

**Perceptions of fruit and vegetable dietary guidelines amongst Australian young adults**

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## **Abstract**

**Aim:** Regular consumption of fruit and vegetables has been associated with a decreased risk of a number of chronic diseases. An appropriate level of knowledge is important to successfully adhere to the dietary guidelines for eating fruit and vegetables. However, there is little research about the level of knowledge that young adults have about fruit vegetable consumption. The current study aimed to investigate the recall and understanding of Australian dietary guidelines, food product and serving size knowledge in a population of young adults.

**Methods:** One hundred and six undergraduate students completed online questionnaires regarding 1) knowledge of dietary recommendations, 2) knowledge of serving size information, and 3) foods that could be included as part of fruit and vegetable intake.

**Results:** The results showed that the sample had significant knowledge gaps in all three areas. Approximately half (54%) of participants correctly reported the recommended daily intake of fruit and vegetables, the majority were not able to correctly report serving sizes (correct responses were 30-61%), and were not able to identify all ingredients from a recipe that counted towards fruit and vegetable intake.

**Conclusions:** Past interventions have not tended to focus on the fruit and vegetable knowledge, or behaviours, of Australian young adults. On the basis of findings from this study it appears that more work is needed to develop messages to effectively target this important group.

**Keywords:** fruit and vegetable consumption, knowledge, dietary guidelines, serving size

## ***Introduction***

Regular consumption of fruit and vegetables has been linked to decreased risk of heart attack,<sup>1-3</sup> stroke,<sup>4</sup> diabetes,<sup>5</sup> obesity<sup>6</sup> and some cancers.<sup>7, 8</sup> In Australia, inadequate consumption of fruit and vegetables is estimated to account for more than 3% of the total burden of disease, and 11% of the total cancer burden.<sup>9</sup> In light of the evidence linking fruit and vegetable intake to risk of major disease, the World Health Organization (WHO) recommends that individuals consume at least 400g of fruit and vegetables each day,<sup>8</sup> and have called for nations to develop targeted campaigns to increase fruit and vegetable consumption to adequate levels.<sup>8</sup>

Consistent with WHO recommendations, the Australian Government recommends that Australians consume two servings of fruit and five servings of vegetables each day.<sup>10</sup> The recommendation has been widely promoted in the Australian community through the *Go for 2&5* social marketing campaign. This campaign was first developed in Western Australia and was implemented nationally in 2005.<sup>11</sup> In New South Wales, the state in which the current study was conducted, the *Go for 2&5* campaign has been promoted in three phases, the last phase which was completed in May 2009 included print, radio, television, and outdoor advertising. The *Go for 2&5* campaign, like other campaigns around the world (e.g. the American 5 a Day campaign)<sup>12</sup> assumes that consumers understand not only what constitutes a serving of fruit and vegetables and but also what food products can be included in the recommended intake (i.e. that they have both serving size knowledge and food product knowledge). However, research suggests that these concepts are often poorly understood by consumers.<sup>13-15</sup> Various studies have found that consumers express difficulty in understanding the serving size concept, and in relating serving sizes to actual food intake.<sup>13, 15</sup> For example, American research found that individuals frequently conflated the concepts of servings and portions, with many participants erroneously believing that servings represent

the amount of fruits and vegetables to be eaten at a single meal.<sup>13</sup> This study, like other research conducted in the field, also found that participants vary considerably in their estimation of the serving size of different fruit and vegetable items.<sup>13, 14</sup> These findings are consistent with Australian research which has found that the majority of participants in a representative sample of Western Australian adults could not report the correct serving size for fruit or vegetables, with less than 15% of participants able to report the correct serving size for vegetables.<sup>16</sup> With regard to food product knowledge, a study evaluating the use of brief measures of fruit and vegetable intake found that some individuals have difficulty in understanding which food items should or should not be included as part of their fruit and vegetable intake.<sup>15</sup> For example, some individuals in that study incorrectly excluded fruit and vegetables eaten as part of a mixed meal such as casserole from their estimation of fruit and vegetable intake.<sup>15</sup> Previous studies of Australian dietary knowledge have not assessed food product knowledge, meaning that no current data on the food product knowledge of Australian adults is available.

The previous research in this field provides valuable insight into the fruit and vegetable related knowledge of a range of consumers; however more research in the Australian context is still needed. The argument for more research into consumer perceptions of Australian dietary guidelines is two-fold. Firstly, because of differences in dietary guidelines between Australia and other countries, most notably in the unique distinction between the recommended intake of fruits and vegetables, research conducted abroad may not be easily applied to the Australian context. Given the differences between Australian dietary guidelines and guidelines in the USA, UK and New Zealand, researchers should be cautious when extrapolating findings from those countries into the Australian context. Secondly, the research which has been conducted on this issue in Australia was conducted only 6 months after the start of the Western Australian *Go for 2&5* campaign.<sup>16</sup> More up-to-

date research is needed to assess the current fruit and vegetable related perceptions of Australian adults. Importantly, given the current body of research, there is a paucity of evidence about the fruit and vegetable knowledge of important sub-groups. For example, research indicates that young adults are less likely than older adults to consume adequate quantities of fruit and vegetables, with 19-24 year olds less likely than any other age group to consume adequate amounts of fruits and/or vegetables.<sup>17</sup>

However, little is known about the fruit and vegetable related knowledge of this age group. Understanding the fruit and vegetable related knowledge of Australian young adults is an important first step in developing programs to increase fruit and vegetable intake in this vulnerable population. The aim of the present study was to address this gap in the research by determining consumer recall and understanding of Australian dietary guidelines in a population of young adults. Food product knowledge and serving size knowledge were both specifically addressed.

## **Methods**

The participants in the study were a self-selected convenience sample of first year students from an Australian University, from a wide range of disciplines within the university. In order to enrol in the study participants were required to be aged between 18 and 24 years of age. Participants received course credit for taking part in this study. This study was approved by the Human Ethics Review Committee of the University.

A web based questionnaire was developed for use in this study. Participants could access the survey from any computer with an internet connection. The survey was made up of three parts, which assessed different aspects of fruit and vegetable related knowledge. Questions were derived on the basis of previous studies into fruit and vegetable related knowledge and from focus groups conducted with a sample of young adults during the

development of the study. However, the questions were not formally validated or piloted. Due to the computerised nature of the questionnaire, participants were not able to move backwards in the survey to view or change their answers to earlier questions.

Knowledge of Australian dietary recommendations was assessed using both unprompted and prompted methods. Participants were asked “*What are the current Australian health guidelines for fruit and vegetable consumption? Please give as much detail as you can*”, after completing that question participants were asked “*According to Australian health guidelines, how many servings of fruit should adults eat each day?*” along with a similar question for vegetable knowledge.

Next participants were asked to report information about the serving size for four foods: lettuce, cooked carrots, grapes, and apples. These foods were chosen because they each represent a different fruit/vegetable type with regard to serving size information in the Australian dietary guidelines.<sup>10</sup> No alternatives were given and there were no prompts available. Participants were able to provide responses by weight (grams), volume (cups), pieces, handfuls, or by specifying their own response format.

In order to assess knowledge about what foods could or could not be counted towards the daily intake of fruit and vegetables, participants were asked to complete a categorisation task. Each participant was given a list of ingredients for a recipe that included a range of food products and was asked to select “*all ingredients that you believe count towards a person’s daily fruit and vegetable consumption*”. Each item in the recipe was accompanied by a colour photo of that ingredient. Ingredients included: beef, flour, canned tomatoes, onion, celery, carrot, turnip, potato, red wine, and tomato paste. These ingredients were chosen because they represented a realistic variety of ingredients for a mixed vegetable dish. The recipe items included in the categorisation task were based on a recipe for ‘Easy Beef Hotpot’ from the *Go for 2&5* website.<sup>18</sup>

Knowledge of Australian dietary guidelines and Australian serving size information were both assessed using free text responses. Responses were coded into relevant categories prior to analysis. All responses were categorised using *a priori* categories. *A priori* guidelines were also used to develop decision rules for serving size estimations where these were within a given margin. For example, weight based estimates of serving size were marked as correct if they were within 10% of the published guideline.

## **Results**

The final sample consisted of 106 participants (79% female), the mean age was 19 years (SD = 1.7), ranging from 18 to 24 years. The majority of participants (59%) identified their predominant ethnicity as “Australian”, and most (83%) lived at home.

Most respondents, 88%, mentioned specific quantities of fruit and/or vegetable when describing Australian dietary guidelines for fruit and vegetable consumption without prompts. Without prompting, 43% of individuals correctly reported the recommended daily intake of fruit, 54% of individuals correctly reported the recommended daily intake of vegetables and a further 2% of individuals correctly reported the combined fruit and vegetable intake without reporting fruit and vegetable consumption guidelines separately. Despite fruit and vegetable guidelines calling for a consumption of a variety of different types of fruit and vegetables,<sup>10</sup> only 6 respondents mentioned the concept of variety in unprompted recall of fruit and vegetable guidelines. When prompted, 48% of participants correctly reported fruit intake guidelines, prompted recall of fruit recommendations ranged from one to eight servings. When prompted, 64% correctly reported guidelines for vegetables, prompted recall of vegetable recommendations ranged from two to eight servings. Only 9% of

participants correctly reported the Australia dietary guidelines for both fruit and vegetable consumption.

Table 1 presents data from the serving size estimation task. Approximately, 5% of participants reported that they were “unsure” or “didn’t know” for at least one fruit or vegetable. A further 13% of responses could not be quantified for analysis. Responses of this type included estimates of serving size such as “large” and “a dish”. The largest number of non-quantifiable responses were for lettuce serving size, where most non-quantifiable responses related serving size to plates or bowls. Across the remaining three categories, the majority of non-quantifiable responses related serving size to abstract ideas (e.g. “medium”, “quite large”, “not large at all”) or related serving size of the food item back to the idea of serving sizes more generally (e.g. “one serve”).

Table 1. Serving size estimation: percentage of responses in each category

|         | Correct (%) | Incorrect (%) | Don't Know (%) | Not quantifiable (%) |
|---------|-------------|---------------|----------------|----------------------|
| Apple   | 61          | 34            | 0              | 6                    |
| Grapes  | 41          | 47            | 0              | 12                   |
| Carrot  | 30          | 57            | 4              | 9                    |
| Lettuce | 30          | 38            | 4              | 28                   |

As shown, even amongst participants who gave answers that could be quantified, the majority of participants were not able to correctly report the serving size for grapes, carrots or lettuce. However, the majority of participants were able to correctly identify the serving size of an apple.

It is also important to note that responses on this task varied greatly between participants. Of the quantifiable responses, some drastically underestimated correct serving size (e.g. by estimating the serving size of grapes as a single grape) while others drastically overestimated serving size (e.g. by estimating that the serving size of lettuce was 500g or that



the serving size of carrot was equivalent to 20 carrots). Individuals who chose to report serving size by weight were particularly poor at correctly identifying serving size. Of the 102 weight based estimates of serving size (across all four food categories), only two participants correctly reported a serving size by weight.

The vast majority of participants were able to correctly identify carrot and celery as contributing to their daily intake of fruits and vegetables, 97% and 96% respectively. Participants performed less well when asked to classify potato (90%), turnip (86%), canned tomato (78%) and onion (71%). Importantly, less than a quarter of participants (23%) correctly classified tomato paste as contributing to fruit and vegetable intake. Some participants also incorrectly classified non-fruit and vegetable items as contributing to their daily fruit and vegetable intake: 10% of participants incorrectly classified beef, 4% incorrectly classified flour, and 7% incorrectly classified wine.

## **Discussion**

An appropriate level of knowledge is conceptually important to successful adherence to dietary guidelines. The importance of knowledge to successful performance of behaviour is recognised in both the Information, Motivation, and Behavioural Skills model of behaviour<sup>19</sup> and the Integrated Behavioural Model.<sup>20</sup> Both of these models argue that sufficient knowledge is a critical determinant of successful performance of health behaviours. Both models have been used to develop successful programs to increase the performance of health promoting behaviours across a range of domains.<sup>19, 20</sup> These models both suggest that knowledge is a necessary, but not sufficient, condition of purposeful adherence to dietary guidelines.

Practically, in order to adhere to dietary guidelines, individuals must be able to recall the guidelines and must understand the assumptions upon which the guidelines are based. In the context of fruit and vegetable consumption, consumers must have sufficient serving size

knowledge to identify what quantity of fruit and vegetables they should consume, and sufficient food product knowledge to correctly identify which foods do or do not fall under the guidelines. Results from this study suggest that Australian young adults have significant knowledge gaps in all three of these knowledge domains. Firstly, almost half of all participants in this study were not able to recall the dietary guidelines for fruit and vegetable consumption, even when prompted. Secondly, participants were not able to reliably identify the correct serving size for three of the four fruit and vegetable categories assessed in the current study. Finally, participants did not have sufficient food product knowledge to correctly assess whether or not a range of foods do or do not fall under the Australian dietary guidelines as they relate to fruit and vegetable consumption.

These findings are broadly consistent with previous research which has been conducted in this area, which have shown significant areas of weakness in fruit and vegetable knowledge as it relates to both recall of recommendations,<sup>11, 16</sup> correct understanding of serving size,<sup>13, 14</sup> and appropriate assessment of the food types included in fruit and vegetable categories.<sup>15</sup> Previous research has suggested that individuals prefer measures of serving size that relate to common measures, such as pieces or cups.<sup>13, 16</sup> This also appeared to be the case in the present sample. Importantly, participants were also markedly less competent in estimating fruit and vegetable serving sizes when they chose not to respond using these formats. This finding serves to again underline the recommendation that fruit and vegetable recommendations should use common household measures, such as pieces and cups, that are familiar to consumers.

The lack of fruit and vegetable knowledge observed in the current sample may account, in part, for the low levels of consumption previously observed in this age group.<sup>17</sup> However when interpreting this data it is important to note that the last national survey of fruit and vegetable consumption was conducted as part of the 1995 National Nutrition

Survey. Low fruit and vegetable consumption observed in that age group during that survey may be a cohort effect and may not necessarily reflect current levels of consumption in this age group. That said, given the limitations to fruit and vegetable knowledge in this age group suggested by this study, developing suitable messages about fruit and vegetable dietary guidelines, in order to increase both knowledge and consumption of fruit and vegetables in this age group, should remain an important goal. Although the *Go for 2&5* campaign has been successful across a number of domains,<sup>11</sup> results from the present study show that there are still significant knowledge gaps in at least some segments of the Australian population. More research is still needed to develop messages which are both recalled and understood by Australian young adults. In particular, results from this study suggest that future messages should address the issue of serving sizes in order to increase understanding of this concept.

This study is the first to specifically examine the fruit and vegetable related knowledge of Australian young people. However, the small convenience sample used in the current study limits the extent to which these findings can be generalised to the wider population. The sample is not representative, and as such care should be taken in interpreting all results. In particular, the sample was less socio-demographically diverse than the population from which they were drawn and females were over-represented. The self-selected sample, and the lack of data on some potential confounders, such as area of study, should also be considered when interpreting these results.

However, given the relationship between demographic factors such as low educational attainment and gender and inadequate fruit and vegetable consumption which has been demonstrated in other studies,<sup>21</sup> and the work on the Knowledge Gap Hypothesis which shows that mass media campaigns are more likely to benefit groups of higher socio-economic status,<sup>22, 23</sup> it would be reasonable to assume that fruit and vegetable related knowledge of Australian young adults may be even lower than was observed in the current

sample. On the basis of these findings it is clear that future research is needed to investigate knowledge gaps in a more socio-demographically diverse population of young adults.

Although more research is still needed to understand the true extent of misconceptions about fruit and vegetable guidelines amongst Australian young people, the current study provides the first evidence of significant fruit and vegetable knowledge gaps amongst Australian young people. Given the low rates of fruit and vegetable consumption in this population, and the importance of fruit and vegetable knowledge for successful adherence to dietary recommendations it is clear programs to increase fruit and vegetable consumption in this population are needed, and that such programs should target common knowledge gaps in this population.

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