

Fruit and vegetables should be targeted separately in health promotion programmes: differences in consumption levels, barriers, knowledge and stages of readiness for change

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Abstract

Objective: The aim of the present study was to investigate whether fruit and vegetables should be treated as separate groups in health promotion programmes by examining consumption levels, barriers, knowledge and the association between stage of change and potential predictors of fruit and vegetable intake.

Design: Computer-assisted telephone interview survey of the target population.

Setting: Hunter and New England regions of New South Wales, Australia.

Subjects: A total of 1403 parents and carers of primary-school-aged children.

Results: Consumption levels and knowledge of recommended intakes and serving size were greater for fruit than for vegetables. There were some differences in the main barriers to the consumption of fruit compared with those cited for vegetables. There was little congruence between the stages of change for fruit consumption and those for vegetable consumption. For fruit, knowledge of serving size and recommended intake, perceptions of adequate consumption, changes made to family intake and educational attainment were all correlated with stage of change categorisation. For vegetables, knowledge of recommended intake, perceptions of adequate consumption and changes made to family intake were correlated with stage of change categorisation.

Conclusions: Significant differences in consumption levels, barriers, knowledge and stages of readiness for change can be shown when fruit and vegetables are treated as separate groups. Health promotion planners may need to consider interventions that focus on improving vegetable consumption in preference to fruit consumption. Messages about the recommended number of servings and serving size must be simplified and this may be achieved by targeting messages towards vegetable consumption.

Keywords
Fruit
Vegetables
Stage of change
Barriers

An adequate fruit and vegetable intake is protective against a number of chronic diseases including some cancers and CHD^(1,2). In the USA, the Fruits & Veggies – More Matters™ Program⁽³⁾, the public health initiative of the National Fruit and Vegetable Program, recommends a range of servings of fruit and vegetables based on age, sex and level of physical activity. In Britain, the national recommendation is five servings of fruit and vegetables per day⁽⁴⁾. The current Australian recommendation advises a daily intake of two servings of fruit and five servings of vegetables for adults⁽⁵⁾. The recommended intake for fruit and vegetables for children varies according to the child's age as shown in Table 1⁽⁶⁾.

There is a body of evidence confirming that there are significant differences in levels of consumption, demographic and psychosocial predictors such as knowledge, beliefs, motives, barriers, attitudes and stages of dietary

change for fruit and vegetables^(7–11). Yet in Australia, current programmes aimed at increasing the consumption of fruit and vegetables such as the national Go for 2&5® Campaign⁽⁵⁾ focus on fruit and vegetables as a single food group rather than individually.

Food consumption surveys in Australia suggest that fruit and vegetable consumption is inadequate^(12,13) with approximately 50% of the adult population meeting the fruit recommendation and only 10% meeting the vegetable guidelines^(12,13).

One of the strongest predictors of fruit and vegetable intake is knowledge⁽¹⁴⁾. Australian studies show that correct knowledge of the recommended number of servings is higher for fruit than for vegetables^(12,13). Consumers are confused about and have limited understanding of serving sizes^(15,16). Although there are few studies on consumer

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Table 1 Percentage of respondents who are able to correctly identify the recommended number of servings for fruit and vegetable for their children and their age

Child's age group (years)	Recommended number of fruit servings	Fruit (% correct)	Recommended number of vegetable servings	Vegetables (% correct)
4–7	1–2	34	2–4	42
8–11	1–2	25	3–5	37
12–18	3–4	18	4–9	20
All ages		29		39

perceptions of serving size of fruit and vegetables, one study showed a significant difference in the proportion of respondents able to correctly identify fruit and vegetable serving sizes (42% could correctly identify the serving size for fruit compared to 14% for vegetable serving size)⁽¹⁷⁾.

Barriers to fruit and vegetable consumption reported in the literature include perceptions of cost, adequacy of intake, lack of availability, poor quality, taste preferences and lack of skills and time to plan and prepare fruit and vegetables^(10,11,18). Some researchers have suggested that there are differences in some of the environmental barriers to fruit and vegetable intake and that these should be further investigated separately^(18,19). The perception of adequacy of intake, the time and the effort needed for vegetable preparation were identified as the three main barriers in a recent Australian study⁽¹⁸⁾.

Best practice in health promotion programming requires the selection of programme components based on an appropriate model or theoretical framework⁽²⁰⁾. At the heart of health promotion research and practice lies a set of models and theories that have proven efficacious in thinking about and developing strategies for addressing health issues. Theories and models increase our understanding of behaviour, anchor and give substance to our actions, and help frame important issues and minimise redundancies^(21,22). Theory is powerful because it organises what professionals pay attention to and how they pay attention. It shapes beliefs that in turn shape action⁽²³⁾.

The transtheoretical model of behaviour change or 'stages of change' model has been used to inform the planning of many health-related interventions^(24–38). The model suggests that individuals can be categorised into different stages of readiness to change health behaviours including pre-contemplation, contemplation, preparation, action and maintenance. The aim of the interventions planned using this model is to help participants progress from their initial stage to action and maintenance. The stages of change model^(39,40) has been applied to smoking, drug and alcohol addiction programmes^(33,34), physical activity⁽²⁴⁾ and to more complex behaviours such as diet, and in particular, fruit and vegetable consumption^(7,25–32,35–38).

There has been some criticism of the stages of change model. These include its applicability to complex behaviours such as diet⁽⁴¹⁾, methods used to allocate subjects to stage^(42–44) and the stability of the stages of change⁽⁴⁵⁾. Some researchers have concluded that there is little evidence

for stage of change as a predictor of fruit and vegetable intake^(7,9–11,45,46). However, a comprehensive review of the evidence concluded that there was 'sufficient' but not 'strong' evidence that the stage of change is a predictor of adult collective fruit and vegetable intake⁽¹⁴⁾.

The present study presents a case for the need to consider fruit and vegetables separately in interventions and focus more heavily on vegetable consumption. We present the results of the relationship of the stage of change of its respondents with potential predictors of fruit and vegetable intake and assesses the congruence between stage of change for fruit and for vegetables. In the context of the present study, the model's stages of change construct provides a means of assessing an individual's readiness to make changes to their fruit and vegetable consumption. Many researchers have assigned stage of change collectively for fruit and vegetables^(11,25,47,48). It is much less common to look at fruit and vegetable stage of change separately^(7,8,49,50).

Experimental methods

Background

The data presented here are based on the results of a telephone survey of parents and carers of primary-school-aged children in the Hunter and New England regions of New South Wales (NSW) conducted for Cancer Council NSW (CCNSW). The results informed the planning and evaluation of the *Eat It To Beat It* Program, a fruit and vegetable intervention pilot programme currently being conducted by CCNSW in the Hunter region of NSW, Australia. The research provided baseline information on intake, knowledge, attitudes and barriers and examined the stage of change of the parents and carers in relation to consumption of fruit and vegetables.

Procedures

A market research company administered a computer-assisted telephone interview (CATI) survey questionnaire developed by CCNSW between 17 January and 27 February 2008. The survey area included the Hunter and New England areas of NSW. Ethics approval for the study was granted by the CCNSW's ethics committee in November 2007.

Household telephone numbers were generated using the random digit dialling methodology. A maximum of

five calls back were made at different times and on different days to secure an interview with the required person. Approximately 7% of interviews were monitored and evaluated using a standard evaluation form. Approximately 5% of interviews were validated by calls back to the household.

Participants

Eligible participants included the parents or carers of primary-school-aged child(ren) who had primary responsibility for shopping and food preparation. If the household indicated that these responsibilities were equally shared among parents or carers, then the household was asked to nominate one of the parents or carers to complete the interview.

Measures

The fifty-two-item questionnaire included questions on knowledge of Australian fruit and vegetable recommended intakes and serving sizes for both adults and children of different age groups, perceived adequacy of intake, barriers to fruit and vegetable intake and demographic information.

Barriers to fruit and vegetable intake were measured by asking respondents what prevents them from eating more fruit (or vegetables). This question was unprompted (open-ended) and responses were later categorised into themes.

A stage of change algorithm described and used in a previous study⁽⁴⁹⁾ was used to assess stage of change. The five stages were then collapsed to make three stages for data analysis. Based on a previous study⁽²⁵⁾, the contemplation stage was combined with the preparation stage and the action stage with the maintenance stage.

Recommended intake knowledge was assessed by asking the respondents how many servings of fruit (or vegetables) they thought they should eat every day to maintain good health. The open-ended responses (the number of servings needed) were then categorised as either correct or incorrect.

Serving size knowledge was assessed by asking the respondents what they thought one serving of fruit (or vegetables) was equal to. Response choices were different cup measures ($\frac{1}{2}$ cup, 1 cup, $1\frac{1}{2}$ cups or none of the above for fruit; and $\frac{1}{4}$ cup, $\frac{1}{2}$ cup, 1 cup or none of the above for cooked vegetables). The responses were then dichotomised as correct or incorrect.

Combined fruit and vegetable knowledge included both serving size and recommended intake knowledge. This was categorised as knowledge, some knowledge (if only one element was correct) and no knowledge (if both elements were incorrect).

Fruit and vegetable consumption was measured by two short questions asking the parents 'How many servings of fruit/vegetables do you usually eat each day?' As examples of serving sizes were provided immediately before

this question, consumption was based on the recommended serving size rather than the respondent's perception of serving size. These questions rely on self-report. Although they do not provide as accurate an estimate of absolute consumption as more detailed dietary assessment tools, they have been found to be able to discriminate between groups with significantly different intakes of fruit and vegetables, rank individuals reasonably well and are widely accepted for use in population-based surveys^(51–53).

Perception of fruit and vegetable intake was measured by asking the parent whether they thought the amount of fruit (or vegetables) they currently eat was 'too little', 'about right' or 'too much'. These categories were further collapsed into those who thought they ate 'too little' and those who thought they ate either 'enough or too much'.

Change to their family's fruit and vegetable intake was assessed by asking the respondent whether in the past 2 or 3 months, they had tried to increase or decrease the amount of fruit (or vegetables) their family eats. The options supplied were: no; yes, increased; or yes, decreased.

Age of respondents was initially collected in five discrete age-range categories and was then further categorised into younger (under 45 years) and older (45 years and above) for data analysis.

Education was categorised as those with low levels (graduated high school or below) and higher levels (those with a trade or certificate and those with university undergraduate or postgraduate qualifications).

Cancer knowledge was assessed by asking the respondents whether they agreed or disagreed with the statement 'Eating enough fruit and vegetables decreases your risk of certain cancers'. This was then categorised as either correct (agree) or incorrect (disagree or do not know).

Data analysis

Data were analysed using the Statistical Package for Social Sciences statistical software package version 14.0 for Windows (SPSS Inc., Chicago, IL, USA). Frequencies for stages of change and cross-tabulations of stages of change with categorical demographic and psychosocial predictors were computed. A Pearson's χ^2 test was applied to determine significant differences. Results were considered significant at the 0.05 level.

Results

The survey resulted in 1403 completed interviews (82% response rate). Average duration of the interview was 11 min. The majority of the respondents were women (86%) and most were aged between 25 and 44 years (84%). Most were either married or *de facto*, with 20% of respondents coming from single parent households. The majority of respondents (63%) held post-school education

including technical or trade certificates and undergraduate and postgraduate university qualifications.

Consumption of fruit and vegetables

In all, 57% reported consuming two or more servings of fruit each day (mean = 1.71; median = 2) and 31% of respondents reported consuming five or more servings of vegetables (mean = 3.31; median = 3).

Knowledge of recommended intakes of fruit and vegetables for adults

For fruit, 41% identified two servings of fruit per day as the amount required for good health (mean = 2.66; median = 3); 38% of respondents thought an adult should eat at least three servings of fruit per day.

For vegetables, 31% identified five servings per day as the amount required for good health (mean = 3.82; median = 4); 63% of respondents thought that an adult should eat less than five servings of vegetables.

Knowledge of recommended intakes of fruit and vegetables for children

The majority of respondents could not accurately identify the correct number of servings of fruit and vegetables required for good health for their child/children's age (Table 1).

Knowledge of serving size

For fruit, 54% of the respondents correctly identified 1 cup of diced fruit as an example of the serving size for fruit. Of those who incorrectly identified the serving size, 33% underestimated it by nominating $\frac{1}{2}$ cup of diced fruit as the serving size.

For vegetables, 34% correctly identified $\frac{1}{2}$ cup of cooked vegetables as an example of the serving size for vegetables; two-thirds of the respondents overestimated the serving size by nominating 1 cup of cooked vegetables as the serving size.

Barriers to fruit and vegetable intake

For those respondents who reported eating less than two servings of fruit per day or less than five servings of vegetables per day, the main barriers specified for not eating more are described in Table 2. Cost was the most common barrier identified for fruit consumption while 'lack of time' and 'food preferences' (preferring to eat one food over another) were the major barriers for vegetable consumption.

Stage of change

Table 3 presents the number of respondents categorised into the collapsed stages of change. More than half the respondents were categorised as being in the action/maintenance group for fruit consumption, while for vegetables around half were classified as being in pre-contemplation. For both fruit and vegetables, around a

Table 2 Barriers to fruit and vegetable intake

Fruit (n 628)		Vegetables (n 1143)	
Barrier	%	Barrier	%
Cost	30	Food preferences	20
Food preferences	20	Lack of time	20
Poor quality/general availability	13	Cost	14
Fruit goes off too quickly/wastage issues	10	Dislike the taste	13

Table 3 Percentage of population in each collapsed stage of change for fruit and vegetables

Stage of change	Percentage of population (n 1403)	
	Fruit	Vegetables
Pre-contemplation	16	49
Contemplation/preparation	29	32
Action/maintenance	55	18

third of the sample were categorised as being in contemplation/preparation.

Congruence between stages of change for fruit and vegetables

There was little congruence between stages of change for fruit consumption and those for vegetable consumption ($\chi^2 = 39.9$, $P < 0.0001$). Significantly more people who were pre-contemplators for vegetables were either contemplators (29.7%) or action/maintainers (47.9%) for fruit intake. Across all vegetable stages of change, the highest proportion of people were action/maintainers (53.5%) for fruit stage of change. Significantly more contemplators for vegetable stages of change were in the action stages of change for fruit (57.7%).

The association between stage of change and potential predictors of fruit and vegetable intake is detailed in Table 4. For fruit, knowledge of serving size and recommended intake, perceptions of adequate consumption, changes made to family intake and educational attainment were all correlated with stage of change categorisation. For vegetables, knowledge of recommended intake, perceptions of adequate consumption and changes made to family intake were correlated with stage of change categorisation.

Discussion

There are many differences between fruit and vegetables that influence people's decision to eat them including culinary uses, taste and cultural norms⁽¹⁰⁾. The health benefits provided by fruit and vegetables are different^(2,10) and the amount of preparation required for vegetables is usually greater than for fruit, which is often eaten raw as a snack.

In addition, as the present study shows, there are differences in consumption, knowledge, perceptions of

Table 4 Association between stage of change and potential predictors of fruit and vegetable intake

Variables	Serving size knowledge (% correct)	Recommended servings (for adults) knowledge (% correct)	Combined knowledge (% with knowledge of both)*	Perceptions of adequacy of intake (% who thought they ate about right or too much)	Change to family intake (% yes) increased	Age, younger (%)	Gender, female (%)	Education, medium–higher educational level (%)	Cancer knowledge (% correct)
Fruit									
Pre-contemplation/Contemplation/preparation	52.4 61.2	48.8 47.3	23.6 29.0	18.3 4.3	47.3 77.5	83.7 88.7	81.8 86.7	57.0 60.0	83.7 87.1
Action/maintainers P value	51.1 0.017	35.8 <0.001	17.8 <0.0001	65.4 <0.0001	55.1 <0.0001	83.1 0.092	88.0 0.124	66.2 0.050	86.7 0.458
Vegetables									
Pre-contemplation/Contemplation/preparation	31.5 34.8	17.4 32.9	7.0 15.0	85.1 39.1	38.5 77.7	83.0 86.2	84.7 88.1	62.4 63.7	86.3 87.8
Action/maintainers P value	39.3 0.148	61.8 <0.0001	28.3 <0.0001	91.6 <0.0001	38.9 <0.0001	86.9 0.310	88.0 0.298	62.6 0.925	85.8 0.770

*For combined fruit (or vegetable) knowledge, 'knowledge of both' is knowledge of both serving size and recommended servings.

adequacy of intake, barriers to consumption and readiness to make changes to fruit and vegetable consumption. This suggests the need to consider fruit and vegetables as separate groups when planning interventions aimed at increasing intake and to make the promotion of vegetable consumption the main focus of the programmes.

Fruit and vegetable consumption

As in previous research⁽¹³⁾, the present survey reported almost twice as many respondents who are achieving the recommended intake for fruit than for vegetables. There appears to be a need for greater emphasis on increasing vegetable consumption to close this gap.

Fruit and vegetable knowledge

There is evidence that fruit and vegetable knowledge is a strong predictor of fruit and vegetable intake⁽¹⁴⁾. While the health benefits of fruit and vegetables are widely recognised, knowledge about what constitutes a serving and how many servings are recommended is less well known^(17,54).

Recommended intakes

In the present study, knowledge of recommended intakes for adults (as measured by the number of servings that should be eaten for good health) differed for fruit and vegetables. While some 40% of respondents could correctly state the recommended intake for fruit, only 30% could do so for vegetables. However, an important difference is that the amount of fruit required per day was overestimated while the amount of vegetables was underestimated, contributing to low intakes of vegetables compared to fruit.

These results are consistent with the findings of some previous research^(13,54) but differ from a separate study conducted in Western Australia⁽¹⁸⁾, where the percentage of respondents who knew the recommended amount was greater for vegetables than for fruit (although there was still a tendency to overestimate fruit and underestimate vegetable requirements). This may be due to the fact that Western Australians have had more exposure over a longer period of time to the fruit and vegetable social marketing campaign (Go for 2&5[®] Campaign⁽⁵⁾) than consumers in NSW. However, it should be noted that the low survey response rates (32% in 2001 and 58% in 2004) reported in the Western Australian study may reduce the generalisability of the findings.

Another factor contributing to low knowledge scores is that the recommended intake of fruit and vegetables for children varies from that for adults and varies according to the child's age, resulting in no less than twelve different recommendations for children⁽⁶⁾. This makes it difficult for parents to know what the recommendations are for their child(ren) (Table 1). A simplified message emphasising the recommended number of servings and serving sizes of vegetables could help to improve consumer knowledge of recommended vegetable intake.

Serving size

More respondents could correctly state the serving size for fruit than for vegetables. The serving size for vegetables was largely overestimated by respondents. This could be because a serving of fruit is 1 cup and consumers assume that a serving of fruit is the equivalent volume as a serving of vegetables. This overestimation may lead to a perception that the recommended vegetable intake is unachievable, contributing to lower vegetable intake. Some researchers have reported confusion around the interpretation of serving size^(15,16,18), and further research is required to determine whether focusing resources on promoting serving size for vegetables alone may reduce this confusion.

Barriers to fruit and vegetable consumption

There is an established association between perceived barriers to fruit and vegetable consumption and actual consumption⁽¹⁴⁾. Theory-driven models that inform health promotion planning have highlighted the importance of identifying strategies to overcome the barriers to fruit and vegetable consumption. Van Duyn⁽¹¹⁾ uses a conceptual model based on a number of theoretical frameworks to discuss the implications of his findings on the selection of strategies by health promotion practitioners.

In the present study, perceptions of cost, quality, availability and wastage issues were the main barriers to the consumption of fruit. In contrast, for vegetables, perceptions of adequacy of intake, lack of time to prepare vegetables, food preferences and the taste of vegetables were the main barriers cited. While cost was also cited as a barrier for vegetables, twice as many respondents cited cost of fruit than of vegetables. These results are very similar to a recent study by Pollard *et al.*⁽¹⁸⁾

These differences in the barriers to consumption of fruit and vegetables demand widely differing interventions to address them. The perception that cost is a barrier requires education to provide people with the skills to compare prices of alternate foods with fruit and vegetables together with the development of food budgeting skills. Disliking the taste of vegetables and lack of time to prepare them requires education to develop the skills to be able to produce quick, tasty meals containing vegetables that families, and in particular children, will eat. Improving the quality and availability of fruit will require a concerted effort by the health and agricultural sectors, retailers, wholesalers and the broader supply chain.

By regarding fruit and vegetables as separate food groups when planning interventions, resources could be directed to areas in which the greatest gains are to be made.

Stage of change

As there is some evidence that stage of change is a predictor of fruit and vegetable intake⁽¹⁴⁾ and that intervention strategies can be more successful when targeted to a particular stage of change^(25–32,35,37,38,52), there are

a number of key learnings from the present study that lend weight to the argument for focusing predominantly on vegetable consumption.

One of the strongest predictors of fruit and vegetable intake is knowledge⁽¹⁴⁾ and Van Duyn⁽¹¹⁾ has shown that the greater the knowledge of recommended daily intakes of fruit and vegetables (as a combined group), the more likely a person is to be in a more desirable stage of change such as action or maintenance. In the present study, in which fruit and vegetable stages of change were measured separately, there were differences in the relationship between fruit knowledge and stage of change and vegetable knowledge and stage of change. For fruit, the relationship was counter-intuitive as actioners/maintainers were less likely to have combined fruit knowledge (i.e. knowledge of both the number of recommended servings per day and serving size) than contemplators and pre-contemplators. Conversely, for vegetables, pre-contemplators had significantly lower combined vegetable knowledge than contemplators and actioners/maintainers. As there are very few studies that look at fruit and vegetables stage of change separately, further research is needed to determine whether the differences found in the present study can be confirmed.

There were also differences in the perceptions of adequacy of intake related to stage of change. For fruit, the majority of pre-contemplators had the correct perception of their inadequate intake, whereas for vegetables, pre-contemplators held the belief that they were consuming adequate amounts. Pollard *et al.*⁽¹⁸⁾ and Dibsall *et al.*⁽⁵⁵⁾ suggest that one of the main impediments to increasing fruit and vegetable intake is an incorrect perception of intake and these findings add weight to the importance of focusing more on vegetable intake.

While higher intakes of both fruit and vegetables have been associated with increasing years of education⁽¹⁰⁾ and a higher level of educational attainment has been found to be associated with the action/maintenance stage of change⁽²⁵⁾, few studies have looked at the relationship between education and stage of change separately for fruit and vegetables. The present study found that the level of education was significantly associated with fruit stage of change, but no relationship for vegetables was shown.

While many researchers have categorised individuals according to the stage of change for fruit and vegetables combined, there is evidence from the present study and from other studies^(8,50) that there is little congruence between an individual's separately assessed stage of change for fruit and vegetables. Therefore, strategies targeted to a particular stage of change (e.g. awareness raising directed at individuals in the pre-contemplation stage) may be appropriate for increasing vegetable consumption in many people, but not as effective for increasing fruit consumption across a population. Interventions designed to increase vegetable consumption need to have

more strategies targeted to the pre-contemplators and different strategies targeted to the contemplators than interventions designed to increase fruit consumption.

Limitations

The present study has a number of limitations that need to be considered when interpreting the findings. The data are derived from a cross-sectional survey and may be subject to response bias with those more interested in healthy lifestyles being more likely to respond. This limitation is mediated by a relatively high response rate. Single items or short questions were used to determine fruit and vegetable consumption rather than a longer tool such as an FFQ or 24 h recall. Short questions do not give as accurate an estimate of absolute intakes and this should be taken into account when interpreting these data^(51–53). Finally, the data were derived from a regional centre in NSW and the results may not be generalisable across a broader population.

Conclusions

Knowledge, consumption and correct perceptions about vegetable intake are much lower than for fruit and these findings lend weight to the argument for interventions having a greater emphasis on vegetable consumption. As there is a much higher proportion of pre-contemplators and contemplators for vegetable intake, the strategies for a programme aimed at increasing vegetable intake would need to focus more on raising awareness, promoting the benefits of increasing consumption and encouraging the target group to examine their current intake against recommended intakes. Education to develop skills for the preparation of vegetables and ways of including vegetables in main meals is also necessary.

Messages about the recommended number of servings and serving size must be simplified and this may be achieved by targeting messages towards vegetable consumption.

In conclusion, consideration may need to be given to planning interventions that provide a greater emphasis on targeted strategies that will increase vegetable consumption.

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