

Visualising future behaviour: Effects for snacking on biscuit bars, but no effects for snacking on fruit

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Abstract

In this study, participants ($N = 223$) were randomised to visualise snacking on fruit, visualise snacking on biscuit bars or no visualisation, and intentions and attitudes towards fruit and biscuit bars, immediate selection of fruit or biscuit bars and subsequent consumption were measured. No effects of visualising snacking on fruit were found once background variables were taken into account. Visualising snacking on biscuit bars, however, resulted in greater intentions to consume biscuit bars (smallest $\beta = 0.19$, $p < 0.01$). These findings suggest that specifics of the visualised target behaviour may be important in visualisation. Further investigation is needed before recommending visualisation for increasing fruit consumption.

Keywords

attitudes, consumption, fruit, intentions, online questionnaire, visualisation

Introduction

Visualisation of the self engaging in behaviours is theorised to result in increased engagement in those behaviours (Gregory et al., 1982; Marks, 1999). Visualisation is thought to result in mental representations of visualised actions, situations and emotions, which in turn can result in increased performance and experience of that being visualised (Drillisk et al., 1994; Knäuper et al., 2011; Marks, 1999; Pham and Taylor, 1999). Although not always successful (e.g. Gregg et al., 2011; Karlson et al., 2013; Verkaik et al., 2013), visualisation has been used with success for performance enhancement in sports (Bernier and Fournier, 2010; Martin and Hall, 1995), for the relearning of daily tasks during rehabilitation (Driediger et al., 2006), has

resulted in greater exam performance in mid-term exams in certain conditions (Pham and Taylor, 1999) and, in combination with other strategies, has been found to result in reduced post-operative pain and distress (Manyande et al., 1995) and improved health behaviours,

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such as smoking cessation (Sykes and Marks, 2001). Knäuper et al., 2011 also demonstrated the successful use of visualisation for increasing fruit consumption.

Strategies to increase fruit and vegetable consumption are required. While World Health Organization (WHO) guidelines currently recommend the consumption of at least 400 g (five portions) of different fruit and vegetables a day (WHO, 1990), it is commonly acknowledged that consumption levels in the United Kingdom, Europe and the United States are below these levels (Appleton et al., 2009; Billson et al., 1999; Schätzer et al., 2009) and that current strategies for increasing intakes (e.g. National Health Service, 2009) are largely of limited impact. Visualisation has been suggested as an easy and inexpensive way to promote goal achievement (Knäuper et al., 2011), and use of visualisation for increasing fruit and vegetable consumption is a possibility (Knäuper et al., 2011). This study aimed to test the effect of a simple visualisation instruction on intentions, attitudes and consumption of fruit.

In the study by Knäuper et al. (2011), participants were asked to visualise eating more fruit for the next 7 days, using goal-based visualisations (which focus on the intended outcome – eating more fruit) or using intention-based visualisations (which focus on the processes involved in reaching the outcome), and these two groups were compared with participants who formed intentions in the absence of visualisation or who neither undertook visualisation nor formed intentions. Participants in the two visualisation groups reported greater subsequent fruit consumption than those performing no visualisation. This study aimed to repeat the goal-based visualisation effects of the study by Knäuper et al. (2011) for fruit consumption and to extend their study by objective measurement of immediate fruit consumption and by comparison with effects in another food group – biscuit bars. Comparison with another food group would demonstrate effects of

visualisation specific to fruit. Biscuit bars, for example, cereal bars, such as *Nature Valley Granola Bars* (General Mills International Sarl, Spain), health bars (e.g. *Kelloggs Nutrigrain bars* (Manchester, UK)), traybakes, for example, *Kelloggs Rice Krispies Squares* (Manchester, UK), individually wrapped biscuits, for example, *Walkers Shortbread Fingers* (Aberdeen, Scotland), individually wrapped cake bars, for example, *Jaffa cake bars* (United Biscuits (UK) Ltd, UK) and confectionery bars, for example, *Twix* (Mars, Slough, UK), were chosen as a food group of similar use and variety as fruit, which represents a more neutral (healthy/unhealthy) food product (e.g. McGill and Appleton, 2009). Participants were asked to visualise eating more fruit or biscuit bars using goal-based visualisations, and effects on intentions and attitudes to consume fruit and biscuit bars, and subsequent consumption of fruit and biscuit bars were compared with that of participants who undertook no visualisation. It was hypothesised that fruit and biscuit bar goal-based visualisation would be equally effective for increasing fruit- and biscuit-bar-based intentions, attitudes and consumption compared to no visualisation.

Methods

Design

Participants were randomly assigned to undertake one of three visualisation tasks: fruit visualisation, biscuit bar visualisation or no visualisation. Intentions to consume and attitudes towards consuming fruit and biscuit bars were assessed immediately after the task; immediate fruit consumption was assessed through the offer of a snack immediately after the visualisation task, and fruit and biscuit bar consumption were reported by participants by email the following day as a measure of subsequent consumption. Various background variables were also assessed for potential influence on intentions, attitudes and consumption.

Participants

A total of 223 volunteers (52 males and 171 females) with a mean age of 23 years (range = 17–63 years, standard deviation (*SD*) = 7.7 years) were recruited from staff and students of Queens University, Belfast, UK. Participants were not informed of the purpose of the study prior to participation to avoid effects due to demand characteristics, but were informed instead that the study was investigating individual differences in abilities to visualise. Ethical approval for the study was given by the Research Ethics Committee of the School of Psychology, Queen's University, Belfast, prior to commencement.

Visualisation

For the fruit and biscuit bar visualisation manipulations, the following instructions were provided: Now picture yourself doing the following action: Snacking on a portion of fruit (a biscuit bar) tomorrow, for example, one apple, two plums, a handful of raisins (e.g. Flapjacks, Traybakes, Kellogg's Elevenses, Rice Krispies Squares, Muffins and Jaffa Cake bars). Now, close your eyes, visualise the action above in your mind's eye. Even if you don't normally snack on fruit (biscuit bars), this is what we would like you to picture. Picture it clearly and in detail. Take your time, think carefully about the action. What are you seeing? What colour is the fruit (biscuit bar)? What consistency is it? What flavour is it? Where are you and what are you doing?

A snacking scenario was used in both fruit and biscuit bar visualisation manipulations to ensure that the visualised situation was plausible, realistic and comparable between conditions. The instructions provided were goal-based and intended to encourage visualisation of a complete and realistic snacking experience (Drillisk et al., 1994; Knäuper et al., 2011; Martin and Hall, 1995; Pham and Taylor, 1999). Overly prescriptive instructions were avoided to ensure that the visualisation was realistic and

possible for each individual. Care was taken not to evoke memories or emotions, in an attempt to avoid potential effects due to past behaviour (e.g. see Higgs, 2008). Other studies have investigated the impact of recalling past behaviours (e.g. Higgs, 2008; Robinson et al., 2011), but future behaviours were the specific focus of this study. Following completion of the visualisation, participants were asked to provide a description of the picture they had visualised and were asked to rate the difficulty of completing the mental visualisation.

Participants in the no-visualisation condition were not provided with instructions to complete a mental visualisation task. Instead, they simply progressed directly to the questions assessing intentions and attitudes towards consuming fruit and biscuit bars.

Intentions and attitudes towards consuming fruit and biscuit bars

Intentions to consume fruit and biscuit bars were assessed using two intention items – 'I intend to snack on fruit (biscuit bars) tomorrow? strongly disagree – strongly agree', and 'How likely is it that you will snack on fruit (biscuit bars) tomorrow? very unlikely – very likely'. Items were responded to on a 7-point scale, scored from –3 to +3.

Attitudes towards consuming fruit and biscuit bars were assessed using the following items:

Four items measured expected affect (My snacking on fruit (biscuit bars) tomorrow would be: unpleasant – pleasant; My snacking on fruit (biscuit bars) tomorrow would be: unenjoyable – enjoyable; How satisfied would you be if you did snack on fruit (biscuit bars) tomorrow? not at all – a great deal; How much would you regret it if you did not snack on fruit (biscuit bars) tomorrow? not at all – a great deal).

Four items measured expected value/importance (How personally important is it for you to snack on fruit (biscuit bars) tomorrow? not at all important – extremely important; My snacking on fruit (biscuit bars) tomorrow would be:

harmful – beneficial; My snacking on fruit (biscuit bars) tomorrow would be: worthless – valuable; How much would snacking on fruit (biscuit bars) tomorrow make a difference to your health? not at all – a great deal).

Three items measured consumption in the face of threats (The following three scenarios describe potential difficulties and/or disincentives you may face as you attempt to snack on fruit tomorrow. Please indicate how likely you would be to eat a portion of fruit (biscuit bars) in the event of each difficulty: You don't have any fruit (biscuit bars) immediately available and it would be difficult to get hold of some? not at all likely – extremely likely; You have already eaten quite a few portions of fruit and vegetables (biscuit bars) today? not at all likely – extremely likely; You have the option of eating an unhealthy snack that looks much more tempting? not at all likely – extremely likely).

Four items measured perceived control over subsequent consumption (How much control do you feel over whether or not you snack on fruit (biscuit bars) tomorrow? no control at all – complete control; I feel in complete control of whether or not I snack on fruit (biscuit bars) tomorrow? strongly disagree – strongly agree; If I wanted to, I would not have problems succeeding to snack on fruit (biscuit bars) tomorrow? strongly disagree – strongly agree; How confident are you that you could snack on fruit (biscuit bars) tomorrow? not at all confident – completely confident).

These items were devised following the guidelines of Ajzen (2006). All items were responded to on a 7-point scale, scored from –3 to +3 as above, and then all items per scale were combined to create a single score for each of the four scales ('expected affect', 'expected value/importance', 'consumption in the face of threats' and 'perceived control over consumption') for fruit and for biscuit bars per person. Cronbach's alphas for each scale are provided in Table 1. Cronbach's alphas demonstrated reliability for all scales excepting those assessing consumption in the face of threats for both

fruit and biscuit bars, presumably due to the different independent situations assessed in this scale. Scales were based on the Theory of Planned Behaviour, but the study was not a test of the theory. The study was primarily an assessment of the use of imagery for improving fruit consumption, and attitudes were measured as part of this assessment.

All participants completed both fruit and biscuit bar intention and attitude questions regardless of visualisation, but the order of questions differed such that fruit visualisation was immediately followed by questions on intentions and attitudes to consume fruit, and biscuit bar visualisation was immediately followed by questions on intentions and attitudes to consume biscuit bars. Questions in the no-visualisation condition were presented in the same order as those in the fruit visualisation condition, as this was the order of the questions on fruit and biscuit bars prior to visualisation.

Immediate fruit and biscuit bar consumption

To assess effects on immediate consumption patterns, participants were offered the choice of a snack on completion of the study, as a token of appreciation for their participation. Snacks provided were fruits – apples and bananas; fruit-based biscuit bars – *Kellogg's Strawberry Nutrigrain* bars, *Kellogg's Blueberry Nutrigrain* bars (Manchester, UK) and non-fruit-based biscuit bars – *Kellogg's Eleveses Ginger Bake* bars and *Kellogg's Eleveses Golden Oat* bars (Manchester, UK). Apples and bananas are two of the most commonly consumed fruits in the United Kingdom (Billson et al., 1999), and other snacks were selected based on their fruit content, or their lack of fruit and chocolate. Care was taken to select non-fruit snacks that were unlikely to be perceived or selected by participants as treats or rewards (Rogers, 1987; Stubbs et al., 1998), and fruit-based biscuit bars were also included as an intermediary between fruit and biscuit bars. Three pieces of each item

were presented, participants were free to take one snack while the researcher was occupied elsewhere to avoid effects due to demand characteristics, and snack choice was covertly recorded after the participant had left the test situation.

Subsequent fruit and biscuit bar consumption

Subsequent consumption was assessed 2 days after the study. Participants were contacted by email and asked to recall the behaviour they had been asked to visualise, to what extent they had carried out that behaviour on the previous day (using a 7-point scale from *not at all* to *exactly as I had imagined*, scored -3 to +3) and how many portions of fruit and biscuit bars they had consumed the previous day.

Background variables

Various characteristics of potential impact on mental visualisation and fruit and biscuit bar consumption were also assessed prior to completion of the visualisation manipulation. These questions investigated gender; age; visualisation familiarity and ability; usual snacking behaviour; number of portions of fruit and biscuit bars consumed yesterday, on average weekdays, and on average weekend days; liking for fruit and biscuit bars; attitudes towards fruit and biscuit bars; individual perceptions of the importance of health; and individual perceptions of the importance of fruit and biscuit bar consumption for health. Studies have demonstrated the importance of imagery ability on task performance (e.g. Marks, 1973, 1999) and have suggested that all consumption variables potentially impact intentions and consumption (Appleton et al., 2009, 2010; Armitage, 2007; Knäuper et al., 2011). Questions on familiarity with and perceived ability at mental visualisation were also used to help maintain the supposed aim of the study and minimise effects due to demand characteristics.

Procedure

Participants completed all questions on consent, visualisation, background variables and intentions and attitudes towards fruit and biscuit bar consumption using an online questionnaire. Instructions for visualisation and visualisation randomisation were also provided via the online questionnaire software. Completion of the online questionnaire was undertaken in individual booths, in the Eating Behaviours Research Unit in the School of Psychology, Queen's University, Belfast. Immediate consumption of fruit was assessed immediately following questionnaire completion. Subsequent fruit consumption was assessed 2 days later via email.

Analysis

Participants' descriptions of their visualisation were first analysed by content analysis, as a manipulation check to ensure that participants were visualising appropriately, where number of descriptive words was used as a measure of visualisation vividness. Effects of visualisation were investigated using multiple linear regression, where intentions, attitudes and consumption were predicted by visualisation group (model 1), and visualisation group plus all background variables (model 2). Regression was used to allow simultaneous investigation of fruit visualisation and biscuit bar visualisation and to allow background variables to be taken into account. Due to the number of background variables, regression was considered more appropriate than analysis of variance (ANOVA) and analysis of covariance (ANCOVA) (Howell, 1997). Because there were three visualisation groups, each visualisation group was coded into two dummy variables – fruit visualisation and biscuit bar visualisation. All background variables were included in regression analyses. All background variables were significantly correlated with intention outcomes (smallest $r = 0.16$, $p = 0.02$). Further regression analyses were also conducted for immediate consumption, to include intentions and attitudes towards

consuming (model 3), and for subsequent consumption, to include intentions and attitudes towards consuming (model 3) and immediate consumption (model 4).

Results

Every participant who was asked to visualise provided description of an appropriate visualisation, excepting four participants (three participants undertaking fruit visualisation and one participant undertaking biscuit bar visualisation). These participants were removed from all analyses. No differences were found between the two visualisation groups in number of descriptive words provided on the visualisation (fruit visualisation ($N = 72$): $M = 5.2$ words ($SD = 2.5$ words), biscuit bar visualisation ($N = 75$): $M = 5.1$ words ($SD = 2.5$ words)) and difficulty of completing the visualisation (fruit visualisation: $M = -1.3$ ($SD = 1.7$), biscuit bar visualisation: $M = -0.9$ ($SD = 1.9$)) (largest $t(145) = 1.49$, $p = 0.14$).

Intentions and attitudes towards consuming fruit and biscuit bars

Mean (SD) scores per group for all intentions and attitudes towards consuming fruit and biscuit bars following visualisation and results of these analyses are shown in Table 1.

In intentions and attitudes towards consuming fruit, no effects were found dependent on fruit visualisation or biscuit bar visualisation, and no changes to these coefficients were found on inclusion of all background variables. In intentions and attitudes towards consuming biscuit bars, visualising biscuit bar consumption was associated with increased intentions to and likely consumption of biscuit bars, and no changes to these coefficients were found on inclusion of all background variables. Similar trends were also found in attitudes towards biscuit bar consumption, although significant effects were found only for likelihood of consumption in the face of threats. Mean (SD) scores per group for all background variables are given in Table 2.

Immediate fruit and biscuit bar consumption

A total of 162 participants (73% of the sample) selected a snack at the end of the study. Of those who undertook fruit visualisation, 16 (31%) participants chose fruit, 11 (21%) participants chose a fruit-based biscuit bar and 25 (48%) participants chose a non-fruit-based biscuit bar. Of those who undertook biscuit bar visualisation, 23 (43%) participants chose fruit, 17 (32%) participants chose a fruit-based biscuit bar and 13 (25%) participants chose a non-fruit-based biscuit bar. Of those who undertook no visualisation, 30 (53%) participants chose fruit, 11 (19%) participants chose a fruit-based biscuit bar and 16 (28%) participants chose a non-fruit-based biscuit bar.

In regression analyses, effects on immediate consumption were initially found dependent on fruit visualisation, where visualising fruit was associated with reduced selection of fruit ($\beta = -0.22$, $p = 0.01$), but with the inclusion of background variables, coefficients were no longer significant ($\beta = -0.19$, $p = 0.09$). Coefficients remained non-significant with the inclusion of intentions and attitudes into the model ($\beta = -0.19$, $p = 0.09$). No effects were found dependent on biscuit bar visualisation (largest $\beta = 0.02$, $p = 0.80$).

Subsequent fruit and biscuit bar consumption

A total of 79 participants (35% of total sample) provided data at follow-up. Of these, 31 participants had undertaken fruit visualisation and reported consuming 1.7 (1.5) portions of fruit and 0.5 (0.9) biscuit bars the day after visualisation; 27 participants had undertaken the biscuit bar visualisation and reported consuming 1.8 (1.3) portions of fruit and 0.7 (0.9) biscuit bars the day after visualisation; and 21 participants had undertaken no visualisation and reported consuming 2.4 (1.7) portions of fruit and 0.6 (0.8) biscuit bars the following day. In regression analyses, no effects were found as a result of fruit visualisation (largest $\beta = -0.21$,

Table 1. Mean (and standard deviation) score for all intention and attitude variables, with regression analysis results.

Outcome variable	Fruit visualisation	Biscuit bar visualisation	No visualisation	Effects due to fruit visualisation	Effects due to biscuit bar visualisation
Intend to consume fruit	1.1 (1.7)	1.1 (1.6)	0.9 (1.7)	Model 1: $\beta = 0.06, p = 0.45$ Model 2: $\beta = 0.07, p = 0.29$	Model 1: $\beta = 0.06, p = 0.46$ Model 2: $\beta = 0.05, p = 0.46$
Likely to consume fruit	0.9 (1.8)	1.1 (1.6)	0.8 (1.8)	Model 1: $\beta = 0.04, p = 0.65$ Model 2: $\beta = 0.04, p = 0.48$	Model 1: $\beta = 0.09, p = 0.27$ Model 2: $\beta = 0.05, p = 0.37$
Perceived control over fruit consumption ($\alpha = 0.84$)	2.0 (0.9)	1.9 (1.1)	2.0 (1.1)	Model 1: $\beta = -0.02, p = 0.82$ Model 2: $\beta = 0.02, p = 0.78$	Model 1: $\beta = -0.05, p = 0.50$ Model 2: $\beta = -0.08, p = 0.30$
Affect over fruit consumption ($\alpha = 0.85$)	1.3 (0.8)	1.3 (0.8)	1.4 (0.8)	Model 1: $\beta = -0.05, p = 0.55$ Model 2: $\beta = -0.02, p = 0.72$	Model 1: $\beta = -0.08, p = 0.33$ Model 2: $\beta = -0.07, p = 0.31$
Value of fruit consumption ($\alpha = 0.75$)	1.4 (1.0)	1.6 (1.1)	1.5 (1.0)	Model 1: $\beta = -0.05, p = 0.57$ Model 2: $\beta = -0.04, p = 0.55$	Model 1: $\beta = 0.03, p = 0.69$ Model 2: $\beta = 0.06, p = 0.35$
Likely to consume fruit in the face of threats ($\alpha = 0.24$)	-0.4 (1.0)	-0.4 (1.3)	-0.5 (1.0)	Model 1: $\beta = 0.06, p = 0.45$ Model 2: $\beta = 0.05, p = 0.57$	Model 1: $\beta = 0.04, p = 0.64$ Model 2: $\beta = 0.05, p = 0.57$
Intend to consume biscuit bars	-0.9 (1.8)	-0.0 (1.9)	-1.0 (1.8)	Model 1: $\beta = 0.04, p = 0.59$ Model 2: $\beta = -0.02, p = 0.77$	Model 1: $\beta = 0.25, p < 0.01$ Model 2: $\beta = 0.20, p < 0.01$
Likely to consume biscuit bars	-0.6 (2.0)	0.4 (2.0)	-0.7 (2.0)	Model 1: $\beta = 0.01, p = 0.87$ Model 2: $\beta = -0.04, p = 0.45$	Model 1: $\beta = 0.23, p < 0.01$ Model 2: $\beta = 0.19, p < 0.01$
Perceived control over biscuit bar consumption ($\alpha = 0.78$)	1.7 (1.3)	1.7 (1.1)	1.6 (1.3)	Model 1: $\beta = 0.04, p = 0.66$ Model 2: $\beta = 0.06, p = 0.48$	Model 1: $\beta = 0.01, p = 0.87$ Model 2: $\beta = 0.02, p = 0.80$
Affect over biscuit bar consumption ($\alpha = 0.60$)	0.6 (1.2)	1.1 (1.0)	0.8 (1.1)	Model 1: $\beta = -0.06, p = 0.48$ Model 2: $\beta = -0.10, p = 0.17$	Model 1: $\beta = 0.14, p = 0.08$ Model 2: $\beta = 0.09, p = 0.19$
Value of biscuit bar consumption ($\alpha = 0.61$)	-1.0 (1.0)	-0.9 (0.9)	-1.1 (0.9)	Model 1: $\beta = 0.05, p = 0.55$ Model 2: $\beta = 0.01, p = 0.93$	Model 1: $\beta = 0.13, p = 0.09$ Model 2: $\beta = 0.12, p = 0.08$
Likely to consume biscuit bars in the face of threats ($\alpha = 0.40$)	-1.0 (1.2)	-1.4 (1.1)	-1.1 (1.1)	Model 1: $\beta = 0.03, p = 0.66$ Model 2: $\beta = -0.01, p = 0.95$	Model 1: $\beta = -0.13, p = 0.11$ Model 2: $\beta = -0.16, p = 0.04$

^aCronbach's alphas for reliability.

Table 2. Mean (standard deviation) scores per group on all background variables.

	Fruit visualisation (<i>n</i> = 72)	Biscuit bar visualisation (<i>n</i> = 75)	No visualisation (<i>n</i> = 72)
Gender	13% male	18% male	20% male
Age (years)	22.4 (7.6)	22.3 (6.7)	23.4 (8.9)
Imagery (familiarity and ability)	0.3 (0.7)	0.3 (0.8)	0.3 (0.9)
Snack on fruit (1: rarely to 5: always)	3.2 (0.9)	3.3 (0.9)	3.2 (1.0)
Snack on biscuit bars (1: rarely to 5: always)	3.2 (0.9)	3.0 (1.0)	3.0 (1.0)
Fruit consumption yesterday (portions)	1.8 (1.5)	2.0 (1.4)	1.7 (1.4)
Fruit consumption on average (portions)	3.7 (3.2)	4.1 (4.5)	4.7 (6.4)
Need to increase fruit (-3 - +3)	-1.4 (1.8)	-1.4 (1.7)	-1.6 (1.6)
Easy to alter (-3 - +3)	0.9 (1.5)	1.2 (1.5)	1.2 (1.6)
Like fruit (-3 - +3)	1.8 (1.4)	1.9 (1.3)	1.8 (1.5)
Fruit important (-3 - +3)	1.7 (1.3)	1.6 (1.6)	1.7 (1.3)
Biscuit bar consumption yesterday	0.8 (1.0)	0.9 (1.4)	0.6 (0.9)
Biscuit bar consumption on average	1.7 (2.2)	1.6 (2.1)	1.5 (2.8)
Need to alter biscuit bars (-3 - +3)	0.9 (1.9)	1.0 (2.0)	1.1 (1.8)
Easy to alter (-3 - +3)	0.8 (1.7)	0.6 (1.8)	0.7 (1.9)
Like biscuit bars (-3 - +3)	1.1 (1.9)	1.2 (1.5)	1.0 (1.7)
Biscuit bars important (-3 - +3)	-1.8 (1.4)	-1.9 (1.4)	-1.9 (1.3)
Health important (-3 - +3)	2.2 (1.0)	2.0 (1.1)	2.1 (1.1)
Others' perception of health important (-3 - +3)	0.1 (1.1)	-0.1 (1.1)	-0.2 (1.0)

$p = 0.14$) or biscuit bar visualisation (largest $\beta = -0.20$, $p = 0.14$).

Discussion

Two key results emerge from this study. First, a single goal-based visualisation of snacking on fruit did not impact on fruit intentions, attitudes or consumption, once background variables were taken into account; second, a single goal-based visualisation of snacking on biscuit bars did impact on intentions and attitudes to consume biscuit bars.

The absence of effects of visualisation on intentions, attitudes and consumption of fruit is contrary to that hypothesised, based on the findings of Knäuper et al. (2011). The reason for this discrepancy is unclear. The effects of Knäuper et al. (2011) were only found in

participants who were low consumers of fruit, whereas the participants in our study were higher consumers. The effects of Knäuper et al. (2011) were also found only in self-reported consumption and not in intentions or attitudes, and behavioural effects may somehow by-pass intentions and attitudes (Ogden, 1998), but effects in our study were found neither in intentions nor in behaviour. This absence of effects may suggest simply that effects of visualisation on fruit consumption are less robust than previously suggested.

Methodological explanations may also be provided, but these are unlikely given the effects found for biscuit bar visualisation using the same methodology. Interestingly, in our study, visualising snacking on biscuit bars did result in a significant increase in intentions towards and likelihood of consuming biscuit

bars. This result is more in line with previous publications of success following mental visualisation (e.g. Knäuper et al., 2011; Libby et al., 2007; Martin and Hall, 1995). Taken together, the findings here for fruit and biscuit bar visualisation may suggest that either some behaviours such as biscuit bar consumption are particularly open to augmentation by visualisation, other behaviours such as fruit consumption are particularly resistant to visualisation, or both. Fruit consumption and biscuit bar consumption differ on a number of characteristics, including social norms, social desirability and regular activity. Notably, in this study, participants reported snacking on fruit and biscuit bars at an equivalent rate and reported an equivalent ease of changing consumption, but reported higher fruit consumption yesterday and on average, and a greater liking for fruit. Participants also reported agreement that fruit was important for health, disagreement that biscuit bars were important for health, disagreement that they needed to increase their fruit consumption and agreement that they needed to alter their biscuit bar consumption. Taken together, these findings may suggest that visualisation may only be effective for behaviours that are unusual and/or that individuals are motivated to carry out, although possibly not for health reasons. The successful use of visualisation for increasing unusual or desired behaviours is consistent with the positive findings of the study by Knäuper et al. (2011) and the majority of other studies where positive effects of mental visualisation have been reported. For the low consumers of the Knäuper et al. (2011) study, eating fruit would be an unusual behaviour. Similarly, in sporting and rehabilitation arenas, individuals often use visualisation specifically for novel, unpractised or little-practised behaviours (e.g. Bernier and Fournier, 2010; Gregg et al., 2011). Drillisk et al. (1994) also found a greater effect of visualisation in novice or naive performers compared to those with more experience. In sports and rehabilitation also, individuals are often highly motivated to achieve their goals (e.g. Bernier

and Fournier, 2010). The possibility that 'health' may be a poor motivator for behaviour change is interesting but has been suggested elsewhere, particularly for individuals who are currently healthy (Ogden, 1998). The suggestion that visualisation may be more effective for behaviours that are unusual and/or that individuals are motivated to carry out, however, clearly needs further investigation before conclusions can be drawn.

Other explanations for a lack of effect of mental visualisation on fruit consumption may also exist. Consuming fruit is a socially desirable behaviour (Ogden, 1998), and thus effects may have been masked. Notably, all consumers reported high intentions to consume fruit, and high intentions in the biscuit bar visualisation and no-visualisation groups could have masked an effect in the fruit visualisation group. Furthermore, the study by Knäuper et al. (2011) demonstrates not only that mental visualisation can affect fruit consumption, but also greater effects for mental visualisation in combination with implementation intentions. Other studies also suggest that the effects of mental visualisation may be more pronounced in combination with other strategies. Sherman et al. (2010), for example, found positive effects of mental visualisation in combination with sensory stimulation for dental flossing, and in combination with motor stimulation for exercise.

The use of specific goals during visualisation and the specifics of the visualised picture may also be important (Gregg et al., 2011; Knäuper et al., 2011). Studies reporting success using visualisation have often asked individuals to visualise specific behaviours, which are subsequently measured (e.g. 'Mentally image yourself consuming extra portions of fruit each day for the next 7 days' (Knäuper et al., 2011: 607)), and which participants subsequently perform better, while studies reporting few effects of visualisation have used less specific goals (e.g. 'Now imagine that you leave all the pain you experience at the beach post' (Verkaik et al., 2013: 4)), which are also more difficult to measure. Pham and Taylor (1999) also found

greater success using process instructions compared to outcome instructions in an exam study task; Martin and Hall (1995) found greater success using performance plus outcome instructions compared to performance-only instructions in a golf-putting task; and Libby et al. (2007) found effects dependent on perspective (first vs third person) used. Knäuper et al. (2011) also suggest that inclusion of sensory, motor and emotive aspects of visualisation may improve success, and studies demonstrating limited benefits of visualisation suggest a role for the positive nature of images or a role for emotion (Gregg et al., 2011; Verkaik et al., 2013). All of these studies demonstrate the importance of the details of the visualisation.

Effects in immediate consumption were found as a result of fruit visualisation, but these were removed once background variables were taken into account. The initial effect (a lower selection of fruit by those visualising snacking on fruit) may represent a habituation effect or a counter-stimulation effect, where early stimulation by visualisation results in a subsequent diminished response (e.g. Morewedge et al., 2010; Pham and Taylor, 1999), but removal of the effect on inclusion of all background variables suggests that these background variables account for the effect. This finding suggests that even where visualising snacking on fruit can affect subsequent behaviour, this behaviour is more heavily influenced by other variables. Strong influences of variables such as previous fruit consumption, regular fruit consumption and liking for fruit are unsurprising (Appleton et al., 2010; Armitage, 2007; Knäuper et al., 2011; Martin and Hall, 1995; Pham and Taylor, 1999). Snack selection may also have been affected by social norms or social pressure (from individuals outside of the study), resulting in increased selection of the more socially acceptable biscuit bar snack (e.g. Ogden, 1998), or by self-reward, resulting in the selection of a more desirable snack as perceived payment for involvement in the study (e.g. Rogers, 1987; Stubbs et al., 1998), although study snacks were specifically selected to try and avoid this perception.

No other effects in immediate consumption or in subsequent consumption were found, even where changes in intentions to consume and likelihood of consuming biscuit bars were found. These results demonstrate that while visualisation for biscuit bars was shown to be effective for intentions to consume, effects did not extend to actual consumption. Thus, the current visualisation method is limited in actually modifying behaviour. This gap between intentions and behaviour is frequently reported (e.g. Knäuper et al., 2011; Martin and Hall, 1995; Pham and Taylor, 1999; Sherman et al., 2010), and strategies such as the addition of implementation intentions and the addition of actions to mental visualisation are showing some success in reducing this gap. This study thus may again have benefitted from the addition of some of these strategies.

Limitations in the methodology may also provide explanations for the possible lack of effects. Participants undertook one visualisation episode, and this may have been insufficient for adequate mental representations to form (Gregg et al., 2011; Martin and Hall, 1995; Pham and Taylor, 1999). Future studies could therefore incorporate a longer or more detailed intervention, in addition to the use of additional stimulation or strategies, as above. The use of a limited selection of snacks at the end of the study may also have affected the detection of effects on immediate consumption. Previous studies on recall have suggested food-item-specific effects where, for example, recalling eating carrots affected subsequent carrot intake, but did not affect celery intake (Higgs 2008). The use of self-report for subsequent fruit consumption and the poor response rate to the email measuring this also limit the value of the results on subsequent consumption. Alternative methods of measurement and contact may be beneficial. The use of a debriefing procedure may also have been useful to investigate effects due to demand characteristics despite attempts to control for this. Participants were also not specifically selected for high visualisation or imagery ability. Previous work suggests that

imagery ability may impact the value of mental imagery (e.g. Marks, 1973, 1999), but our intention was to investigate the value of visualisation as a population-wide public health strategy, thus for all individuals of the population. Imagery ability as assessed at the start of the questionnaire, however, also did not alter the effects or lack of effects found here when included in regression analyses (alongside all other background variables). Details of the methodology however cannot explain a lack of effects for fruit, while effects for biscuit bars using the same methodology were found.

Conclusion

Visualising snacking on fruit had no effect on subsequent intentions to consume fruit or subsequent consumption of fruit. Visualising snacking on biscuit bars, however, was found to result in increased intentions to consume and likelihood of consuming biscuit bars using the same methodology. These findings suggest different effects for different visualised behaviours. Further investigation is needed before recommending visualisation for increasing fruit consumption.

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