How much is ‘5-a-day’?: A qualitative investigation into consumer understanding of fruit and vegetable intake guidelines

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Authorship

CR contributed towards the design of the PS questionnaire, conducted qualitative data collection, carried out all analyses and drafted the manuscript. JVW designed the study and was Principal Investigator on the grant. ISY, MCMcK and KMA were co-investigators on the grant application, and MCMcK assisted with the analysis and interpretation of the qualitative data. KMA developed the first draft of the PS questionnaire and provided advice on its analysis. CRD, LLH and AJMcG were responsible for participant recruitment and completion of the study protocol. CRD and AJMcG also assisted with the FG discussions. All authors critically reviewed and approved the manuscript.
ABSTRACT

Background: Despite the known health benefits of fruit and vegetables (FV), population intakes remain low. One potential contributing factor may be a lack of understanding surrounding recommended intakes. This study aimed to explore understanding of FV intake guidelines among a sample of low FV consumers.

Methods: Six semi-structured focus groups were held with low FV consumers (n=28, age range 19-55 years). Focus groups were digitally recorded, transcribed verbatim, and analysed thematically using NVivo to manage the coded data. Participants also completed a short questionnaire assessing knowledge on FV intake guidelines. Descriptive statistics were used to analyse responses.

Results: Discussions highlighted that although participants were aware of FV intake guidelines, they lacked clarity with regards to the meaning of the ‘5-a-day’ message, including what foods are included in the guideline, as well as what constitutes a portion of FV. There was also a sense of confusion surrounding the concept of achieving variety with regards to FV intake. The sample highlighted a lack of previous education on FV portion sizes, and put forward suggestions for improving knowledge, including increased information on food packaging, in supermarkets and through health campaigns. Questionnaire findings were generally congruent with the qualitative findings, showing high awareness of the ‘5-a-day’ message, but a lack of knowledge surrounding FV portion sizes.

Conclusions: Future public health campaigns should consider how best to address the gaps in knowledge identified in this study, and incorporate evaluations that will allow impact of future initiatives on knowledge, and ultimately behaviour, to be investigated.
INTRODUCTION

Research has shown that a diet rich in fruit and vegetables (FV) may provide protection against certain chronic illnesses such as cardiovascular diseases [1]. Based on this evidence, the World Health Organisation (WHO) set a minimum daily target of 400 g FV (the equivalent of five 80 g portions), which has since been translated into the ‘5-a-day’ public health message within the UK [2,3]. However, despite these guidelines, current population intakes remain suboptimal, with recent figures suggesting average national intakes of 4.1 portions/day amongst adults (19 – 64 years) [4].

One factor which has previously been suggested to be a potentially important predictor of FV intake is adequate knowledge [5-8]. However, minimal studies have thus far investigated consumer understanding of the meaning of the ‘5-a-day’ FV intake recommendations, including which foods are included in the guidelines, and what counts as a portion of FV. It could be hypothesised that greater awareness on details, such as the specific amounts and types of foods needed to achieve the recommended guidelines, might have positive implications in terms of better adherence and increased intake. For example, improved comprehension of the ‘5-a-day’ guidelines, including how to achieve a portion of FV, may enhance consumers’ capability and motivation to achieve the recommendations [9]. It might also better allow individuals to accurately assess their current FV intake which could consequently impact upon their intentions for future consumption. A further justification for investigating this topic is based on evidence which shows discordant findings between people’s perception of their FV intake and their actual intake. For instance, one study [10] found that amongst 426 elderly participants, 83% were aware of FV intake guidelines, and 35% felt they were eating enough FV. However, a closer examination (using a dietary recall of typical FV intake) of the latter group showed that some individuals were consuming as little as two portions of FV per day. A possible reason for this discrepancy is that there was a misunderstanding with regards to FV intake guidelines, and in particular the nature of a portion of FV according to the ‘5-a-day’ message.

The few studies which have been conducted to date on consumer understanding surrounding FV intake guidelines have primarily investigated knowledge amongst American [8, 11–14], Australian [9, 15–17] and New Zealand consumers [18]. Only two studies [19, 20] have investigated knowledge within the UK, and these studies used samples of University students and socially-deprived individuals. Given that FV-based public health campaigns, intake recommendations and portion size (PS) guidance vary greatly between countries (see Supporting Information, Table S1),
the majority of evidence to date cannot necessarily be generalised to a UK context. Hence, the
objective of the current paper was to explore awareness and understanding of FV intake guidelines,
with a particular emphasis on sources of FV and FV portion sizes (PSs), within a sample of low FV
consumers.

MATERIALS AND METHODS

Study Sample and Recruitment
The current sample comprised participants taking part in a pilot randomised controlled feeding
study, entitled the Biomarkers of Fruit and Vegetable (BIOFAV) study. Full details of the pilot trial
have been published elsewhere [21], but, in brief, it was designed to investigate novel biomarkers of
FV consumption amongst 32 healthy, habitually low FV (< 2 portions) consumers (identified by a
7-day diet recall). Participants were recruited through an intranet advertisement published within
[University name removed for blinding purposes], and through word-of-mouth. The study was
approved by the [School name removed for blinding purposes] research ethics committee of
[University name removed for blinding purposes], and participants provided written informed
consent.

Focus Group Discussions
Six focus groups (FGs) were conducted between August 2011 and May 2012. The FGs, which
ranged in size between four and six participants, were conducted in the first week of the four week
BIOFAV study. The discussions lasted between 45 to 60 minutes and digital recordings were taken.

The FGs were moderated by CR, who was assisted by another member of the research team
(CRD/AJMcG). Moderators received formal training in conducting FGs. To ensure consistency, a
semi-structured topic guide was developed based on a prior literature search. The script was piloted
on a group of four research students (aged between 20-30 years). Sample questions from the final
topic guide are illustrated in Table 1. The co-moderator ensured all topic areas were covered within
each session and volunteers were encouraged to fully express their views, provided the conversation
was relevant to the aims of the research. At the end of each session, participants were thanked for
their time and asked if they had any other issues that they would like to raise.
Prior to the FGs, demographic information was collected on the sample. A questionnaire comprising questions surrounding the ‘5-a-day’ FV guideline was also administered. Given the small sample size, the intended use of the questionnaire was not to derive generalisable conclusions about consumer knowledge of FV guidelines, but rather to provide some context on the sample, and to aid with the interpretation of participant responses during the qualitative discussions. Additionally, the small sample size did not permit the use of statistical testing between responses and demographic variables.

The questionnaire covered four areas; awareness of the ‘5-a-day’ message, knowledge on foods that are classified as a fruit or vegetable according to the ‘5-a-day’ message, PSs of commonly consumed FV and knowledge on portions provided by combinations of FV (to reflect normal dietary consumption patterns). Participants were firstly asked ‘Are you aware of the ‘5-a-day’ message about FV consumption?’, to which they could answer ‘yes’, ‘no’ or ‘not sure’. Secondly, participants were given a categorisation task which required them to identify foods which counted as a fruit or vegetable according to the ‘5-a-day’ message from a list of 39 commonly consumed foods. A third question showed a list of 27 FV with specific quantities (e.g. four spears of broccoli) and asked participants to record how many portions of fruit or vegetables each would contribute towards the ‘5-a-day’ message (e.g. ½ portion). Finally, the questionnaire presented seven combinations of FV (e.g. one medium apple, one medium pear and two medium glasses of fruit juice) and asked participants to specify how many portions each set would equate to if eaten within the course of one day.

**Statistical Analysis**

FGs were transcribed verbatim by CR. The study technician listened to the audio recordings and checked this against the transcripts. Data were analysed using Braun and Clarkes’ inductive thematic analysis framework [22]. This involved a six-step process i) familiarisation with data, ii) initial descriptive coding of data, iii) search for themes, iv) review of themes, v) naming and defining of themes and vi) writing up of results. CR carried out this process, and the transcripts were then read by MCMcK and the codes were checked and compared. Only a small number of between-researcher discrepancies were found and consensus was reached through discussion. QSR NVivo 8 was used to facilitate data coding and management.
Questionnaire responses were analysed using PASW (SPSS Inc, Chicago, IL). Descriptive statistics were used to describe the demographic profile of participants. Categorical data are presented as frequencies and percentages, while continuous data are shown as the median and interquartile range (IQR) (due to the small sample size). To analyse the questionnaire on FV intake guidelines, correct responses were given a score of one, whilst incorrect and ‘don’t know’ responses were given a score of zero, making a maximum possible score of 74. Participants’ percentage of correct responses were calculated for the overall questionnaire, and for each of the four questionnaire domains separately. Simple descriptive statistics were used to establish the frequency of correct and incorrect responses, and percentage knowledge scores for the sample are presented as the median and interquartile range (IQR).

RESULTS

Twenty-eight participants took part in the FGs (sample characteristics are shown in Table 2). The following section presents a description of the main themes which emerged from the analysis of the transcripts; (i) knowledge, (ii) education and (iii) suggestions for improving FV PS knowledge (see Supporting Information Table S2 for a full list of themes, subthemes and quotations).

Knowledge

Whilst the majority of participants claimed to be aware of the ‘5-a-day’ campaign, a lack of knowledge was evident regarding the specifics of the message (Quote 1, Table 3). For example, most participants were confused as to which foods counted as a fruit or vegetable according to the ‘5-a-day’ message. Additionally, when prompted by the moderator, some expressed their surprise at foods such as tomato-based sauces, which they would not have previously classified as a fruit or vegetable (Quote 2, Table 3). Some participants also said they were unaware that potatoes did not classify as a vegetable according to the guidelines. However, most ambiguity existed with regards to composite foods (e.g. spaghetti bolognaise and stew), with many participants claiming that they did not normally count these foods towards their FV intake (Quote 3, Table 3). One participant also indicated that they were uncertain about what conditions a food needed to satisfy to be classified as a fruit or vegetable (Quote 4, Table 3).

Most participants also expressed a lack of awareness surrounding PSs for FV, and this was the prevailing topic of conversation during the FG discussions about the ‘5-a-day’ message. Respondents mentioned varieties they deemed particularly difficult, including lettuce, and the
heterogeneity in PSs for different FV was highlighted as a factor which made it more difficult to
decipher what a portion of FV equated to (Quote 5, Table 3). When additional FV guideline rules
were discussed, for example surrounding pure fruit juice (i.e. that it can only count towards a
maximum of one portion per day) some participants questioned the reasoning behind this rule
(Quote 6, Table 3). Generally, it was suggested by participants that PSs for fruit were easier to
establish than vegetables, with some mentioning fruit as “more discrete” (FG1, M, 19yrs) and the
fact that you could “use the whole thing” (FG2, M, 20yrs). The majority of participants claimed
that composite food dishes including FV (e.g. sandwiches, stew and soup) were particularly difficult
to quantify in terms of the number of portions that were provided in one serving (Quote 7, Table 3).

Variety was a key concept discussed in multiple FGs. Firstly, some participants claimed that they
had misinterpreted the ‘5-a-day’ message as meaning five portions of fruit, plus five portions of
vegetables a day (Quote 8, Table 3). Many participants also alluded to the fact that they were not
previously aware that FV intake should ideally be comprised of a variety of FV, with some stating
that they thought eating five of the same type of fruit or vegetable would be sufficient to meet
recommendations (Quote 9, Table 3).

Finally, it was evident that participants had difficulty estimating their current intake of FV as a
result of their lack of knowledge on FV PS. Some believed they had been overestimating their
intake (Quote 10, Table 3), whilst others thought the contrary (Quote 11, Table 3).

**Education**

Overall, findings from the FGs suggested that participants had received little or no information on
what constituted a portion of FV according to intake guidelines. However, some sources of
education mentioned included front-of-pack labelling, school and magazine articles (Quote 12 &
13, Table 3). There were mixed opinions with regards to the preferred method of communication
for FV PSs. Some believed conveying FV portions in terms of grams was superior as this is a
universal measurement, and such information could be used in conjunction with weights of FV
provided on packaging (Quote 14, Table 3). However, other participants stated that working in
grams presented additional problems in terms of the ‘hassle’ of having to weigh FV before eating
them. Some also expressed concern that they were not familiar with grams as a form of
measurement. There was also a sense of complacency in terms of how precise FV portions needed
be (Quote 15, Table 3). Tablespoons and handfuls were both generally perceived as more useful and relevant measures for FV PS. For example, tablespoons were seen as less effort in comparison to grams (Quote 16, Table 3). However, despite this, two participants believed that handfuls were confusing, based on the concept that the size of individual’s hands differ (Quote 17, Table 2). In two FGs, participants stated that they preferred to guess FV PSs based on the size of well-known FV such as an apple (Quote 18, Table 3).

Similarly, there were varied opinions on whether having increased knowledge of FV PS would increase FV intake. On the whole, participants agreed that having more information on what constitutes a portion of FV would impact positively on their current FV consumption (Quote 19 & 20, Table 3). For example, some people suggested that they were not motivated to meet the ‘5-a-day’ recommendations as they were unsure of how their current intake compared to the guidelines. With increased information some said they would feel ‘more informed' and ‘more aware’, and that the guidelines would be ‘more achievable’. However, other participants said that they do not think about FV PS, instead preferring to eat depending on their appetite. Additionally, some said that they would not measure portions in spite of increased information (Quote 21 & 22, Table 3). Two female participants suggested that increased FV PS information would not overcome other barriers towards FV consumption, including routine and preparation (Quote 22, Table 3).

**Suggestions for Improving Portion Size Knowledge**

Participants contributed multiple ideas on how information surrounding achieving a portion of FV according to ‘5-a-day’ guidelines could be conveyed to the public in the future. Suggestions included increased information on packaging and displays in the FV produce section of supermarkets. Two participants said they would like personal assistance whilst shopping for FV (i.e. somebody to inform you of how much you need to make up a portion of FV) (Quote 23, Table 3), although this idea was refuted by younger participants who felt they would not welcome such an approach (Quote 24, Table 3).

Other proposals included increased FV PS information in eateries which could be used when ordering food, governmental campaigns and more promotional material, including leaflets or posters (Quote 25 & 26, Table 3). Many participants suggested that key messages which should be
communicated are increasing people’s knowledge on how to easily incorporate more portions of FV into daily routine, as well as increasing awareness of the number of portions provided by commonly consumed composite meals (Quote 27, Table 3). Assistance with meal planning and FV PS information in recipe books were also suggested as possible motivators for increasing FV intake (Quote 28, Table 3).

Questionnaire Results

A summary of the scores from each domain of the FV guidelines questionnaire are illustrated in Table 4. All participants within the sample stated they were aware of the ‘5-a-day’ FV intake guidelines. The majority of participants were able to correctly identify foods which counted as a fruit or vegetable (median knowledge score 91%). However, as shown in Supporting Information Table S3, for two foods, less than half of the sample scored correctly; jacket potatoes (39.3% correct) and potatoes (42.9% correct). Other foods for which 80% or less of the sample correctly identified as FV were; chips (78.6), chickpeas (75% correct), lentils (75% correct), tomato soup (75% correct) and vegetable lasagne (60.7% correct).

The sample’s median knowledge score for identifying the portions provided by different amounts of individual types of FV was 37% (Supporting Information Table S4). For most foods (59%), less than half of the sample correctly answered the portions provided by the stated quantities of FV. More than 50% of participants correctly identified the portions provided by ten foods only. These were mostly in the form of one ‘piece’ of fruit or vegetable (e.g. one apple, one banana).

Apart from one combination of FV (1 apple, 1 banana, 1 glass of fruit juice), the majority of participants (≥ 50%) incorrectly assessed the number of portions provided by different selections of FV (Supporting Information Table S5). The median knowledge score for this task was 21.4%.

DISCUSSION

Despite awareness of the UK government’s ‘5-a-day’ recommendation for FV, this study has demonstrated a lack of knowledge with regards to the specifics of the message. Some misunderstandings of the ‘5-a-day’ message exist, notably the belief that it recommends five fruit and five vegetables per day, and not appreciating the importance of variety. There were also some
knowledge gaps regarding what is included in the FV recommendation, and a lack of knowledge about what constitutes a portion of FV, or how to actually achieve the recommended intake target.

Identification of FV within the Context of the ‘5-a-day’ Guidelines

The FG discussions highlighted a lack of clarity with regards to which foods count as a fruit or vegetable according to the ‘5-a-day’ message. Specifically, individuals illustrated a deficit of knowledge on whether certain composite foods counted towards FV guidelines. This is in line with findings from another study [14] which suggested that FV consumed in composite dishes were the most difficult to classify for American consumers. The exclusion of composite foods whilst assessing FV intake can have important implications in terms of the conclusions that are reached regarding current consumption. For example, a study [23] showed that excluding composite foods from FV estimates can misclassify participants as low/non-consumers of FV. This notion may also provide a possible explanation for the increase in FV consumption amongst detected 19-64 year olds from the 2002 National Diet and Nutrition Survey [24] to the most recently published survey [4] (2.8 portions FV/day versus 4.1 portions FV/day respectively). In comparison to the 2002 survey, the more recent survey used disaggregated data for a wider range of composite dishes. These findings, alongside evidence which shows that composite foods are accountable for as much as 20-30% of vegetable intake and 10% of fruit intake, illustrate the need for consumers to be better informed of the value of FV-rich meals in relation to achieving FV guidelines [25]. Additionally, the public should be made aware of how to easily incorporate portions into commonly consumed meals. Such information could have a positive impact in terms of making the ‘5-a-day’ target seem more achievable; a point which was strongly advocated in the FGs within this study.

Interestingly, findings from the questionnaire showed that the sample scored well when asked to identify foods which are classified as a fruit or vegetable. However, while participants were able to identify common FV, as voiced in the FGs, some uncertainty was evident with regards to other foods including potatoes, as well as chickpeas and lentils. With regards to potatoes, this is unsurprising, given the international variation in the classification of potatoes, with some countries, such as the USA, including potatoes as a vegetable, and others, such as the UK, excluding potatoes from their FV guidelines (as per recommendations set by the WHO/FAO). Hence, it could be speculated that the continuing debate over potatoes may have contributed towards the confusion amongst the current sample. Regardless of the reason, this is an important finding as it highlights
that some consumers may count potatoes towards their daily intake of FV, and thus they may not be adequately assessing or reporting their intake of FV. Future education resources should endeavour to clarify this for the general public.

### Understanding of FV Portion Sizes within the Context of the ‘5-a-day’ Guidelines

Another key finding from the focus groups was that the majority of participants had trouble conceptualising a portion of different types of FV, which is a key skill required in understanding the ‘5-a-day’ message. This finding is consistent with previous studies conducted in the area [8, 12, 14, 15, 18–20]. Participants generally found it more challenging to decipher the portions provided by FV which were not in the form of one whole food/piece, with some stating that this was the main reason why vegetables were often more difficult to determine in terms of portions in comparison to fruit. The questionnaire responses served to reinforce this finding, and also revealed that, when faced with a list of FV, most respondents in the current sample were unable to tell how many portions the combination would provide if consumed within one day. When translated into a normal day-to-day dietary context, this suggests that these consumers are unlikely to be able to accurately assess their own daily intake of FV. This concept was acknowledged by various participants within the FGs. Hence, it is possible that this sample are making dietary choices regarding FV consumption based on ill-informed perceptions about their current intake. Another key finding from this study was that some participants believed that the ‘5-a-day’ guidelines stipulated the consumption of five portions of fruit in addition to five portions of vegetables per day. This notion, which has also been alluded to by individuals elsewhere [26], could potentially be very demotivating, and thus might suggest a need for the refinement of current UK FV guidelines in order to facilitate better consumer understanding. There may be some merit, for example, in providing separate intake recommendations for FV, as is the case in Australia (Go for 2&5 campaign).

From a nutrition research perspective, the lack of PS knowledge presented within this study emphasises the complexities of measuring FV intake using self-report measures. For example, some measures of dietary intake, including FFQs, require respondents to report their frequency of consumption of FV based on an ‘average portion’. However, this research has highlighted that people are not necessarily aware of what a standard portion of FV equates to according to UK guidelines, and hence the validity of such data might be compromised. In terms of implications for
the assessment of FV intake in the future, researchers should seek to use detailed measures (e.g. diet histories/food diaries) and should provide assistance to respondents when quantifying FV intake (e.g. through the use of a food PS atlas), rather than relying on individuals’ perceptions of FV portions. Alternatively, if using FFQs, examples of standard portions for each type of FV should be provided in an attempt to increase accuracy of reporting.

One of the key messages advocated by the ‘5-a-day’ campaign is the importance of consuming a variety of FV. Conversely, this work showed that one of the prime misunderstandings surrounding FV consumption is related to misconceptions about variety. For example, during the FGs, a number of individuals indicated that they had previously thought eating five of the same FV would suffice in terms of achieving the ‘5-a-day’ guidelines. Similarly, Carter et al. [16] also found that a sample of Australian participants were unclear as to whether FV intake guidelines stipulated that five different FV needed to be consumed each day. These are again important findings in terms of the probability that people are misjudging the adequacy of their FV intake. Participants in the current study also conveyed the notion that eating five of the same FV was unappealing and an unrealistic target in relation to their satiety. Hence education on consuming a variety of FV, particularly within meals, could make the guidelines more achievable.

In terms of why consumers lack understanding on FV intake guidelines including PSs, there are a number of proposed explanations. The first, and perhaps most obvious reason, could simply be a result of a lack of education. Within the current study, for example, the majority of participants claimed to have had received limited information about FV PSs, except occasionally from packaged FV sources. A second potential reason, which was raised by participants in this study, is the confusion generated by the substantial variation in the amounts of FV needed to make up one portion.

In terms of the future, and how knowledge on achieving a portion of FV could be increased, the results from the FGs suggested a collaborative effort is required from the food industry (e.g. packaging), retailers (e.g. supermarket displays and eateries) and health promotion bodies (e.g. campaigns and promotional material). With regards to PS information on packaged FV, it is perhaps worth noting that, at present, no regulations exist within the UK in relation to making claims on the portions provided by FV products. Manufacturers are not obliged to display such details, and thus there is great inconsistency with regards to the level of information currently provided.
Furthermore, there is evident variability in the methods used to communicate PS information to consumers (e.g. various logos have been employed). In order to increase consumer awareness and confidence in the accuracy of such information, there is a need for clear guidance and regulation to be provided to the UK food industry regarding FV PS.

What was ambiguous from the current study was how PS information would best be communicated in terms of grams/household measures. Future studies should seek to clarify this issue. Last but not least, future public health campaigns should investigate not only whether increasing PS information can reduce confusion and increase understanding (knowledge), but also whether it has the potential to facilitate long-term increases in FV consumption (behaviour).

**Strengths and Limitations**

This study provides some of the first evidence surrounding consumer understanding of FV guidelines within the UK, including the novel topic area of FV PSs. However, the findings should be interpreted in light of some limitations. Firstly, the generalisability of the sample is questionable, as it comprised a small number of mostly well-educated individuals with normal BMIs. The former may have had implications in terms of how knowledgeable the participants were about FV guidelines. However, the sample of low FV consumers represented an ideal opportunity to investigate understanding of intake guidelines. Secondly, whilst the FGs were held as close as possible to the start of the four week intervention, participants may have sought information on FV from the research team during prior feeding sessions which could have influenced their attitudes. Similarly, although the quantitative questionnaire was distributed at the beginning of the study, it is possible that participants may have acquired some information on FV at screening visits. However, this was unavoidable as the questionnaire could not have been distributed before individuals were deemed eligible, and consented onto the study. Furthermore, the question assessing knowledge of the ‘5-a-day’ message may have facilitated guessing which could have potentially inflated the accuracy score. Finally, the questionnaire was not validated nor formally piloted prior to use. Whilst one existing validated questionnaire contains questions on FV PS knowledge [20], it assessed knowledge on a limited number of foods and did not examine understanding surrounding sources of FV, which was a key aspect of the current paper. In comparison to most previous studies assessing knowledge surrounding FV intake guidelines, including FV sources and FV PS, the questionnaire
used in the current study measured knowledge based on a greater number of items, making it one of the most comprehensive measures to date.

In conclusion, this study showed some mis-understanding surrounding the UK ‘5-a-day’ message, including what foods are included within the guideline. It also emphasised a lack of knowledge with regards to FV PS, although further studies are needed to replicate these findings in larger, more diverse samples. Future public health campaigns should attempt to address these mis-conceptions and gaps in knowledge, and incorporate evaluations that will allow impact of future initiatives on knowledge, and ultimately behaviour, to be investigated.

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