Anderson AS, Lean MEJ & Mela DJ (1996) Identifying barriers to increasing fruit and vegetable consumption in the U.K. *Appetite* **24**, 267.
- Cox DN, Anderson AS, Reynolds J, McKellar S, Lean MEJ & Mela DJ (1998) Take Five, a nutrition education intervention to increase fruit and vegetable intakes: impact on consumer choice and nutrient intakes. *British Journal of Nutrition* **80**, 123–131.
- Curry SJ, Kristal AR & Bowen DJ (1992) An application of the state model of behaviour change to dietary fat reduction. *Health Education Research* **7**, 97–105.
- Dittus DZ, Hilliers VN & Beerman KA (1995) Benefits and barriers to fruit and vegetable intake: relationship between attitudes and consumption. *Journal of Nutrition Education* **27**, 120–126.
- Forsyth A, Anderson AS & Macintyre S (1994) Diets for disease – urban food choices. *Appetite* **22**, 259–274.
- Glanz K, Patterson RE, Kristal AR, Diclemente CC, Heimendinger J, Linnaus L & McLennan DF (1994) Stages of change in adopting healthy diets: fat, fiber, and correlates of nutrient intake. *Health Education Quarterly* **21**, 499–519.
- Gregory J, Foster K, Tyler H & Wiseman M (1990) *The Dietary and Nutritional Survey of British Adults*. London: HM Stationery Office.
- Huppert F & Whichelow MJ (1993) *The Health and Lifestyle Survey: Seven Years On*. Aldershot: Dartmouth.
- Jeffrey RW, French S, Raether C & Baxter J (1994). An environmental intervention to increase fruit and salad purchases in cafeteria. *Preventive Medicine* **23**, 788–792.
- Krebs-Smith SM, Heimendinger J, Patterson BH, Subar AF, Kessler R & Pivanka E (1995) Psychosocial factors associated with fruit and vegetable consumption. *American Journal of Health Promotion* **10**, 98–104.
- Lloyd HM, Paisley CM & Mela DJ (1993) Changing to a low fat diet: attitudes and beliefs of low fat consumers. *European Journal of Clinical Nutrition* **47**, 361–373.
- Marshall D, Anderson AS, Lean M & Foster A (1995) Eat your greens: the Scottish consumers perspective on fruit and vegetables. *Health Education Journal* **54**, 186–197.
- Ministry of Agriculture, Fisheries and Food (1997) *National Food Survey 1994*. London: HM Stationery Office.
- Office of Population Censuses and Surveys (1991) Appendix A. Allocation of standard classification occupational unit groups to social classes and socio-economic groups. In *Standard Occupational Classification 1991*. London: HM Stationery Office.
- Prochaska JO & DiClemente C (1986) Towards a comprehensive model of change. In *Treating Addictive Behavior*, pp. 3–27 [W Miller and N Heather, editors]. New York, NY: Plenum Press.
- Scottish Office (1993) *Scotland's Health: A Challenge to us All*, pp. 54–76. Edinburgh: HM Stationery Office.
- Sparks P, Hedderley D & Shepherd R (1991) Expectancy value models of attitudes: a note on the relationship between theory and methodology. *European Journal of Social Psychology* **21**, 261–271.
- Taylor-Nelson (1990) *What's for Breakfast, Lunch, Tea-time, Evening meal. Family Food Panel Special Report*. Epsom: Taylor-Nelson.
- Treiman K, Freimuth D, Demron D, Lasswell A, Anliker J, Havas S, Langberg P & Feldman R (1996) Attitudes and behaviors related to fruits and vegetables among low income women in the WIC program. *Journal of Nutrition Education* **28**, 149–156.
- World Health Organization (1990) *Diet, Nutrition and the Prevention of Chronic Disease. Technical Report Series no. 797*. Geneva: WHO.