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'Eat five a day' vs 'Eat one more': Increased fruit and vegetable consumption when goals are provided, and when goals are more achievable or perceived to be easier

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ARTICLE INFO	A B S T R A C T
Handling Editor: Prof. M.M. Hetherington	Background: Three studies investigated 'achievable' and 'relevant' elements of a fruit and vegetable (FV) con-
Keywords: Fruit and vegetables Goals Goal-setting theory Ease Health promotion	 sumption goal. Study 1 compared more/less achievable goals (<i>Eut 1 more vs Eut 5)</i> and no goal on FV outcomes and potential mechanisms. Study 2 investigated more/less achievable and more/less relevant goals ('<i> for current benefit</i>' vs '<i> for future benefit</i>') on FV outcomes and mechanisms. Study 3 examined the goals of Study 2 in a real-world setting. <i>Methods:</i> Studies 1 and 2 used independent-groups designs, involving 127 and 226 participants, respectively. FV outcomes were intentions to consume FV, immediate FV selection and subsequent FV consumption. Variables studied as potential mechanisms included perceived ease of goal, perceived importance of FV, various attitudes
	and motivations. Study 3 used a mixed-design involving 10 canteens and 21 4-week FV purchasing assessment periods. <i>Results:</i> In Study 1, FV consumption was greater after both goals compared to no goal. No differences were found between goals, but FV consumption was positively associated with perceived ease of goal. In Study 2, FV selection and consumption were greater following the more achievable (<i>'Eat 1 more'</i>) goals. Several additional variables were also associated with FV outcomes. In Study 3, FV purchasing was greater during goal display, with no differences between goals. No effects of goal relevance were found. <i>Conclusions:</i> Our findings demonstrate increased FV consumption when goals are provided compared to no goal. Some benefit was also found from goals that were more achievable or perceived to be easier.

1. Introduction

Low fruit and vegetable (FV) consumption is a major public health concern. FV consumption is associated with reduced risk from a number of global health concerns, including cardiovascular disease, type II diabetes, and obesity [Aune, Giovannucci, Boffetta, et al., 2017; Oyebode et al., 2014; Tohill, 2005; World Health Organisation (WHO), 2003], yet FV consumption across Western populations is low [European Food Satefy Authority (EFSA), 2021; Public Health England (PHE), 2020; United States Department of Agriculture (USDA), 2022]. In the UK, adults are reported to consume an average 286g FV/day [PHE, 2020], compared to World Health Organization (WHO) recommendations of 400g FV/day [WHO, 2022]. Average consumption in Europe is reported at 386g FV/day [EFSA, 2021], and average consumption in the

US totals 2.39 cups FV/day, approximating 325g FV/day [USDA, 2022].

Possibly the best-known public health strategy for encouraging FV consumption has been the translation of the WHO recommendations into portion-based guidelines for consumers. In many countries, consumers are given a goal to consume 5 portions of FV per day [e.g. Helsedirektoratet, 2022; National Health Service (NHS), 2020], a minimum of 5 portions of FV per day [e.g. 5+A Day, 2022], or in some countries, consumers are given a portion-based goal of a different number of portions, but portion-size estimations would result in consumption of around or more than 400g FV per day [e.g. 5 A Day Association Japan, 2022; Deutsche Gesellschaft für Ernährung, 2022; USDA and U.S. Department of Health and Human Services, 2020; Voedingscentrum, 2022]. Awareness of these guidelines among consumers is reported to be high [Appleton, Krumplevska, Smith, et al., 2018; Ashfield-Watt, 2006;

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Carter, Pollard, Atkins, et al., 2010; Herbert et al., 2010; Rooney, McKinley, Appleton, et al., 2017], but implementation remains low.

Implicit in all these recommendations is a goal. SMART goals are described as goals that are Specific, Measurable, Achievable, Relevant and Time-bound, and the use of SMART goals is recommended for goal attainment [Wade, 2009]. The WHO recommendations are specific, measurable and time-bound. However, based on low levels of FV consumption, alongside reports from consumers on the difficulties associated with consuming FV [Appleton et al., 2010; Carter et al., 2010; Herbert et al., 2010; John & Ziebland, 2004; McMorrow et al., 2017; Pollard, Miller, Woodman, et al., 2009], it can be argued that 5-a-day goals may not be perceived as achievable. Qualitative reports demonstrate these perceptions [Appleton et al., 2010; Carter et al., 2010; Dibsdall et al., 2002; Rooney et al., 2017]. Poor understanding of the reasons for the message are also expressed [Appleton et al., 2018; Carter et al., 2010; Chapman, Havill, Watson, et al., 2016; Dibsdall et al., 2002], or reasons for consuming FV are recognized, e.g. for long-term health benefits, but these are not seen to be relevant to individuals [Carter et al., 2010; Chapman et al., 2016; Dibsdall et al., 2002; Herbert et al., 2010]. Thus, the relevance component of a SMART goal may also be lacking. Goal-setting theory [Locke & Latham, 2002; Locke & Latham, 2006] also describes a role for the achievable and relevant natures of goals in the forms of self-efficacy and goal importance, respectively. Several theories of health behaviour also include a central role for self-efficacy (e.g. Social Cognitive Theory [Bandura, 2004], the Health Action Process Approach [Schwarzer, 2008]), and/or a central role for goal importance (e.g. the Health Belief Model [Rosenstock, 1974]), and evidence supporting a role for these constructs in FV consumption is available [Bandura, 2004; Deshpande, Basil, & Basil, 2009; Dittus, Hillers, & Beerman, 1995; Guillaumie, Godin & Vezina-Im, 2010; Schwarzer, 2008; Shaikh, Yaroch, Nebeling, et al., 2008; Wiedemann et al., 2009].

In the only other investigation of the 5-a-day FV message as a goal, of which we are aware, Ungar, Sieverding & Stadnitski [2013] found greater FV consumption following the provision of a '5-a-day' goal compared to an easier 'Just one more' goal. This finding is surprising and contradicts the theoretical suggestions given above. The mechanisms underlying these effects were not investigated; notably, underlying perceptions, such as the achievable nature or perceived ease of the goal, self-efficacy and relevance or goal importance were not assessed.

This work aimed to investigate the impact of increasing the 'achievable' and 'relevant' elements of a FV consumption goal. In Study 1, we examined the effects on FV consumption of two FV health promotion goals compared with no goal. Our two FV health promotion goals were less achievable 'Eat 5 portions of FV today' and more achievable 'Eat 1 more portion of FV today'. Underlying perceptions of ease of goal and goal importance were also assessed. In Study 2, effects of relevance were also investigated. We compared the effects on FV consumption of four FV health promotion goals: 'Eat 5 portions of FV today for current benefit', 'Eat 5 portions of FV today for future benefit', 'Eat 1 more portion of FV today for current benefit', and 'Eat 1 more portion of FV today for future benefit'. A range of underlying individual perceptions were also assessed. In Study 3, the four health promotion goals of Study 2 were assessed for impacts on FV purchasing in a real-world scenario. All studies were planned independently (thus, study 2 did not depend on the results of study 1, and study 3 did not depend on the results of studies 1 or 2). Different studies were used to test for effects and potential mechanisms in a number of scenarios.

All studies were undertaken in British student samples. This population group generally have poor healthy eating practices, including low FV consumption [Deliens et al., 2014; Malinauskas, Raedeke, Aeby, et al., 2006], and are likely to benefit from the development of long term healthy eating habits. All goals were provided using gain-framed as opposed to loss-framed language, which clearly defined the target behaviour, as has been suggested for encouraging preventive behaviours, such as healthy eating [Gallagher & Updegraff, 2011; Lewis,

Thomas, Hyde, et al., 2010]. The health benefits of FV consumption have been demonstrated as linear, particularly at low levels of consumption, thus the consumption of one more portion of FV is beneficial for health [Aune et al., 2017]. In studies 2 and 3, the benefits of consuming FV were related specifically to a healthy body weight. FV are beneficial for body-weight, both as energy-dilute foods for those who are overweight [Tohill, 2005; WHO, 2003], and as often acceptable nutritious foods for those who are underweight [National Institutes of Clinical Excellence, 2021], and we have recently demonstrated increased value from a weight-based, compared to a health-based, health promotion message for increasing FV selection and consumption without negative side effects [Appleton, 2016; Appleton, 2023]. Body weight is also known to be important to young adult populations and healthy weight control strategies will also likely be of benefit [Deliens et al., 2014; Malinauskas et al., 2006]. Effects of all goals were assessed using FV consumption (Studies 1 and 2), intentions to consume FV (Studies 1 and 2), immediate FV selection at the end of the study (Study 2), and FV selection and purchase (Study 3). Of these, we considered the consumption, selection and purchase outcomes as those of greatest importance, as those that will directly impact health. We hypothesized that all FV outcomes would be greater following goals compared to no goals, following messages to 'Eat 1 more ... ' compared to 'Eat 5 ... ', and following messages to consume for 'current' compared to 'future' benefit.

2. Study 1

Study 1 sought to investigate the effects on FV consumption of a more achievable health promotion goal (*'Eat 1 more portion of FV today'*), a less achievable health promotion goal (*'Eat 5 portions of FV today'*), and no goal, while also investigating some potential underlying mechanisms for any effect.

2.1. Methods

Using an independent-groups design, participants were randomly assigned to receive one of two health promotion messages or a control message, and subsequent FV consumption, intentions to consume FV in the future, and various characteristics likely to be associated with FV consumption were assessed.

2.1.1. Participants

In total, 127 British University students (48 (38 %) male; aged 20.9 \pm 2.7 years) took part in the study. To increase ecological validity, all participants who volunteered for the study were invited to take part; there were no exclusion criteria. Participants were unaware of the true purpose of the study, and to reduce demand characteristics, information sheets promoted the study as an investigation of *'the impacts of different health promotion messages*'. Ethical approval for the study was given by the Research Ethics Committee of Bournemouth University, UK, prior to commencement (ID 23297/8/9), and the study was conducted with full adherence to the Ethical Principles of the British Psychological Society. All participants provided written informed consent.

2.1.2. Health promotion goals

Two health promotion messages were used: '*Eat 1 more portion of fruit or vegetables today*'; and '*Eat 5 portions of fruit or vegetables today*'. Messages were displayed on magnets, approx. $10 \text{ cm} \times 5 \text{ cm}$ in size, intended for placement on a metallic kitchen surface. Each magnet consisted of a central message (as above) surrounded by coloured pictures of FV and also included the phrase 'Don't forget to fill in your food diary'. All magnets were identical, excepting the central message, to be displayed in an easily visible location in the kitchen for one week. The two health promotion goals are shown in the Supplementary Materials.

2.1.3. No goal control

As an alternative to the health promotion messages, a control group

also received a magnet with no health promotion goal. These magnets looked identical to those with the health promotion goals, but included only the phrase '*Don't forget to fill in your food diary*'. The control magnet is also shown in the Supplementary Materials.

2.1.4. FV outcomes: subsequent consumption and future intentions

FV consumption was assessed both before and during the one-week intervention using food diaries. Participants were asked to record all FV consumed throughout the day for 3 days before the intervention, as a baseline measure, and then for each day while the magnet was in place. Participants were only asked to report FV consumption, following training on FV portion sizes as recommended in the UK [NHS, 2020]. Baseline diaries were assessed following completion via interviews between participants and researchers, to ensure all participants were completing the diaries accurately, and were content to continue with the study.

Intentions to consume FV in the future were assessed with a single question 'Do you intend to increase your FV consumption in the future?', using a 3-point Likert scale ('no', 'maybe/unsure', 'yes'), each scored -1, 0, 1, respectively.

2.1.5. FV consumption: additional variables

Various characteristics of potential impact on FV consumption were also assessed [Appleton, 2016; Appleton, 2023; Appleton, Dinnella, Spinelli, et al., 2019; Appleton et al., 2010; De Bruijn, 2010; De Bruijn, Kremers, de Vet et al., 2007; Herbert et al., 2010; Pollard et al., 2009]. Given the proposed value of the achievable nature of the goal, and considering associations between relevance and goal importance, perceived ease of goal ('How easy or difficult was it for you to adhere to the message on your magnet?' (very difficult - very easy)) and perceived importance of FV consumption ('How important to you personally are fruits and vegetables in your diet?' (very unimportant - very important)) were assessed. With the importance of effort in goal-setting theory [Locke & Latham, 2002; Locke & Latham, 2006], effort applied ('How much effort did you put in to adhere to the message on your magnet?' (none at all – a lot indeed)) was also assessed. Additional characteristics known to impact FV consumption were: gender; age; liking for FV ('How much do you like fruits and vegetables?' (not at all – like very much)); perceived awareness of FV consumption ('Are you aware of the fruits and vegetables you eat?' (no, unsure, yes)); and the perceived importance of other people ('Do you feel that other people had an effect on your fruit and vegetable consumption?' (no, maybe/unsure, yes)). All variables were measured after completion of the final food diary by questionnaire. Gender and age were measured directly, and all other variables were assessed on a 5-point Likert scale and scored to result in a score from -2 to +2 (low to high) per characteristic, with the exception of liking, which was scored out of 10 and reduced to a 5-point scale following study completion for consistency, and perceived awareness of FV consumption and the perceived importance of other people, which were assessed using a 3-point Likert scale, and scored to result in a score from -1 to +1 (low to high).

2.1.6. Procedure

Participants undertook the study individually, in their own homes, from November 2018–March 2019, with additional data collected in May 2024. Instructions were provided by researchers face-to-face, then all food diaries and questionnaire items were completed using an online survey tool (Qualtrics – www.qualtrics.com). Participants completed all aspects of the study in the following order: 1. receive instructions and provide informed consent; 2. undertake a food diary for three days; 3. confirm continued participation following the completion of comprehensive food diaries; 4. receive a study magnet to be placed in the kitchen for one week; 5. complete a food diary each day of the week; 6. complete a final questionnaire; 7. receive a debrief. Message randomization was undertaken using a dice throw by a researcher with no direct contact with participants, following satisfactory completion of baseline

food diaries and subsequent agreement to continue in the study. Allocation remained concealed during all outcome assessments. Participants were not blinded to magnet message, but were blinded to the aims of the study and to the possible alternatives.

2.1.7. Analyses

Food diary data were first converted into portions of FV consumed per day, and then meaned across the three days prior to magnet provision (baseline) and the following seven days (end) to give mean FV consumption per day. Effects on FV outcomes: end FV consumption and future FV intentions, of the provision of a goal vs no goal, and of the '*Eat 1 more* ... ' vs '*Eat 5* ... ' goal were investigated separately. For both comparisons, effects were investigated using multiple regression, where FV outcomes were investigated in model 1) using message condition (goal vs no goal; '*Eat 1 more* ... ' vs '*Eat 5* ... '), in model 2) using message condition, perceived ease of goal and perceived importance of FV, and in model 3) using message condition, perceived ease of goal, perceived importance of FV and all individual characteristics including baseline FV consumption. Checks in advance of these analyses revealed no concerns over multi-colinearity (largest r = .38) [Howell, 2020].

2.2. Results

2.2.1. Participants

Following randomization, 44 participants received message '*Eat 1* more portion of FV today', 42 participants received message '*Eat 5 portions* of FV today' and 41 participants received no goal. All participants completed all food diaries, but three participants failed to complete the following questionnaire (2 participants from the '*Eat 1 more* ... ' group, 1 participant from the no goal group). To allow these individuals to be included in analyses, missing data for gender and age were completed with the mode and mean for the whole sample, respectively, and missing data for all individual characteristics were completed with the midpoint of each response set. Participant characteristics are given in Table 1.

2.2.2. Goal vs No goal

Comparing a goal (*Eat 1 more* ... / *Eat 5* ...) vs no goal, in initial analyses, end FV consumption was significantly higher when a goal was provided compared with no goal (Beta = .301, p < 0.01). In model 2, end FV consumption was positively associated with both goal provision (Beta = .310, p < 0.01) and with perceived ease of following the goal (Beta = .397, p < 0.01). There was no association with perceived importance of FV (Beta = .083, p = 0.29). On consideration of all background variables, provision of a goal vs no goal (Beta = .228, p < 0.01) and ease of following the goal (Beta = .230, p < 0.01) remained significant. End FV consumption was also positively associated with baseline FV consumption (Beta = .503, p < 0.01) and effort applied (Beta = .161, p = 0.02).

In future FV intentions, there was no effect of goal vs no goal in any

Table 1

Participant characteristics and FV	outcomes,	per group	(N = 127),	, mean (SD)
unless stated otherwise.				

	Goal: ' <i>Eat 1 more</i> ' (N = 44)	Goal: <i>'Eat 5</i> ' (N = 42)	No goal (N = 41)
Baseline (FV portions/day)	3.0 (1.4)	3.1 (1.5)	2.7 (1.1)
End (FV portions/day)	3.4 (1.5)	3.6 (1.4)	2.6 (1.1)
Future FV intentions $(-1 - +1)$.5 (.7)	.7 (.6)	.5 (.7)
Ease (-2 - +2)	.2 (.9)	.0 (1.0)	.1 (.7)
Importance of FV $(-2 - +2)$.9 (.8)	.9 (.9)	1.0 (.7)
Gender (males: N (%))	16 (36 %)	17 (40 %)	15 (37 %)
Age (years)	20.8 (2.8)	19.7 (2.0)	22.1 (2.7)
FV Liking (-2 - +2)	1.2 (.6)	1.1 (.7)	.7 (.7)
Awareness of FV $(-1 - +1)$.7 (.7)	.6 (.7)	.7 (.6)
Importance of the opinions and actions of others $(-1 - +1)$.0 (.9)	2 (.9)	0 (.9)
Effort applied $(-2 - +2)$.1 (.8)	.4 (.7)	2 (1.0)

model (largest Beta = .049, p = 0.58), nor was there any effect of perceived ease (largest Beta = .125, p = 0.17) or perceived importance of FV (largest Beta = -.104, p = 0.23). In model 3, future FV intentions were positively associated with awareness of FV consumption (Beta = .449, p < 0.01). Full results of all regression analyses are given in Table 2.

2.2.3. Goal: 'Eat 1 more ... ' vs 'Eat 5 ... '

Comparing the two goals 'Eat 1 more ... ' vs 'Eat 5 ... ', there was no effect of goal type on end FV consumption in any model (largest Beta = .102, p = 0.28). In models 2 and 3, end FV consumption was positively associated with ease of following the goal (smallest Beta = .362, p <0.01), but there were no associations with perceived importance of FV (largest Beta = .008, p = 0.94). In model 3, end FV consumption was also positively associated with baseline FV consumption (Beta = .464, p <0.01).

In future FV intentions, there was no effect of goal type in any model (largest Beta = .179, p = 0.09). In model 2, FV intentions were positively associated with ease of following the goal (Beta = .223, p = 0.05), but this was reduced on consideration of all other variables in model 3 (Beta = .209, p = 0.08). There were no effects of perceived importance of FV (largest Beta = -.169, p = 0.12). In model 3, future FV intentions were also positively associated with awareness of FV consumption (Beta = .467, p < 0.01). Full results of all regression analyses are given in Table 2.

2.3. Summary

This study demonstrates greater FV consumption when participants are provided with a goal compared to no goal, but type of goal ('Eat 1 more ... ' vs 'Eat 5 ... ') had no effect. Greater FV consumption was also associated with greater perceived ease of the goal, regardless of goal type. FV consumption and intentions were also associated with additional variables known to affect FV consumption, but no effects of goal

Table 2

c 11 ograssion analyses (N = 127) importance were found.

3. Study 2

Study 2 sought to investigate the effects on FV outcomes of four health promotion goals based on achievable nature ('Eat 1 more portion of FV today ... ' vs 'Eat 5 portions of FV today ... ') and relevance (' ... for current benefit' vs ' ... for future benefit'), while also investigating several potential underlying mechanisms for any effect.

3.1. Methods

Using an independent-groups design, participants were randomly assigned to view one of four health promotion messages, and intentions to consume FV, immediate FV selection, subsequent FV consumption, and various additional characteristics likely to be associated with FV consumption were assessed. Equivalent measures of biscuit bar consumption were also undertaken as a control.

3.1.1. Participants

A total of 226 British University students (64 (28 %) male; aged 21.0 \pm 5.5 years) took part. To increase ecological validity, all participants who volunteered for the study were invited to take part; there were no exclusion criteria. Participants were unaware of the true purpose of the study, and to reduce demand characteristics, information sheets promoted the study as investigating 'individual preferences for posters for a range of health behaviours'. Ethical approval for the study was given by the Research Ethics Committee of Bournemouth University, UK, prior to commencement (ID 1724), and the study was conducted with full adherence to the Ethical Principles of the British Psychological Society. All participants provided written informed consent.

3.1.2. Health promotion messages

Four health promotion messages were used: 'Eat 1 more portion of

Results of all regression analyses (N	- 127).							
	Goal vs No Goal					at 1 more ' vs 'Eat 5	,	
	FV const	umption	Future F	V intentions	FV cons	umption	Future FV intentions	
			$R^2 = .01$, adj. $R^2 = .01$, F(1,126) = .31, p = 0.58		$R^2 = .01$, adj. $R^2 = .01$, F(1,85) = .36, p = 0.55		$R^2 = .02$, adj. $R^2 = .01$, F(1,85) = 1.50, p = 0.23	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
No goal vs goal Goal: Eat 1 more vs Eat 5	.301	<.01	.049	.58	.065	.55	.132	.23
	$R^2 = .20$ (3,126)	6, adj. R ² = .25, F = 14.44, p < 0.01	$R^2 = .02$ = .80, p	, adj. R ² = .01, F(3,126) = 0.50	R ² = .2 (3,85) =	7, adj. R ² = .24, F = 10.10, p < 0.01	$R^2 = .07$ = 2.18,	7, adj. R ² = .04, F(3,85) p = 0.10
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
No goal vs goal Goal: Eat 1 more vs Eat 5	.310	<.01	.049	.58	.102	.28	.148	.17
Ease	.397	<.01	.125	.17	.515	<.01	.223	.05
Importance of FV	.083	.29	053	.56	.008	.94	150	.18
	$R^2 = .59$ (10,126)	9, adj. R ² = .56, F) = 16.83, p < 0.01	R ² = .24, adj. R ² = .18, F (10,126) = 3.72, p < 0.01		R ² = .56, adj. R ² = .50, F (10,85) = 9.64, p < 0.01		R ² = .31, adj. R ² = .21, F (10,85) = 3.31, p < 0.01	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
No goal vs goal Goal: Eat 1 more vs Eat 5	.228	<.01	.037	.70	.079	.34	.179	.09
Ease	.230	<.01	.108	.24	.362	<.01	.209	.08
Importance of FV	.042	.52	104	.23	003	.97	169	.12
Gender	.021	.74	.012	.89	.096	.26	.075	.48
Age	.111	.09	013	.89	.134	.11	.021	.84
Baseline FV consumption	.503	<.01	.114	.23	.464	<.01	.042	.72
FV Liking	.051	.50	015	.89	015	.88	.039	.76
FV Awareness	090	.16	.449	<.01	138	.10	.467	<.01
Importance of the opinions of others	085	.18	.028	.75	039	.63	039	.70
Effort applied	.161	.02	.082	.37	.103	.26	065	.57

fruit or vegetables today for your current body weight' (Message 1C); 'Eat 1 more portion of fruit or vegetables today for your future body weight' (Message 1F); 'Eat 5 portions of fruit or vegetables today for your current body weight' (Message 5C); and 'Eat 5 portions of fruit or vegetables today for your future body weight' (Message 5F). Messages were displayed on posters, each consisting of a central message surrounded by coloured pictures of fruit. All posters were identical, excepting the central message. All four posters are provided in the Supplementary Materials.

3.1.3. FV outcomes: FV intentions, immediate selection and subsequent consumption

Intentions to consume FV were assessed immediately after poster viewing using two intention questionnaire items relevant to 'today', and two questions relating to 'tomorrow': '*I intend to eat fruit and vegetables later today [tomorrow]*' and '*I am likely to eat fruit and vegetables later today [tomorrow]*'. Questions were responded to on a 7-point Likert scale anchored from 'strongly disagree' – 'strongly agree'.

Immediate FV selection was assessed by offering participants a choice of one of twelve snacks on completion of the study as a token of thanks: four items of fruit - two apples, two bananas; four fruit-based biscuit bars – two apple *Kellogg's Nutrigrain* bars, two strawberry *Kellogg's Nutrigrain* bars; and four non-fruit-based biscuit bars – two golden oats *Kellogg's Elevenses*, two ginger bake *Kellogg's Elevenses*. The biscuit bars were considered comparable to the fruit snacks considering usual use [Appleton, Hemingway, Saulais, et al., 2016; Glasson et al., 2011], and deliberately did not include chocolate to avoid selection of certain snacks specifically as a reward or treat. Snack selection was observed covertly by the researcher prior to the participant leaving the laboratory. No snack was also permitted as a choice.

Subsequent consumption was assessed firstly by self-report two days and seven days after poster viewing, by email, in response to an email requesting 'number of portions of fruit and vegetables consumed yesterday'. Secondly, subsequent consumption was assessed by providing participants with 7 apples at the end of the study, again as a thank you token for taking part. Participants were told that the apples (one for the next 7 days) were for them to consume as they wished. They were asked not to give them away or allow others to eat them, but they were also not instructed to eat them - no emphasis was placed on consumption. At the end of the seven day period, participants were contacted by email, number of apples eaten was requested, and payment (50p per apple) was offered for any uneaten apples that were returned to the research unit by the next day. This procedure was untaken to encourage participants to be accurate and truthful about their apple consumption, as apple consumption was likely to have been perceived as a desired behaviour. Manipulation of the measure for profit was unlikely because apples were not easily or cheaply available on or near the study location and returns were required within one day.

3.1.4. FV consumption: additional variables

Various characteristics of potential impact on FV consumption [Appleton, 2016; Appleton, 2023; Appleton et al., 2019; Appleton et al., 2010; De Bruijn, 2010; De Bruijn et al., 2007; Glasson et al., 2011; Herbert et al., 2010; Pollard et al., 2009] were also assessed by questionnaire. These were gender; age; past FV consumption ('Yesterday, how many portions of FV did you eat?'); usual FV consumption ('On an average week day, how many portions of FV do you eat?', 'On an average weekend day, how many portions of FV do you eat?'); awareness of FV consumption ('I need to increase my intake of FV' (strongly disagree - strongly agree)); liking for FV ('I like FV' (strongly disagree - strongly agree)); usual motivation towards health ('How important is your health to you?' (not at all extremely important), 'I try to keep in good health' (strongly disagree strongly agree), 'I wish I was more healthy' (strongly disagree - strongly agree)); usual motivation through body-weight based concerns ('How important is your weight to you?' (not at all – extremely important), 'I try to keep a healthy body weight' (strongly disagree - strongly agree), 'I wish I had a different body weight' (strongly disagree - strongly agree)); motivation

towards future health ('How important is your future health to you?' (not at all - extremely important)'; motivation towards future body weight ('How important is your future weight to you?' (not at all – extremely important)'; perceived importance of the opinions of others ('I would be affected if someone criticized my diet' (strongly disagree – strongly agree), 'What other people think of my diet matters to me' (strongly disagree – strongly agree)); attitudes towards FV consumption today [tomorrow] ('My snacking on *FV* later today [tomorrow] would be: unpleasant – pleasant; unenjoyable – enjoyable; worthless - valuable; harmful - beneficial'); self-efficacy over FV consumption today [tomorrow] ('How easy will it be for you to snack on FV today [tomorrow]? (not at all - very easy)', 'If I wanted to, I would not have problems succeeding to snack on FV later today [tomorrow]' (strongly disagree – strongly agree), 'How confident are you that you could snack on FV later today [tomorrow]?' (not at all - completely confident)); and perceived behavioural control (PBC) today [tomorrow] ('How much control do you feel over whether or not you snack on FV later today [tomorrow]?' (none at all – complete control), 'I feel in complete control of whether or not I snack on FV later today [tomorrow]' (strongly disagree – strongly agree)).

The Theory of Planned Behaviour (TPB) [Ajzen, 2002] was used as a theoretical framework for the study, alongside goal-setting theory [Locke & Latham, 2002; Locke & Latham, 2006] to further explain any variance in our outcomes, hence the use of some particular constructs. FV attitudes, self-efficacy and PBC were assessed after poster viewing; all other participant characteristics were assessed prior to poster viewing. Usual and past FV consumption were measured in portions consumed/day. All other questionnaire items were responded to on a 7-point Likert scale, summed where appropriate, and scaled to result in a score from -3 to +3 (low - high) per characteristic. To reduce demand characteristics, alongside promotion of the study as investigating individual preferences, a range of distractor questions on poster perceptions, personal attributes and preferences were also asked. All measures were based on previous publications [Adams et al., 2015; Rennie et al., 2014].

3.1.5. Biscuit bar consumption: intentions, subsequent consumption and additional variables

Intentions to consume biscuit bars, subsequent biscuit bar consumption and relevant participant characteristics (past consumption, usual consumption, liking for biscuit bars, awareness, attitudes, selfefficacy and PBC over biscuit bar consumption) were assessed using the equivalent questionnaire measures and email requests as for FV.

3.1.6. Procedure

Participants undertook the study individually, in the Eating Behaviours Laboratory of Bournemouth University, UK, from November 2014-March 2017. All instructions and questionnaire items were provided using an online survey tool (Qualtrics - www.qualtrics.com). Participants completed the study in the following order: 1. receive instructions and provide informed consent; 2. complete questions on individual characteristics; 3. view a health promotion poster; 4. complete questions on all outcomes; 5. select a snack / no snack as a token of thanks; 6. complete subsequent outcome measures; 7. receive a debrief. Participants were given as long as they wished to complete the study while in the laboratory, to increase the ecological validity of the study, and this included as long as they wished to view the poster. Poster viewing was ensured by the requested completion of several questions on perceptions of the poster, e.g. on the colours included, message wording. Poster randomization was undertaken by a researcher with no direct contact with participants using two coin tosses, prior to each participant's entry into an individual study booth, and remained concealed during all outcome assessments. Participants were not blinded to poster message, but were blinded to the possible alternatives. All participants completed questionnaire assessments of FV intentions, selection and relevant characteristics. Subsequent consumption was requested only for a subset of 120 (53 %) individuals in the sample (randomly selected), due to resource restrictions and to limit participant burden. Responses to the follow-up email were limited to a five day and then 12 day period, to ensure direct relevance to the study. Email responses received after this were discarded and not used for analyses. Similar procedures have been published previously [Adams et al., 2015; Rennie et al., 2014].

3.1.7. Analyses

All data were analysed using multiple linear regression. Models were conducted where FV intentions, selection and subsequent consumption were predicted by 1) achievable nature and relevance, and 2) achievable nature and relevance, plus all additional variables. Separate models were conducted for each outcome. To allow regression analyses to be conducted for FV selection, snacks selected were converted into number of portions of fruit selected where fruit = 1, fruit-based biscuit bars = .33, and non-fruit-based biscuit bars = 0. Cronbach's alphas demonstrated reliability for all multi-item questionnaire scales (smallest alpha = .77) [Howell, 2020]. Checks for multi-colinearity in advance of conducting the analyses [Howell, 2020] revealed high correlations between FV self-efficacy and PBC (r = .75), thus only FV self-efficacy was included in analyses.

3.2. Results

3.2.1. Participants

Of the 226 participants who took part: 57 participants were randomized to view message 1C, 61 participants were randomized to view message 1F, 54 participants to view message 5C, and 54 participants were randomized to view message 5F. Details of all participant characteristics are given in Table 3.

All 226 participants completed all questions on intentions and confounding variables, 191 (85 %) participants chose a snack at the end of the study and so provided data on immediate FV selection, 105 (88 %) of 120 participants responded by email after 2 days and 100 (83 %) participants responded after 7 days and returned to the laboratory to provide data on subsequent FV and apple consumption. Descriptive statistics for all FV outcomes are given in Table 4.

Table 3

Participant characteristics,	by message group ($N = 226$)), mean (SD) un	less stated
otherwise.			

Message	1C (N = 57)	1F (N = 61)	5C (N = 54)	5F (N = 54)
Gender	Male: 14 (25 %)	Male: 19 (31 %)	Male: 17 (32 %)	Male: 14 (26 %)
Age (years)	20.9 (6.1)	20.7 (5.0)	20.7 (3.6)	21.6 (6.9)
Past FV consumption (FV portions/day)	2.0 (1.6)	2.2 (1.5)	2.1 (1.5)	2.3 (1.8)
Usual FV consumption (FV portions/day)	2.8 (1.9)	3.0 (1.8)	3.3 (1.8)	2.9 (2.0)
Liking for FV $(-3 - +3)$	2.2 (1.2)	1.9 (1.4)	2.0 (1.3)	1.8 (1.6)
Awareness of FV consumption (-3 - +3)	1.3 (1.6)	1.4 (1.6)	1.2 (1.7)	1.5 (1.9)
Past BB consumption (portions/day)	.6 (.9)	.6 (1.0)	.5 (.9)	.7 (1.3)
Usual BB consumption (portions/day)	.9 (1.0)	1.5 (1.5)	1.3 (1.0)	1.3 (1.8)
Liking for BB (-3 - $+3_{-}$	1.1 (1.8)	1.5 (1.3)	1.1 (1.5)	1.5 (1.5)
Health motivation (-3 - +3)	1.8 (.8)	1.8 (.8)	1.7 (.8)	1.8 (.9)
Weight motivation (-3 - +3)	1.0 (1.6)	1.0 (1.6)	1.2 (1.3)	1.0 (1.4)
Future health motivation $(-3 - +3)$	2.4 (.8)	2.1 (1.0)	2.4 (.7)	2.4 (.9)
Future weight motivations (-3 - +3)	1.8 (1.3)	1.9 (1.1)	2.0 (1.1)	1.9 (1.2)
Perceived importance of others (-3 - +3)	2 (.8)	3 (.9)	2 (.8)	3 (.7)

Table 4

FV	outcomes	(mean	(SD)),	by message	group ((N = 2)	226)
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Message	1C (N	1F (N	5C (N	5F (N
	= 57)	= 61)	= 54)	= 54)
FV: Intentions $(-3 - +3)$	1.6	1.5	1.7	1.5
	(1.6)	(1.4)	(1.4)	(1.5)
FV: Attitudes $(-3 - +3)$	2.1 (.8)	2.1 (.9)	2.1	2.1 (.9)
FV: Self-efficacy $(-3 - +3)$	2.1	2.0	2.0	2.1 (.8)
FV: PBC (-3 - +3)	2.3 (1.1)	(1.1) 2.0 (1.4)	2.3 (1.1)	2.3 (1.0)
Group	1C (N	1F (N	5C (N	5F (N
	= 46)	= 53)	= 44)	= 48)
Immediate snack choice (Fruit; FBB (fruit-based biscuit bars); BB (Biscuit bars)	Fruit = 27;	Fruit = 32;	Fruit = 17;	Fruit = 21;
	FBB = 11; BB = 8	FBB = 15; BB = 6	FBB = 24; BB = 3	FBB = 17; BB = 10
Group	1C (N	1F (N	5C (N	5F (N
	= 26)	= 27)	= 27)	= 25)
FV: 2 days (portions)	2.8	2.6	2.4	2.6
	(1.2)	(1.5)	(1.1)	(1.4)
Group	1C (N	1F (N	5C (N	5F (N
	= 25)	= 24)	= 26)	= 25)
FV: 7 days (portions)	2.2 (1.6)	2.8 (1.5)	2.0 (1.2)	2.4 (1.4)
FV: Apples (portions)	4.9	5.4	4.2	4.5
	(2.5)	(2.3)	(2.4)	(2.7)

3.2.2. 'Eat 1 more ... ' vs 'Eat 5 ... '

Results from all regression analyses are given in Table 5. In initial models, FV selection was predicted by the achievable nature of the goal (Beta = -.154, p = 0.03), such that greater FV selection was found after the message '*Eat 1 more* ... ' compared to the message '*Eat 5* ... '. This effect also remained after controlling for all other variables (Beta = -.152, p = 0.04). No effects were found in FV intentions or subsequent consumption (2 days, 7 days, apple consumption) in initial analyses (largest Beta = -.168, p = 0.10), but an effect was found in models for apple consumption after controlling for other variables (Beta = -.230, p = 0.04). Apple consumption was greater after the message '*Eat 1 more* ... ' compared to after the message '*Eat 5* ... '.

3.2.3. Current vs future body weight

No differences were found based on relevance in any FV outcome either in initial models (largest Beta = .181, p = 0.07), or with consideration of all other variables (largest Beta = .169, p = 0.08).

3.2.4. Additional FV variables

Our regression analyses also revealed additional associations when considering all variables previously associated with FV consumption. Greater intentions to consume FV later today were associated with more positive attitudes toward FV consumption and greater FV self-efficacy (smallest Beta = .218, p < 0.01). Greater intentions to consume FV tomorrow were associated with greater past FV consumption, lower awareness of a need to increase FV consumption, greater liking for FV, higher health motivations, and greater self-efficacy regarding FV consumption (smallest Beta = .125, p = 0.05). Immediate FV selection was associated with lower motivation based on body-weight concerns (Beta = -.207, p = 0.04). Greater FV consumption after 2 days was associated with more positive attitudes towards FV consumption (Beta = .250, p =0.03). Greater FV consumption after 7 days was associated with being female, lower motivation based on body-weight concerns and more positive attitudes towards FV consumption (smallest Beta = .246, p =0.03). Greater apple consumption was also associated with lower

Table 5

Results of all regression analyses (N = 226).

	Intentior	ns today	Intention tomorrov	s v	Immedia	te FV	FV 2 day	s	FV 7 day	s	Apples	
		$R^2 = .01$, ad .01, F(2,225 p = 0.43	j. R ² =) = .85,	$R^2 = .01$, ad .01, F(2,225) p = 0.79	j. $R^2 =$) = .39,	$R^2 = .02 ac$.01, F(2,19 2.31, p = 0	dj. $R^2 =$ 00) = 0.10	$R^2 = .01, a$.01, F(2,10 .34, p = 0.	udj. R ² = 04) = 72	R ² = .04, a .02, F(2,99 2.12, p =	adj. R ² = 9) = 0.13	$R^2 = .03$, adj. $R^2 = .02$, F (2,99) = 1.73, p = 0.18
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Message: 1 vs 5	085	.20	.022	.75	- .154	.03	081	.42	096	.34	168	.10
Message: Current vs Future	.015	.82	054	.42	.013	.86	009	.93	.181	.07	.079	.43
	R ² = .46	, adj. R ² =	R ² = .54,	adj. R ² =	R ² = .07,	adj. R ² =	$R^2 = .16$, adj. R ²	R ² = .30,	adj. R ² =	R ² = .22,	adj. R ² =
	.43, F(15	5,225) =	.50, F(15	,225) =	.02, F(15	,190) =	= .02, F(15,104)	.18, F(15	,99) =	.08, F(15	,99) =
	12.10, p	< 0.01	16.16, p	< 0.01	.82, p = 0	0.66	= 1.16, p	o = 0.32	2.42, p <	: 0.01	1.61, p =	= 0.09
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Message: 1 vs 5	086	.10	.021	.66	- .152	.04	.036	.74	.000	.99	- .230	.04
Message: Current vs Future	.052	.32	028	.57	.031	.68	010	.92	.169	.08	.068	.50
Gender	041	.47	.027	.61	.042	.63	.061	.61	.246	.03	.031	.79
Age	.006	.91	.030	.54	033	.66	085	.47	062	.57	139	.22
Past FV	.084	.22	.125	.05	059	.58	002	.99	.032	.79	.190	.13
Awareness of FV Liking for FV	.110 078 .094	.06 .23 .16	.016 135 .203	.02 <.01	.078 081 .031	.37 .41 .75	.012 156 .123	.91 .20 .27	021 090 .130	.84 .43 .22	.112 .177 107	.32 .15 .34
Health motivation	.013	.84	.156	.01	039	.69	.073	.58	.194	.12	.066	.62
Weight motivation	.046	.51	007	.91	207	.04	.024	.87	- .341	.01	- .281	.05
Future weight motivation Importance of the opinions of others	070 .036 .087	.27 .61 .14	.038 .035 .033	.51 .59 .55	.044 .131 .004	.03 .20 .96	172 .015 073	.18 .92 .54	032 .165 060	.24 .60	.196 .175 .024	.13 .24 .84
FV: Attitudes	.218	<.01	027	.60	002	.99	.250	.03	.261	.01	.118	.27
FV: self-efficacy	.355	<.01	.432	< .01	.011	.91	.086	.44	.084	.42	006	.95

motivation based on body-weight concerns and more positive attitudes towards FV consumption (smallest Beta = -.281, p = 0.05).

3.2.5. Biscuit bars

No impacts of the achievable nature or relevance of the poster message were found in measures of biscuit bar consumption (largest Beta = -.049, p = 0.38). Greater intentions to consume biscuit bars were associated with more positive attitudes toward biscuit bar consumption, greater self-efficacy regarding biscuit bar consumption and lower PBC over consumption (smallest Beta = -.121, p = 0.03). Greater biscuit bar consumption after 2 days was associated with lower motivation based on body-weight concerns and lower PBC over biscuit bar consumption (smallest Beta = -.227, p = 0.04), and after 7 days, with lower future health motivation and a lower PBC over consumption (smallest Beta = -.265, p = 0.05). Descriptive statistics and the results for all regression analyses for biscuit bars are given in the Supplementary Materials Tables SM1 and SM2, respectively.

3.3. Summary

Greater FV selection and greater apple consumption were found following the '*Eat 1 more* ... ' compared to the '*Eat 5* ... ' goals. No effects of relevance were found. FV intentions and consumption were also associated with additional variables known to affect FV consumption.

4. Study 3

Study 3 sought to investigate the effects on FV purchasing of four health promotion goals based on achievable nature (*'Eat 1 more portion of FV today ... ' vs 'Eat 5 portions of FV today ... ')* and relevance (*' ... for current benefit' vs ' ... for future benefit'*) in a public health scenario.

4.1. Methods

Study 3 used a mixed design where the health promotion messages from Study 2 were displayed in canteens for a one-week period and FV sales for this week, for the previous week and for the following two weeks were measured.

4.1.1. Canteens

Ten canteens from Bournemouth and Poole, UK, took part in the study. Canteens serviced two large colleges (approx. 2000 students), six small colleges (approx. 500 students) and a large city hospital (2 canteens) (Royal Bournemouth Hospital, serving the general public). Each canteen displayed between 1 and 3 of the 4 different health promotion messages for one week (in a 4-week measurement period), one at a time. Thus, some canteens took part in the study several times, e.g., canteen 1 displayed posters 1C for one week within a four week assessment period in January/February 2018, and posters 5C for one week within a four week assessment period in April/May 2019. This allowed reduced variation in the data as a result of any features specific to each canteen. Ethical approval was given by the Research Ethics Committee of Bournemouth University, UK (ID 17589), prior to commencement. To address concerns over covert data collection, while also minimizing the impact of the study on realistic behaviours, a sign was placed outside each canteen during the data collection period stating that 'A Bournemouth University Research Study is being undertaken in the canteen at this time'. Contact details of researchers were provided, and canteen users who did not wish to contribute to the study were asked to use alternative facilities (as were available in all cases).

4.1.2. Health promotion messages

Health promotion messages and posters were those used in Study 2. Between 1 and 6 copies of all posters were displayed in each canteen depending on canteen size. At least one poster was visible from every location in each canteen.

4.1.3. FV sales

FV sales were assessed in terms of number of dishes sold. Data were collected via till spreadsheets, where these were available from the canteen, or via the completion of food charts by canteen personnel. Where canteen personnel completed measures, this was done at the time of serving, and double checked after the serving period to ensure accuracy. Sales data were only available on a weekly basis, thus data from food charts were also collected over each week to provide a weekly total. Dishes were considered to contribute a portion of FV if this was explicitly stated, e.g. '*beans'*, '*salad'*, '*apple'*, or if a dish was known to be exclusively FV based, e.g. '*veggie burger'*, '*falafel sandwich'*. Fruit juice (pure) and fruit smoothies were also included. Sandwiches or other dishes which appeared to contain some FV, e.g. '*cheese and tomato sandwich'* were not included as FV dishes, as the amount of FV in these dishes is typically very small.

Data were collected between January–May 2018 and April–May 2019 in 21 four-week data collection periods. No other healthy eating campaigns were introduced in the locations during these periods.

4.1.4. Analysis

Data were first adjusted to account for day closures to a canteen, e.g. due to bank holidays and building closures due to snow, to result in average weekly sales. Secondly, data were converted to percentages of baseline data, to account for large differences in absolute sales, mostly due to canteen size. Analyses were undertaken using 2×4 repeated measures ANOVA to investigate differences between poster goals (*'Eat 1 more ... ' vs 'Eat 5 ... ',* for *'current body weight' vs 'future body weight')* over time (4 weeks).

4.2. Results

FV sales (mean per week), as a percentage of baseline values, over time are demonstrated in Fig. 1. (Data (mean (SD)) are provided in the Supplementary Materials Table SM3). A significant effect of time was found (F(3,51) = 2.89, p = 0.04, η_p^2 = .12), where FV sales were higher in the week when posters were displayed and in the following week, compared to baseline (smallest t(20) = 2.87, p = 0.01). No significant effects over time were found based on achievable nature (*'Eat 1 more ... '* vs *'Eat 5 ... '*) (F(3,51) = .88, p = 0.46), relevance (*'... for current body weight'* vs *'... for future body weight'*) (F(3,51) = 1.25, p = 0.30) or an interaction between these (F(3,51) = .37, p = 0.78).

4.3. Summary

In a real-world setting, provision of a goal increased FV sales for the week while the goal was displayed and for the following week. No differences were found between the goals based on their achievable nature or relevance.

5. Discussion

This work investigated the value of an FV goal compared to no goal for increasing FV consumption, and the 'achievable' and 'relevant' elements of that goal in relation to the 5-a-day FV consumption goal. Three studies were conducted. In relation to the value of the goal vs no goal, studies 1 and 3 demonstrate greater FV consumption on provision of a goal compared to no goal. In relation to the achievable and relevant elements, study 2 demonstrates greater FV consumption with the use of a more achievable compared to a less achievable goal, and study 1 demonstrates a positive association between FV consumption and perceived ease of following a goal. No effects of relevance were found in any study. Taking the results of all three studies together, we find clear benefit for FV consumption from providing a goal compared to no goal, and some benefit from providing a goal that was perceived or designed to be perceived as easier or more, compared to less, achievable.

The provision of goals for encouraging health behaviours is well known; consume 5 FV portions per day [NHS, 2020], undertake at least 150 min moderate intensity physical activity or 75 min vigorous activity per week [U.K. Government, 2022], drink no more than 14 units of alcohol per week [National Health Service, 2022]. These goals are largely based on the scientific evidence for health benefit, and are intended to offer simple practical advice, with the aim of improving population health. The value of these goals for population health has been demonstrated, although effect sizes are typically small (Capacci & Mazzocchi, 2011; Pollard, Miller, Daly, et al., 2008). Capacci and Mazzocchi (2011) demonstrate a .3 portions/day increase in FV consumption in the three years following the launch of the 5-a-day FV campaign in the UK. Pollard et al. (2008) report a .8 FV portions/day increase following a three year FV campaign in Australia. Our findings demonstrate that the provision of a FV consumption goal can increase FV consumption by a similar degree, to result in increases in consumption of .5 FV portions/day in a home setting (Study 1) or a 10 % increase in FV sales in a canteen setting (Study 3). Our effect sizes are comparable to those found in other studies conducted in similar settings [e.g. Collins, Thomas, Robinson, et al., 2019; Pomerleau et al., 2005; Thomas, Ursell, Robinson, et al., 2017], and while effect sizes can be small per individual, escalation to the general population could have significant population-wide health and societal benefits [Dauchet, Amouyel, & Dallongeville, 2005; Dauchet et al., 2006; Lock, Pomerleau, Causer, Altmann, & McKee, 2005].

The use of goals that are perceived as achievable is recommended [Wade, 2009], and this may be particularly pertinent to the 5-a-day FV message considering reports from consumers that 5 FV a day is difficult to achieve [Appleton et al., 2010; Carter et al., 2010; Dibsdall et al.,





2002; Rooney et al., 2017]. Our studies add to the existing literature through investigation of the perceived ease of following the goal, and through the consideration of two different goals that were deliberately designed to differ in level of perceived ease or achievability. Our findings confirm greater positive health behaviours where the goal was perceived to be easier or more achievable; the goal that was perceived to be easier and the use of the more achievable goal ('Eat 1 more ... ') resulted in greater FV consumption compared to the well-known 'Eat 5 a day' message. Effect sizes are small, and the impact of the two message types on FV consumption is clearly much smaller than the use of any goal. In Study 1, each 1 point increase in perceived ease on a 5-point scale resulted in an increase of .3 portions of FV consumed. In Study 2, the 'Eat 1 more ... ' goal resulted in 60 % participants choosing a fruit snack and consumption of a mean 5.1 apples, while the 'Eat 5 ... ' goal resulted in 41 % participants choosing a fruit snack and consumption of a mean of 4.3 apples. Importantly, however, while small in size, these effects were found in our behavioural measures, so will have potential impacts on health, and the health impacts of FV consumption have been reported as linear, even at low levels of consumption [Aune et al., 2017]. These findings demonstrate the importance of our behavioural measures. Benefit, furthermore, in Study 2, was notably found where the goal provided could be satisfied immediately and/or by the use of the supplied FV. These findings may also be related to ease, where consumption of one FV is easier when one FV is supplied, while consumption of five FV will be harder. The limited variance predicted in these analyses however, also suggests that immediate FV selection and apple consumption are better explained by factors other than those measured as part of the study. Obvious candidates include liking for the FV offered or dislike of the alternatives available. Immediate selection may also have been affected by hunger, earlier consumption or planned later consumption. However, where FV are supplied, e.g. during catered-for lunches, our findings suggest that an instruction or goal to 'Eat 1 more ...' may more likely elicit action than a reminder or goal to 'Eat 5 a day', although either goal will likely elicit greater action than no goal.

We also confirm a positive association between effort applied and achievement of a goal (Study 1), as suggested in goal-setting theory [Locke & Latham, 2002; Locke & Latham, 2006]. However, it is important to note that this positive relationship is only likely up to a point, after which the need for greater effort will likely result in reduced goal attainment; an aspect of goal attainment also linked to ease of the goal or task difficulty [Locke & Latham, 2002; Locke & Latham, 2006].

Our findings suggest the use of goals for encouraging FV consumption, and the use of goals that are perceived or designed to be easier or achievable. Based on our findings, it is also possible to suggest that current failings from the 5-a-day message may stem, at least in part, from the perceived difficulty of the 5-a-day goal. Ironically, the individuals most in need of greater FV consumption – those with the lowest FV intakes, will also be furthest from consuming 5 FV portions/ day, so those most likely to perceive the goal as more difficult. Suggestions to increase the goal furthermore, through adding portions, e.g., to 6 or 7 FV/day, will only increase the discrepancy between current position and goal position for these individuals, and so increase the perceived difficulty of the task.

No differences were found between our goals based on relevance or benefit. It is possible that the distinction between '*current*' and '*future*' benefit in our messages was limited, as any behaviour that benefits my *current* health or body-weight is also likely to benefit my *future* health or body-weight, and vice versa. Some associations with weight-based motivations were found, although these effects were counter to those that may have been expected from our messages, as greater immediate FV selection, subsequent consumption and apple consumption were associated with lower weight-based motivations, rather than higher motivations. It is possible that those concerned about their body-weight were simply consuming less overall, including less FV and less apples. The reference to body-weight in the posters may also have increased the salience of body-weight for these individuals, and/or increased resolve [Locke & Latham, 2002; Locke & Latham, 2006]. Alternatively, these reversed effects are also possibly a result of reactance - the idea that being told what to do can result in opposing or reduced actions to those requested, as a result of a perceived loss of control or free choice [Brehm & Brehm, 1981]. Reactance to a message to eat FV for your body weight, thus, may specifically result in reduced consumption in those who have body weight concerns. Ungar, Sieverding, Schweizer & Stadnitski [2015] reported reactance to requests to change FV intakes using two different FV message goals, but this was not something we measured in our studies. Only one FV outcome was positively associated with health motivation as a measure of goal importance.

Variables known to be associated with FV consumption were found to be associated with FV consumption in our studies, to include higher past FV consumption, higher awareness of FV consumption, higher FV liking, more positive attitudes and higher FV-related self-efficacy. These relationships have been previously reported [Appleton, 2016; Appleton, 2023; Appleton et al., 2019; Appleton et al., 2010; Astrom & Rise, 2001; Blanchard, Fisher, Sparling, et al., 2009; Bogers et al., 2004; De Bruijn, 2010; De Bruijn et al., 2007; Dijkstra, Neter, Brouwer, et al., 2014; Guillaumie et al., 2010; Luszczynska, Horodyska, Zarychta, et al., 2016; Luszczynska, Tryburcy, & Schwarzer, 2007; Shaikh et al., 2008].

Strengths of our work include the use of the three different but complementary studies and the consistent results within these, the consideration of underlying mechanisms in studies 1 and 2, and the use of the real-world scenario in study 3. Limitations include the absence of a 'no magnet' control condition in Study 1, the absence of a 'no goal' control condition in Study 2, and the absence of additional controls in all studies for common elements, such as effects due to priming, effects of receiving an external-derived instruction or the effects of being in a research study. It is possible, for example, that the mention of FV and pictures of FV surrounding the messages affected FV consumption, regardless of or in addition to, any effects of the messages via subliminal or supraliminal priming [Forwood et al., 2015; Minas et al., 2016]. Forwood et al. (2015) find increased self-reported fruit selection following priming via advertising (dependent on situation and personal characteristics), and Minas et al. (2016) find effects of a body-weight-based prime on food intake (again dependent on personal characteristics). It is also possible that the use of the experimental scenario in studies 1 and 2 alters behaviour to improve intakes through social desirability and/or increased perceived accountability. These additional control conditions were considered wasteful given our research questions and the use of the 'no goal' control in studies 1 and 3 and the 'biscuit bar' control in Study 2. However, these conditions could have provided additional understanding of the mechanisms underlying our effects. We gave also no consideration to possible impacts of differing individual responses to internal or external cues, or differing individual orientations, e.g. approach or avoidance tendencies, in our messaging [Forwood et al., 2015; Minas et al., 2016; Ungar et al., 2015]. Our research was set in a population-based public health scenario, thus this consideration was not thought appropriate, but this may also have aided further understanding of underlying mechanisms. Our studies are also limited by the focus on students, and our samples for all three studies were likely to be dominated by students. Although this was our intended population group considering current low FV consumption in this group and the benefits of encouraging healthy habits, this focus limits the generalisability of our findings to the wider population. We have no reason however, to believe that different effects would be found in different population groups, and we do not foresee any bias that would have resulted from this. We also did not investigate additional aspects of goal-setting that may facilitate FV consumption. Additional features of goals themselves, e.g., their specificity and focus, can also impact goal attainment [Locke & Latham, 2002, 2006; Michie et al., 2009; Michie, Richardson, Johnston, et al., 2013], while various strategies such as action planning, problem solving and reviewing [Michie et al., 2009, 2013] may also be facilitative for goal attainment. Finally, the sample size for Study 2 was based on a similar previous study

[Appleton, 2016], where differences between two health promotion posters were found with similar analyses using sample sizes of 42 vs 52 participants (Beta = .22, SD = 1.3–2.0 FV portions). While these participant numbers were gained for studies 1 and 2, the sample size for Study 3 is limited. Caution should be exercised when considering the results of Study 3, given the small number of data points involved. Indeed, the increase in FV sales in week 4 in one poster group may result purely from the select five canteens that displayed this poster. This study was difficult and time-consuming to run, but a larger sample for this study would add value, and differential benefit from the different posters would be of interest.

6. Conclusions

In conclusion, we find clear benefit for FV consumption from providing a FV goal compared to no goal, and some benefit from the use of a goal that is perceived to be easier or designed to be more achievable. Other determinants of FV consumption were also reported, although no effects of relevance were found. Our findings demonstrate the facilitation of health behaviours by providing goals, and by providing goals that individuals feel that they can achieve. Based on these findings, we recommend the provision of goals, specifically easy/achievable goals for encouraging FV consumption. Some benefits may yet be gained from an '*Eat 1 more* ... ' as opposed to an '*Eat 5 a day*' FV goal.

CRediT authorship contribution statement

Katherine M. Appleton: Writing – review & editing, Writing – original draft, Supervision, Investigation, Formal analysis, Conceptualization. Zara Borgonha: Writing – review & editing, Investigation.

Ethics approval and consent to participate

Study 1: Ethical approval for the study was given by the Research Ethics Committee of Bournemouth University, UK, prior to commencement (ID 23297/8/9), and the study was conducted with full adherence to the Ethical Principles of the British Psychological Society. All participants provided written informed consent; Study 2: Ethical approval for the study was given by the Research Ethics Committee of Bournemouth University, UK, prior to commencement (ID 1724), and the study was conducted with full adherence to the Ethical Principles of the British Psychological Society. All participants provided written informed consent. Study 3: Ethical approval was given by the Research Ethics Committee of Bournemouth University, UK (ID 17589), prior to commencement. To address concerns over covert data collection, while also minimizing the impact of the study on realistic behaviours, a sign was placed outside each canteen during the data collection period stating that 'A Bournemouth University Research Study was being undertaken in the canteen at the time'. Contact details of researchers were provided, and canteen users who did not wish to contribute to the study were asked to use alternative facilities (as available in all cases).

Availability of data and materials

All materials are provided in the Supplementary Materials. Data are available from the corresponding author on request.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2025.108014.

Data availability

Data will be made available on request.

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