Public Health Nutrition: 10(7), 671–680 doi: 10.1017/S1368980007382517

Effect of a pilot community intervention on fruit and vegetable intakes: use of FACET (Five-a-day Community Evaluation Tool)

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Submitted 14 November 2005: Accepted 26 September 2006: First published online 20 February 2007

Abstract

Background: In 2001 the UK Department of Health funded pilot community-based interventions to improve fruit and vegetable intakes in five economically deprived areas of England. The effectiveness of the programme and the use of a brief tool for evaluating community interventions are reported here.

Methods: Data on intakes of and beliefs about fruit and vegetables were collected by a short postal questionnaire (FACET – Five-a-day Community Evaluation Tool) simultaneously from 810 individuals living in the pilot communities and 270 individuals who were participating in an unrelated observational study (controls). Data were collected before and after a 12-month intervention period. Quantitative dietary data derived from 7-day food diaries available for control subjects were used to assess the ability of the FACET questionnaire to estimate fruit and vegetable intakes.

Results: Compared with controls, the intervention group significantly increased their knowledge of the 5-a-day optimum ($P < 0.01$) and reported increased access to fruits and vegetables ($P < 0.001$). Overall, the intervention had no demonstrable effect on total fruit and vegetable intakes as measured by FACET. However, smoking habit strongly predicted change in fruit and vegetable intakes ($P < 0.01$) in the intervention group. Opposite trends were observed in the two groups, with 'smokers' and 'non-smokers' in the intervention and control groups respectively reducing their fruit and vegetable intakes. The FACET questionnaire agreed with food diary estimates of fruit and vegetable intakes in 56% of cases.

Conclusions: Community-based interventions can produce important changes in knowledge of and access to fruit and vegetables. However, in this study change in fruit and vegetable intakes was strongly influenced by smoking habit. This bias needs to be considered in planning future intervention and evaluation programmes. The FACET questionnaire provides acceptable estimates of fruit and vegetable intakes which may be used for grading intake in large community-based projects.

Keywords
Five-a-day
Fruit and vegetables
Community intervention
FACET

Diets rich in fruits and vegetables are associated with reduced morbidity and mortality from chronic diseases such as ischaemic heart disease and cancer[1]. Despite this, fruit and vegetable intakes in the UK fall short of the recommended minimum intake ($400\,g\,day^{-1}$ or 5 portions day^{-1}) and are among the lowest in Europe[2,3]. Intakes are particularly poor in deprived areas, for people on low incomes and in those lacking social support. For a sustained improvement to occur individuals need a clear understanding of what constitutes a portion of fruit or vegetables, skills to purchase, store and prepare these foods, and a local supply structure which is consistent, accessible, affordable and provides good-quality produce.

In 2001 the UK Department of Health commissioned a pilot initiative to increase fruit and vegetable intakes in five deprived communities by improving awareness, attitudes and access to fresh fruits and vegetables[4]. These initiatives involved building community networks to achieve and sustain increased fruit and vegetable intakes through collaboration between retailers, educators, primary care teams, employers and local media. A range of community activities was undertaken within each pilot site[4].

To assess the success of the pilot initiative, intakes of fruit and vegetables before and after the interventions were measured using a short dietary/attitude questionnaire, the Five-a-day Community Evaluation Tool (FACET). Any change which occurred was then compared

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https://doi.org/10.1017/S1368980007382517 Published online by Cambridge University Press

with intakes in a control population, in which no attempts were made to influence fruit and vegetable consumption. Participants in the European Prospective Investigation into Cancer and Nutrition (EPIC) study in Norfolk served as the control population[5]. Data on these same EPIC study participants were also used to assess the accuracy of the FACET questionnaire for measuring fruit and vegetable intakes.

Subjects and methods

Prior to the start of the community interventions, FACET questionnaires were mailed to 1560 individuals selected from the electoral rolls of those areas involved in the 5-a-day pilot activities by a random stratified sampling method. In addition, questionnaires were mailed simultaneously to a sample of 400 subjects in the EPIC–Norfolk cohort.

It was estimated that a sample size of 200 subjects from each intervention site plus 200 control subjects would be required to demonstrate a 0.5 portion change in fruit and vegetable intakes with 80% power. The number of postal questionnaires sent out was based upon an expected 65% response rate. To maximise the number of responses, freepost (reply paid) envelopes and incentive payment request forms were included with each questionnaire. Non-respondents were sent reminders. Nine hundred and seventy-five intervention subjects and 309 control subjects returned baseline questionnaires. A random sample of 140 non-responders was followed up by telephone, but this yielded only an extra seven completed questionnaires and further telephone follow-up was therefore curtailed.

One year after the pilot interventions had begun follow-up questionnaires were mailed to all 1284 intervention and control subjects who had returned baseline questionnaires. Of these, 1080 subjects (810 intervention subjects, 270 controls) provided two useable questionnaires.

Assessments

FACET

The dietary assessment part of the FACET questionnaire was a modified version of a short food-frequency questionnaire (FFQ) used by Cox *et al.* to assess fruit and vegetable intakes in an adult British population[6]. Subjects were requested to indicate on a 5-point scale (0 to 4+ portions day^{-1}) how often they consumed certain foods at various meal times during the previous day. Nine of the 14 questions are relevant to the assessment of fruit and vegetable intakes. The FACET questionnaire is shown in Appendix A.

Part 2 of the FACET questionnaire concerned health beliefs relating to fruit and vegetable intakes: optimum fruit and vegetable intake levels; perceptions of current fruit and vegetable intakes; and perceived ability to change intake. At follow-up this section was extended to include questions on perceived changes in intakes, awareness of intervention strategies and increased accessibility of fruit and vegetables. An excerpt of this questionnaire, results of which are discussed herein, is presented in Appendix B.

Data on ethnicity and income were also collected from intervention group subjects.

Comparison of FACET intake estimates with food dairy data

Food diary data had previously been collected from the control group. These were used to assess the accuracy of the intake estimates derived from the FACET. Subjects had been given instructions on the completion of the food diary by a trained nurse. Portion sizes were reported in household measures, by packet sizes, and by reference to 17 sets of photographs depicting small, medium and large portions of a range of foods. Diaries were coded and entered to the Data Into Nutrients for Epidemiological Research (DINER) program[7]. Data on edible portions of all fruit and vegetable observations for the control subjects were extracted from DINER and converted into intake frequencies (portions day^{-1}) of fruits and vegetables for comparison with the FACET data.

Data management

A high proportion (85%) of the subjects who had returned a baseline questionnaire also returned one at follow-up. Some of the questionnaires, however, were returned incomplete. Omitted questions on the FACET questionnaire were considered to represent zero intakes. This did not significantly alter the proportion of subjects ranked as having 1, 2, 3, 4 or 5+ portions fruit and vegetables per day. Data on subjects with intakes above the 99th percentile (13 portions day^{-1}) of the distribution were excluded ($n = 14$) from the assessment of change in intakes from baseline. In total, data from 268 controls and 798 intervention group subjects were included in the estimates of dietary change.

Daily intake frequencies were calculated from the FACET as number of portions per day for total fruit and vegetable intakes and for total fruit intakes and total vegetable intakes separately. For the assessment of daily fruit and vegetable intakes, data on fruit juice intake were recoded so that only one portion could contribute to total daily intakes, in accordance with World Health Organization recommendations. For the comparison of FACET with food diary data, however, all fruit juice consumption was included.

Statistical analysis

Within groups, pre- and post-intervention intakes were compared using Wilcoxon's test. Between-group differences were compared by the Mann–Whitney or independent *t*-test, as appropriate. Associations between categorical variables were assessed using the chi-square

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test. Changes in fruit and vegetable intakes were calculated as post-intervention intake frequency minus pre-intervention frequency. Regression analysis was used to investigate the relationships between demographic factors, intervention grouping, fruit and vegetable intakes and changes in fruit and vegetable intake. The relationship between the FACET and food diary intake estimates was investigated using iteratively reweighted least squares. Iteratively weighted regression was performed until convergence to take care of heteroscedasticity within the dependent variable. A prediction interval for the regression equation was calculated using a non-parametric bootstrap method (2000 repeats)[8]. Data are presented as mean (standard deviation, SD) and median (interquartile range, IQR). Unless specified otherwise, dietary data presented are unadjusted FACET estimates. Analyses were performed using STATA version 7.0 (STATA Corporation) and Minitab version 13.0 (Minitab Inc.) (weighted regression analysis and bootstrapping).

Results

Comparison of dietary survey methods

Quantitative comparisons – control group only

FACET estimates were generally greater than the food diary estimates (mean (SD) portions day^{-1}: FACET, 5.6 (2.29); food diary, 4.3 (2.0)). This difference between methods was not related to individual characteristics such as sex or age. Figure 1 shows that FACET estimates of total fruit and vegetable intakes were positively correlated with food diary estimates ($r = 0.46$, $P < 0.001$, $n = 269$). The figure also shows the extent to which the two dietary assessment methods agreed in terms of classification of subjects on the basis of 5-a-day consumption. The FACET classification of subjects as consumers of <5 portions day^{-1} and consumers of ≥ 5 portions day^{-1} agreed with the food diary classification into these same groupings for only 56% subjects. The proportion of subjects with food diary estimates <5-a-day who were correctly classified by FACET (sensitivity) was 40% and the agreement between methods for subjects who reported intakes of ≥ 5-a-day by food diary (specificity) was 88%.

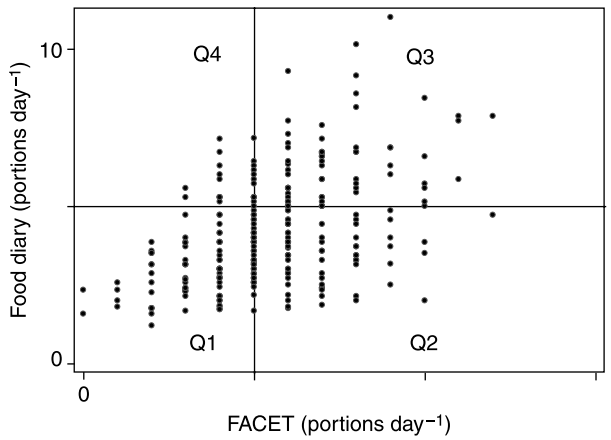

Fig. 1 Comparison of total fruit and vegetable intakes estimated by FACET (Five-a-day Community Evaluation Tool) and food diary. Scatter plot shows the association between FACET estimates of intake and those derived from the reference food diary method. Lines at 5 portions of fruit and vegetables per day on each axis divide the data into quadrants which illustrate agreement between the two methods for categorising intakes into <5 or ≥ 5 portions day^{-1}. Quadrants 1 and 3 show agreement between the two methods (<5-a-day). The proportions of total subjects represented in each quadrant are as follows: agreement – quadrant 1, 26% and quadrant 3, 30% (= 56%); disagreement – quadrant 2, 39% and quadrant 4, 4% (= 44%). Figure excludes three subjects with intakes above 15 portions day^{-1}

The absolute difference between FACET and food diary estimates increased with increasing frequency of intake. The following regression equation derived using the iteratively reweighted regression analysis explained 28% of the variation in food diary estimates:

$$\text{Food diary} = 1.91 + 0.421 \times \text{Total fruit and vegetable intake from FACET}$$

(prediction interval for fitted food diary estimate based on an estimated intake from FACET of 4 portions day^{-1}, 95% confidence interval 2.47 to 6.05).

The fitted values derived using the prediction equation closely agreed with the measured values up to 9 portions day^{-1} as measured by the FACET (Table 1).

Qualitative comparisons – all subjects

When subjects were grouped according to self-reported perceived fruit and vegetable intakes (very low, quite low, moderate, quite high, very high) the median unadjusted FACET intake estimates increased incrementally from the very low through to the very high group, suggesting that the FACET is able to rank fruit and vegetable intakes.

Table 1 Comparison of adjusted FACET estimates and reference food diary estimates

FACET (portions day^{-1})	Food diary (portions day^{-1})	Adjusted* FACET (portions day^{-1})
0	1.95	1.91
1	2.18	2.34
2	2.60	2.76
3	3.20	3.18
4	3.63	3.60
5	4.05	4.02
6	4.56	4.44
7	5.01	4.86
8	5.20	5.28
9	5.44	5.70

FACET – Five-a-day Community Evaluation Tool.
*FACET fruit and vegetable intakes adjusted using equation: adjusted intake = 1.91 + 0.421(FACET). Regression analysis based on $n = 268$ subjects.

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Baseline characteristics

Age, gender, smoking habit

More women than men participated in the study; however, there were similar proportions of males and females in the intervention and control groups. Control group subjects were older on average than intervention group subjects and smoked less (males 69 vs. 49 years, females 67 vs. 50 years, respectively; current smokers, 6 vs. 28%, respectively; all comparisons $P < 0.001$). Within the intervention group equal proportions of men (28%) and women (27%) were current smokers.

Ethnicity

Information on ethnicity was provided by 782 of the subjects who completed both baseline and follow-up questionnaires. Of these, over 95% were Caucasians. The other 4% were black Caribbean; non-Caribbean, non-African blacks; Indian; Pakistani; Bangladeshi; Chinese; mixed ethnic group; or 'other'.

Income

Data on household income were provided by 648 intervention group subjects. Twenty-six per cent of households were classified as having income below the low income threshold[9].

Factors affecting baseline fruit and vegetable intakes – estimated using FACET

Gender

Total fruit and vegetable intakes were significantly higher (1 portion day^{-1}, $P < 0.001$) in women compared with men. Both total fruit and total vegetable intakes were higher in women than men in the intervention group ($P < 0.001$ for both). In the control group fruit intakes were higher in women than men ($P < 0.001$), but vegetable intakes did not differ between sexes. Table 2 shows the distribution of fruit and vegetable intakes by gender.

Age

Age was positively correlated with total fruit and vegetable intakes in the intervention group ($n = 796$, $r_S = 0.21$, $P < 0.001$), but not in the control group.

Smoking habit

Never-smokers and ex-smokers had similar fruit and vegetable intakes, therefore these groups were combined and the intakes of current smokers versus all non-smokers were compared using regression analysis. Non-smokers ate 0.6 more portions of fruits and vegetables per day than current smokers ($P < 0.002$). Fruit and vegetable intakes of current smokers were similar in the intervention and control groups (note that the number of smokers in the control group was small). Fruit and vegetable intakes in each smoking category are illustrated in Table 3.

Intervention grouping

Control group subjects had significantly greater fruit and vegetable intakes compared with intervention subjects (median (IQR) portions day^{-1}: controls, 5.5 (4, 7); intervention, 4 (3, 6); $P < 0.0001$). This may be partly explained by the greater proportion of non-smokers in the control group and the higher mean age.

Ethnicity

Average intakes of fruit and vegetables in non-Caucasians tended to be higher than in Caucasians, but not significantly so (median (IQR) portions day^{-1}: Caucasians ($n = 748$), 4 (3, 6); non-Caucasians ($n = 34$), 5 (2, 7)). Further analysis of the influence of ethnicity on intakes was not performed due to the low number of non-Caucasian respondents.

Income

Low income (assessed in the intervention group only) was not significantly associated with fruit and vegetable intakes.

Effect of intervention on 5-a-day beliefs and access

General awareness of local efforts to encourage people to eat more fruit and vegetables was similar in the intervention and control group (21%). The proportion of subjects who agreed strongly (indicated by selecting 5 on a 5-point Likert scale) that fruits and vegetables are protective against (a) coronary heart disease, (b) cancer, (c) digestive problems and (d) overweight increased in the intervention group. However, there was no significant

Table 2 Baseline fruit and vegetable intakes (estimated using FACET) in intervention and control groups subdivided by gender

	Intervention				Control			
	Men ($n = 347$)		Women ($n = 451$)		Men ($n = 115$)		Women ($n = 153$)	
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Total fruit and vegetables*	4.2 ± 2.4	4 (2, 5)	5.2 ± 2.7	5 (3, 7)†	5.0 ± 2.1	5 (4, 6)	6.0 ± 2.0	6 (5, 7)†
Total fruit*	2.0 ± 1.6	2 (1, 3)	2.5 ± 1.8	2 (1, 4)†	2.4 ± 1.5	2 (1, 3)	3.2 ± 1.5	3 (2, 4)†
Total vegetables*	2.2 ± 1.5	2 (1, 3)	2.6 ± 1.5	3 (2, 3)†	2.6 ± 1.3	2 (2, 3)	2.8 ± 1.2	3 (2, 4)

FACET – Five-a-day Community Evaluation Tool; SD – standard deviation; IQR – interquartile range.
Figures for each sex are unadjusted FACET intakes.
* Significant difference between group intakes (both sexes together), $P < 0.01$, by Mann–Whitney test.
† Within-group significant difference between sexes, $P < 0.001$, by Mann–Whitney test.

https://doi.org/10.1017/S1368980007382517 Published online by Cambridge University Press

Table 3 Fruit and vegetable intakes stratified by smoking habit and intervention group

	Smokers			Non-smokers		
	n	FACET*	Adjusted†	*n*	FACET*	Adjusted†
Control group						
Baseline	16	4.3 (1.9)	3.7 (0.8)	246	5.6 (2.1)§	4.3 (0.9)§
Follow-up	16	4.4 (1.8)	3.8 (0.8)	246	5.2 (2.1)‡	4.1 (0.9)‡
Change	16	0.1 (1.4)	0.1 (0.6)	246	−0.5 (2.2)	−0.2 (0.9)
Intervention group						
Baseline	213	4.3 (2.6)	3.7 (1.1)	564	4.9 (2.6)§	4.0 (1.1)§
Follow-up	213	3.8 (2.4)‡	3.5 (1.0)‡	564	4.9 (2.5)§	4.0 (1.1)§
Change	213	−0.6 (2.7)	−0.2 (1.1)	564	0.03 (2.5)¶	0.0 (1.1)¶

FACET – Five-a-day Community Evaluation Tool; SD – standard deviation.
* Figures are mean (SD) unadjusted FACET intakes (portions day^{-1}).
† Figures are mean (SD) FACET intakes (portions day^{-1}) adjusted using the regression equation: total fruit and vegetable intake = 1.91 + 0.421 (FACET).
‡ Significantly different from baseline, $P < 0.01$, by Wilcoxon test.
§ Significantly different from smokers, $P < 0.02$, by Mann–Whitney test.
¶ Significantly different from smokers, $P < 0.01$, by unpaired *t*-test.

difference in the proportions of intervention and control group subjects who increased, decreased or maintained their baseline agreement level for each condition (all $P > 0.05$ by chi-square test).

A greater proportion of intervention group respondents than controls demonstrated improved knowledge of the 5-a-day optimum (intervention 17%, control 8%, $P = 0.01$). Additionally, the proportion of subjects in the intervention group who reported increased access to fruit and vegetables over the last year (35%) was significantly greater than in the control group (21%; $P < 0.001$).

Effect of intervention on fruit and vegetable intakes

Total fruit and vegetable intakes decreased significantly over one year in the control group (−0.4 portions day^{-1}, $P < 0.01$), but there was no significant change in total fruit and vegetable intakes in the intervention group (Table 4). Fruit intakes did not significantly change in either group, but there was a small reduction in vegetable intakes in both groups that was statistically significant (control $P < 0.01$, intervention $P < 0.05$).

Gender, age, reported awareness of 5-a-day strategies and income (income reported in pilot groups only) did not significantly influence change in total fruit and vegetable intakes. Non-significant trends towards lower total fruit and vegetable intakes at follow-up were observed in intervention group subjects who did not report increased access to fruit and vegetables and in those who were unaware of the 5-a-day optimum fruit and vegetable intake (Table 5).

Effect of smoking habit on change in fruit and vegetable intakes

Of the demographic and lifestyle variables tested, only smoking habit had any significant effect on change in fruit and vegetable intakes. This was of particular interest due to the observed lower fruit and vegetable intakes in current smokers at baseline and the greater proportion of current smokers in the intervention group compared with controls. Table 3 presents the total fruit and vegetable intakes of smokers and non-smokers stratified by intervention grouping. These data show that current smokers in the intervention group reported lower fruit and vegetable intakes post-intervention compared with baseline (−0.6 portions day^{-1}, $P < 0.01$) while non-smokers maintained baseline intakes. The number of smokers in the control group was inadequate for statistical analysis ($n = 16$). In the much larger group of non-smokers in the control group ($n = 246$) estimated intakes of fruit and vegetables were significantly lower at follow-up compared with baseline (−0.5 portions day^{-1}). When FACET data were adjusted using the regression equation derived from the comparison with the food diary data described above, the estimated fruit and vegetable intake levels were lower (as expected), but the significant differences between smokers and non-smokers and the changes from baseline persisted (Table 3).

Conclusions

In this study we have observed that a multidisciplinary approach to increasing fruit and vegetable intakes involving retailers, educators, primary care teams,

Table 4 Change in fruit and vegetable intakes in intervention group and controls

		Control		Intervention	
		Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Total fruit and vegetables	Baseline	5.6 (2.1)	5.5 (4, 7)	4.8 (2.6)	4.0 (3, 6)
	Follow-up	5.1 (2.1)	5.0 (4, 6)*	4.6 (2.5)	4.0 (3, 6)
	Change	−0.4 (2.1)	0.0 (−2, 1)	−0.1 (2.6)	0.0 (−2, 1)
Total fruit	Baseline	2.8 (1.5)	3.0 (2, 4)	2.3 (1.7)	2.0 (1, 3)
	Follow-up	2.7 (1.4)	3.0 (2, 4)	2.3 (1.6)	2.0 (1, 3)
	Change	−0.1 (1.4)	0.0 (−1, 1)	−0.0 (1.6)	0.0 (−1, 1)
Total vegetables	Baseline	2.7 (1.2)	3.0 (2, 3)	2.5 (1.5)	2.0 (1, 3)
	Follow-up	2.4 (1.3)	2.0 (2, 3)*	2.3 (1.5)	2.0 (1, 3)†
	Change	−0.3 (1.4)	0.0 (−1, 1)	−0.1 (1.8)	0.0 (−1, 1)

SD – standard deviation; IQR – interquartile range.
* Significantly different from baseline, $P < 0.01$, by Wilcoxon test.
† Significantly different from baseline, $P < 0.05$, by Wilcoxon test.

https://doi.org/10.1017/S1368980007382517 Published online by Cambridge University Press

Table 5 Effect of response to awareness and access questions on estimated total fruit and vegetable intakes

Question	Response		Control		Intervention	
			Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Access increased	Yes	Baseline	5.6 (2.0)	5 (4, 7)	4.9 (2.7)	5 (3, 7)
		Follow-up	5.2 (2.1)	5 (4, 6)	5.0 (2.5)	5 (3, 7)
		Change	−0.4 (2.0)	0 (−2, 1)	0.1 (2.6)	0 (−2, 2)
		n	52		246	
	No	Baseline	5.5 (2.1)	6 (4, 7)	4.7 (2.6)	4 (3, 6)
		Follow-up	5.0 (2.1)	5 (4, 6)*	4.4 (2.5)	4 (3, 6)*‡
		Change	−0.5 (2.2)	0 (−2, 2)	−0.3 (2.5)	0 (−2, 1)
		n	194		457	
Aware 5-a-day optimum	Yes	Baseline	5.9 (2.0)	6 (5, 7)	5.1 (2.5)	5 (3, 7)
		Follow-up	5.6 (2.0)	5 (4, 7)	5.1 (2.4)	5 (3, 7)
		Change	−0.3 (2.0)	0 (−1, 1)	−0.0 (2.4)	0 (−2, 2)
		n	164		390	
	No	Baseline	5.2 (2.1)	5 (4, 6.5)†	4.4 (2.7)	4 (2.5, 6)‡
		Follow-up	4.4 (2.2)	4 (3, 6)*‡	4.1 (2.5)	4 (2, 6)*‡
		Change	−0.8 (2.3)	0 (−2, 1)	−0.3 (2.7)	0 (−2, 1)
		n	93		389	

SD – standard deviation; IQR – interquartile range.
* Significantly different from baseline within same intervention group and response group, $P \leq 0.02$, by Wilcoxon test.
† Significantly different from alternative response within same intervention group and time point, $P \leq 0.05$, by Mann Whitney test.
‡ Significantly different from alternative response within same intervention group and time point, $P \leq 0.001$, by Mann Whitney test.

employers and the media, which was co-ordinated at a local level, significantly influenced beliefs about and access to fruit and vegetables in economically deprived areas within the UK. A trend towards greater fruit and vegetable intakes in individuals who demonstrated awareness of the initiatives, whether in terms of beliefs or access to fruit and vegetables, suggests that the programme is raising sensitivity to the 5-a-day message. However, a measurable effect on fruit and vegetable intakes may require a longer intervention period or alternative interventions targeted at specific groups, e.g. smokers. Questions which more deeply probe issues of accessibility and awareness of 5-a-day would likely benefit the understanding of the transition from knowledge to behaviour. The data reported herein are of use in providing guidance on the refinement of intervention strategies and their evaluation. An overview of the 5-a-day programme has been published and further details of the community interventions are available on the 5 A DAY website (http://www.doh.gov.uk/fiveaday)[10].

Comparison of dietary assessment methods

This study has piloted the use of a short FFQ for assessing fruit and vegetable intakes which can easily be used by non-nutritionists working in the field of primary health care. Intakes assessed using FACET were positively correlated with estimates derived from the more detailed food diary method. FACET intake estimates also quantitatively reflected subjects' perceived intakes and were sensitive to known differences in fruit and vegetable intakes between sexes and according to smoking habit[11]. Comparative data were available for the control group only at a single time point; therefore the repeatability of the FACET has not been addressed in this study. Validity, as determined by correct classification of subjects according to whether they attained the 5-a-day guideline or not, was not high with 56% agreement between the FACET and food diary estimates. Specificity of FACET was high (88%) and therefore only a small proportion of individuals who are achieving the 5-a-day target would be misclassified. Sensitivity, however, was low (40%), indicating that FACET could misclassify as achieving 5-a-day a large proportion of subjects whose true intake was low. This may partly be explained by the overestimation of fruit and vegetable intakes by FACET observed in this study.

The accurate classification of 56% subjects into the <5-a-day and ≥ 5-a-day intake groups by FACET contrasts with the original validation of the FFQ part of FACET in a group of Scottish adults by Cox *et al.*[6]. These authors reported that the short FFQ agreed with weighed dietary record (WDR) estimates of intakes above/below 400 g day^{-1} (5-a-day) in 79% of subjects and concluded that no subjects with WDR intakes less than 400 g day^{-1} were classified as having intakes >5-a-day by the FFQ. Differences in sample size (Cox *et al.*: $n = 42$), sample characteristics (Cox *et al.*: mean age 36.5 years, 73% women) and timing of the dietary assessments may partly explain these contrasting results. In addition, there were differences in the methodology: Cox *et al.* compared weights of fruit and vegetables consumed (by multiplying FFQ frequencies by the 80 g estimated average portion size for fruits and vegetables[12]) whereas the current study compared frequency of fruit and vegetable intakes as estimated by the food diary and FACET methods.

While the FACET is capable of ranking intakes, the overestimation of absolute fruit and vegetable intakes and the consequent low sensitivity of the method are of concern. A regression equation was developed to adjust the FACET data so that the fruit and vegetable intakes derived from FACET can better identify those subjects

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whose true intakes are below 5-a-day. The weighted regression analysis of the relationship between food diary intake estimates and FACET intake estimates produced a model with good fit, enabling the prediction of food diary intakes from FACET within the range 0–9 portions day^{-1} FACET. This adjustment improves the overall agreement between FACET and food diary estimates (67%), particularly the classification of subjects as <5-a-day consumers by FACET (sensitivity 87%), but there is some loss of specificity in the ≥ 5-a-day consumers (29%). Further validation of FACET for assessing compliance with the 5-a-day guideline would be required if the FACET is to be used as an evaluation tool in public health interventions because of the likely greater variability of post-intervention intake data. In the meantime FACET can be used for grading intakes in such studies.

For the estimation of change in intakes it was assumed that measurement error at baseline and follow-up would be constant both within and between groups. FACET estimates of change in fruit and vegetable intakes in the control group reflected trends observed in the National Food Survey. However, further work is required to investigate the ability of FACET to estimate change in fruit and vegetable intakes.

Evaluation of interventions

Fruit and vegetable intakes did not change in the intervention group over the course of the study, but fruit and vegetable intakes in the control group declined by approximately half a portion per day. Comparison of between-group changes was complicated by the between-group differences observed at baseline. Intervention group subjects had significantly lower fruit and vegetable intakes at baseline than control group subjects. This may be partly explained by the significantly greater proportion of current smokers in the intervention group (30%) compared with the control group (6%) because current smokers were observed to have lower fruit and vegetable intakes than non- or ex-smokers at baseline. Individual characteristics such as age and sex, although associated with intakes at baseline, did not significantly influence change.

At follow-up the estimated difference in intakes between smokers and non-smokers had increased in the intervention group due to a reduction in estimated intakes in current smokers. In the control group the difference between smokers and non-smokers became smaller because of a reduction in intakes in non-smokers, but there were too few current smokers in the control group to assess this trend accurately. In this study smoking habit influenced baseline fruit and vegetable intakes and also the change in fruit and vegetable intakes over the 12 months of the study, overshadowing any benefits of the community intervention programme. This suggests that future 5-a-day programmes require different intervention strategies for smokers and non-smokers and need to reinforce/be reinforced by existing smoking cessation campaigns.

The aims of this study were twofold: (1) to assess the ability of the FACET to estimate fruit and vegetable intakes and (2) to evaluate the community fruit and vegetable interventions in terms of improving awareness of the importance of fruit and vegetables in the diet and improving access to these foods. This study used a convenience cohort as a control group. The value of the control group was in facilitating evaluation of the FACET questionnaire and indicating secular awareness and knowledge of the 5-a-day message/programme, but it was of limited value in assessing the effectiveness of the community intervention programmes for increasing fruit and vegetable intakes. Control group subjects were not matched to the intervention group on certain key factors such as smoking habit, age and residential area that are known to influence dietary behaviour. Future evaluations of community interventions would benefit from using and resourcing an appropriately matched control group.

The 5-a-day community-based activities employed by the intervention centres produced increases in reported awareness of 5-a-day and access to fruits and vegetables. Observed trends towards greater fruit and vegetable intakes associated with awareness of the 5-a-day optimum and improved access to fruit and vegetables reinforce the need to address both knowledge and structural factors to create an environment which encourages and supports healthy eating and healthy lifestyles.

Acknowledgements

Sources of funding: This project was funded by the United Kingdom Department of Health.

Conflict of interest declaration: The authors declare no competing interests.

Authorship responsibilities: S.A.B. and A.A.W. conceived and designed the project, P.A.W. analysed the data with statistical input from S.G., P.A.W. and S.G. interpreted the data, P.A.W. drafted the article and P.A.W., S.A.B., A.A.W. and S.G. reviewed it critically for important intellectual content. All authors approved the final version to be published.

Acknowledgements: We acknowledge Joanna Camus and Robert Luben for their help with extracting the data on the EPIC–Norfolk controls and Judi Scheffer for statistical help with the iteratively reweighted regression and non-parametric bootstrap.

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https://doi.org/10.1017/S1368980007382517 Published online by Cambridge University Press

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https://doi.org/10.1017/S1368980007382517 Published online by Cambridge University Press

Appendix A – Food-frequency questionnaire section of FACET (Five-a-day Community Evaluation Tool)

FACET Questionnaire.doc

PART 1

For each question, please indicate the answer (or answers) by crossing the relevant box(es)

Try to make sure the crosses are clearly in the box they refer to, like this ☒, not like this ☐

Please use black or blue biro

If you make a mistake, just blank out the mistake like this ■ and carry on

Q.1 Please write in today's date.

Day	Month	Year
		2003

Q.2 Have you eaten any of the following foods in the last 24 hours ?

PLEASE "X" THE NUMBER OF PORTIONS OF FOODS EATEN FOR EVERY ROW

FOR EXAMPLE:

	0	1	2	3	4+	
Fruit as a dessert	☐	☒	☐	☐	☐	

NUMBER OF PORTIONS

	0	1	2	3	4+	
Breakfast cereal	☐	☐	☐	☐	☐	
Fruit for breakfast, e.g. on cereal	☐	☐	☐	☐	☐	✓
Crisps	☐	☐	☐	☐	☐	
Fruit as a between meal snack	☐	☐	☐	☐	☐	✓
A glass of pure, unsweetened fruit juice (not squashes or fruit drink)	☐	☐	☐	☐	☐	✓
Fruit as a starter to a meal	☐	☐	☐	☐	☐	✓
A baked potato	☐	☐	☐	☐	☐	
A bowlful of home-made style vegetable soup	☐	☐	☐	☐	☐	✓
Portions of vegetables with main meals (include baked beans and pulses as vegetables but not potatoes)	☐	☐	☐	☐	☐	✓
Any type of meat	☐	☐	☐	☐	☐	
A vegetable based meal	☐	☐	☐	☐	☐	✓
Any type of fish	☐	☐	☐	☐	☐	
A bowlful of salad	☐	☐	☐	☐	☐	✓
Fruit as a dessert	☐	☐	☐	☐	☐	✓

✓indicates questions used to determine fruit and vegetable intakes. Frequency of intakes for each of the nine questions were summed, 4 + portions were counted as 4 portions.

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Appendix B – Selected questions from Part 2 of FACET (Five-a-day Community Evaluation Tool) used in the present report

Please tick or circle ONE statement that you agree with for the following questions:

By eating more fruit and vegetables, I think that people can reduce their chances of getting:

	Strongly agree				Strongly disagree
a) Heart disease	1	2	3	4	5
b) Cancer	1	2	3	4	5
c) Digestive problems	1	2	3	4	5
d) Overweight	1	2	3	4	5

How many portions of fruit and vegetables are recommended by health experts to be eaten every day?

(please circle) 0 1 2 3 4 5 6

Are you aware of any efforts in your local area over the last year to encourage people to eat more fruit and vegetables?

Yes _____ No _____ Don't know _____

Has your access to fruit and vegetables increased over the last year?

Yes _____ No _____ Don't know _____

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