

Appendix 1. Investigating Attitudes and Willingness to Adopt Different Behavioural and Technological Interventions to Increase Healthier and More Environmentally Sustainable Food Choices – A Survey

Study rationale

The rapid review has identified a vast amount of work examining the efficacy of different food labels on changing behaviour towards healthier, safer, and more sustainable food choices. However, there is a considerable gap in current understanding of peoples' views on different behavioural measures, such as labelling, and other technological innovations to promoting behavioural change relative to each other. In other words, when presented with a range of different types of interventions, which do people judge to be most influential and most ethical? Which interventions are people most likely to adopt to achieve potential positive behavioural change?

Aims of the study

To date, there has been no comprehensive examination of the attitudes towards, and willingness to adopt a variety of behavioural interventions (labelling, public campaigns) and new technological innovations that utilise food labelling to assist in consumer choices (for example recommender systems, autonomous shopping systems). In light of this, the current empirical study aimed to reduce this gap.

Research Questions

1. Which behavioural interventions currently in operation, and forecasted technological innovations are:
 - a) consumers most willing to adopt?
 - b) perceived as most ethical?
 - c) perceived as most influential in achieving behavioural change?
2. To what extent do motivations to change behaviour influence likely adoption of the different types of interventions?
3. To what extent do demographic factors play a role in the adoption of particular interventions?
4. What do consumers understand by the notion of 'environmentally sustainable' food choices?

Method

Participants

A total of 400 participants were recruited via the survey platform Prolific Academic , comprising of 119 participants worldwide who took part in the pilot, and the final sample of 281 who were UK

nationals, currently living in the UK and aged between 18-75 years. For final sample characteristics, see Table 1. The study took approximately 10-12 minutes to complete and participants received £1.10 for taking part. Ethical approval was granted from the Queen Mary University Ethics Board - QMREC1948.

Table 1 Characteristics of sample

Gender

Categories	Percentage in study	Number
Male	21.7	61
Female	76.5	215
Other	1.4	4
Prefer not to say	0.35	1

Age

Categories	Percentage in study	Number
18 to 24	42.0	118
25 to 34	28.1	79
35 to 44	17.1	48
45 to 54	5.7	16
55 +	7.1	20
Prefer not to say	0	0

Education

Categories	Percentage in study	Number
Primary	7.1	20

Categories	Percentage in study	Number
Secondary (GCSEs)	41.3	116
Higher or further education (A levels)	35.6	100
Undergraduate	14.2	40
Postgraduate	1.1	3
Doctoral	0.7	2

Income

Categories	Percentage in study	Number
Less than £10,000	9.6	27
£10,000 to £19,999	12.8	36
£20,000 to £29,999	17.1	48
£30,000 to £39,999	10.7	30
£40,000 to £49,999	15.3	43
£50,000 to £59,999	7.1	20
£60,000 to £69,999	5.3	15
£70,000 to £79,999	3.2	9
£80,000 to £89,999	1.8	5
£90,000 to £99,999	2.1	6
£100,000 to £149,999	1.8	5

Categories	Percentage in study	Number
£150,000 +	2.8	8
Prefer not to say	10.3	29

Children under 18

Categories	Percentage in the study	Number
Yes	23.1	65
No	76.5	215
Prefer not to say	0.4	1

Dietary preferences

Categories	Percentage in the study	Number
None	76.5	215
Pescatarian	5.0	14
Vegetarian	8.2	23
Vegan	3.2	9
Other	6.8	19
Prefer not to say	0.4	1

Frequency of meat eating

Categories	Percentage in the study	Number
Seven days a week	15.8	34

Categories	Percentage in the study	Number
At least five days a week	40.0	86
At least three days a week	29.8	64
At least one day a week	12.1	26
At least once a fortnight	2.3	5

Questionnaire and procedure

The study was run using Qualtrics. Participants were first asked to respond to a number of demographic questions, including age, gender, education, income and if they had children under 18 years (see Table 1). Participants were also asked to indicate if they had any specific dietary preferences and if applicable, they were asked how frequently they ate meat.

Firstly, participants were asked to indicate their general motivation to change their shopping habits in line with a) more environmentally sustainable food choices and b) more nutritional food choices, on a slider scale from 0 (No motivation to change) to 100 (Completely motivated to change). On the next screen, they were asked to write what they understood by the term 'environmentally sustainable food choices' in a free text response box. Then, participants were presented with a list of 18 behaviours/food choices (see Table 2) and asked to select those they would classify as 'environmentally sustainable'. They were then asked to indicate which of those behaviours/food choices they selected they engaged in on a regular basis.

Table 2: Understanding of 'environmentally sustainable' behaviours/food choices.

Food choices/behaviour	Percentage classifying as environmentally sustainable	Percentage indicating they engaged in on regular basis
Reduce meat consumption	25.3	14.4
Reduce dairy consumption	19.0	8.4
Buy organic food	19.2	5.9
Buy fairtrade food	18.3	7.2

Food choices/behaviour	Percentage classifying as environmentally sustainable	Percentage indicating they engaged in on regular basis
Reduce alcohol consumption	5.0	2.5
Buy less processed food	22.2	12.0
Buy locally grown food	30.2	12.3
Buy seasonal food	25.1	12.8
Buy low carbon food	25.4	1.9
Buy less pre-packaged food	28.2	15.9
Buy food only in the place of origin	19.2	1.1
Eat fewer foods high in fat, salt and sugar	4.5	2.0
Eat more plants	18.9	11.9
Reduce food waste	30.0	23.8
Eat more healthily	9.1	7.0
Adopt a vegetarian/vegan diet	19.5	5.9
Eat more variety	5.2	3.3
Grown own food	28.5	7.4

For the main part of the study, we identified three types of interventions which could be used to elicit behaviour change: smart applications (technological), financial and behavioural, each of which consisted of six specific interventions (see Table 3).

Table 3: Interventions referred to in the study.

Intervention Type	Specific Intervention
Smart applications	An application on a smart phone/online that RECOMMENDS options based on the most NUTRITIONAL food options for you for your weekly shop.
Smart applications	An application on a smart phone/online that AUTOMATICALLY SELECTS ALL YOUR options based on the most NUTRITIONAL food options for you for your weekly shop.
Smart applications	An application on a smart phone/online that RECOMMENDS options based on the most ENVIRONMENTALLY SUSTAINABLE food options for you for your weekly shop.
Smart applications	An application on a smart phone/online that AUTOMATICALLY SELECTS ALL YOUR options based on the most ENVIRONMENTALLY SUSTAINABLE food options for you for your weekly shop.
Smart applications	An application on a smart phone/online that gives you an OVERALL NUTRITIONAL SCORE of your weekly shop according to latest recommended health guidelines.
Smart applications	An application on a smart phone/online that gives you an OVERALL CARBON FOOTPRINT SCORE of your weekly shop according to latest recommendations for environmental sustainability.
Financial	A system where low nutritional food options are taxed (for example sugar tax, salt tax, fat tax) and the money from the taxes is used to subsidize (i.e. reduce costs) the most nutritional food options in your weekly shop.
Financial	A system where low environmentally sustainable food options are taxed (for example carbon tax on red meat) and the money from the taxes is used to subsidize (i.e. reduce costs) the most sustainable food options in your weekly shop.
Financial	A system where low nutritional food options are taxed (for example sugar tax, salt tax, fat tax) to discourage the choices of low nutritional food options.
Financial	A system where low environmentally sustainable food options are taxed (for example carbon tax on red meat) to discourage the choices of low environmentally sustainable food options.

Intervention Type	Specific Intervention
Financial	A scheme where you can apply for a discount voucher of £10 off your fruit and vegetables weekly shop, if you scan your shopping receipts every time you shop.
Financial	A scheme where you can apply for a discount voucher of £10 off your weekly shop when you buy low carbon footprint meals, if you scan your shopping receipts every time you shop.
Behavioural	Local events in schools [for pupils and parents] arranged to encourage nutritional food choice through taste-testing of vegetarian/vegan/meat substitute foods, on-stage cooking courses, goodie bags with, products, a recipe booklet.
Behavioural	Local events in schools [for pupils and parents] arranged to encourage environmentally sustainable food choice through taste-testing of ethically sourced/organic/local foods, on-stage cooking courses, goodie bags with, products, a recipe booklet.
Behavioural	Public campaigns explaining the reasons behind how adopting specific food options would make a direct positive impact on healthy eating.
Behavioural	Public campaigns explaining the reasons behind how adopting specific food options would make a direct positive impact on the environment.
Behavioural	Improvements to food labelling on food products to help decide which food options are the most nutritious.
Behavioural	Improvements to food labelling on food products to help decide which food options are the most environmentally sustainable.

For each type of intervention, participants were asked to rank the six specific interventions (presented randomly) in the order that they would be willing to adopt them, from most to least likely to adopt. After ranking, participants were presented with the specific intervention they were most willing to adopt, and asked a) to what extent they thought it would encourage them to positively change their shopping habits and b) to what extent they thought it was ethical (where ethical meant that even if the method was implemented, they would still be able to overrule it and choose what they wanted freely). Finally, participants were asked to indicate whether they would want each method of influence to be used to influence their food choices, answering 'Yes' or 'No' for the three types of intervention. Then participants were thanked, debriefed and re-directed to claim their reward.

Results

General motivation to change

Participants were significantly more motivated to change their shopping habits in line with more nutritional food choices (M= 70.49 SD= 19.50) than more environmentally sustainable food choices ((M= 62.14 SD= 24.09), $t(280) = 5.86$, $p < .001$).

Smart applications

The recommender system for sustainable food choices was generally the most highly rated intervention across all three dependent variables (willingness to adopt, likely change in behaviour and ethicality). The application which generated an overall environmental score (carbon footprint) was also rated similarly highly in terms of ethicality versus the recommender system for sustainable food choices (see Table 4).

Table 4 Ratings for smart applications

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Recommender system nutrition	23.13	66.42	74.77
Automatic selector nutrition	9.61	68.74	69.22
Recommender system sustainable	35.59	82.17	80.46
Automatic selector sustainable	6.05	71.41	72.06
Nutritional score	16.01	68.6	69.27
Environmental score	9.61	74.67	80.70

Note: Bold cells indicate highest ratings.

82.21% would want smart applications to be used to influence choices.

M = 70.11 (SD = 18.74) Average rating of likely change in behaviour.

M = 75.79 (SD = 21.74) Average ratings of ethicality.

Financial interventions

The discount voucher scheme for buying fruit and vegetables was generally the most highly rated intervention across all three dependent variables (willingness to adopt, likely change in behaviour and ethicality). The discount voucher scheme for buying low carbon footprint meals, as well as a

tax on low nutritional value foods was also rated similarly highly in terms of likelihood of inducing behaviour change (see Table 5).

Table 5: Ratings for financial interventions

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Tax + subsidies nutrition	10.32	69.79	70.69
Tax + subsidies environmental	13.17	75.30	71.03
Tax nutrition	2.14	79.17	66.33
Tax environmental	2.14	62.83	65.17
£10 voucher nutrition	45.20	79.61	82.35
£10 voucher environmental	27.05	79.23	79.30

Note: Bold cells indicate highest ratings.

90.39% would want financial interventions to be used to influence choices.

M = 77.56 (SD = 20.28) Average ratings of likely change of behaviour

M = 78.12 (SD = 20.46) Average ratings of ethicality

Behavioural interventions

Improvements to food labelling regarding environmental sustainability was the most popular behavioural intervention in terms of willingness to adopt and was perceived as the most ethical, though improvements to food labelling regarding nutrition also received high ratings of ethicality. The latter intervention received the highest ratings in terms of likelihood of inducing behaviour change (see Table 6).

Table 6 Ratings for behavioural interventions

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
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Taste testing in schools nutrition	13.52	61.87	79.21
Taste testing in schools environmental	11.03	67.10	76.65
Public campaigns nutrition	6.41	70.11	70.39
Public campaigns environmental	6.76	64.74	79.25
Labelling nutrition	30.60	72.38	81.34
Labelling environmental	31.67	69.88	83.11

Note: Highlighted cells indicate highest ratings.

72.95% would want behavioural interventions to be used to influence choices.

M = 69.06 (SD = 21.43) Average ratings of likely change of behaviour

M = 80.28 (SD = 20.86) Average ratings of ethicality

General type of intervention

Popularity

Looking at the range of specific interventions for each of the types of intervention for achieving behavioural change (smart applications, financial, behavioural), and only focusing on the most popular rated option.

The most popular rated option (across all interventions) was introducing a discount voucher scheme for money off more nutritious food options. However, the recommender system for environmentally sustainable options was rated as the most likely to lead to personal changes in behaviour, and the labelling of environmentally sustainable options was judged to be the most ethical overall (see Table 7).

Table 7: Most popular intervention for each type.

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
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Smart application Recommender system sustainable	35.59	82.17	80.46
Financial £10 voucher nutrition	45.20	79.61	82.35
Behavioural labelling environmental	31.67	69.88	83.11

Implementation preference

Here we look at the percentage of respondents that would want the three types of interventions (smart applications, financial, behavioural) to be used to influence food choices (with the response yes/no). Significantly more participants responded yes to the financial interventions (90.39%) compared to smart functionalities (82.21%) or behavioural interventions (72.95%), ($F = 28.80$, $p < .001$).

Likelihood of change in behaviour

Here we look at the average overall ratings (scale from 0 to 100) estimating the likelihood of the three general methods (smart applications, financial, behavioural interventions) to lead to personal behavioural change. Financial interventions were perceived as the most likely to lead to personal behavioural change ($M = 77.56$, $SD = 20.28$) versus behavioural interventions ($M = 69.06$, $SD = 21.43$) or smart applications ($M = 70.11$, $SD = 18.74$). The differences here are significant (one-way ANOVA, $F(2,840) = 14.80$, $p < .001$). A post-hoc Tukey test showed that financial interventions were significantly different from the two others, with no significant differences between behavioural interventions and smart applications.

Perceived ethicality

Here we look at the average overall ratings (scale from 0 to 100) estimating the ethicality of the three general methods (smart applications, financial, behavioural interventions). The most ethically rated general method were the behavioural interventions ($M = 80.28$, $SD = 20.86$) compared to financial interventions ($M = 78.12$; $SD = 20.46$) and smart applications ($M = 75.79$; $SD = 21.74$). The differences here are (marginally) significant – one-way ANOVA, $F(2,840) = 3.27$, $p = .04$. A post-hoc Tukey test showed that smart applications were perceived as significantly less ethical than behavioural interventions, with no other significant differences.

Take home summary

There are slight differences in ratings of perceived ethicality of the three general methods (smart applications, financial, behavioural interventions), with smart applications perceived as less ethical than behavioural interventions. People tend to estimate that they will likely change their behaviour more when financial incentives are introduced and would like to see these implemented. Judging that financial methods are more likely to lead to personal behavioural change more than the other methods, corresponds to the consistent finding that the cost of food items is one of, if not the, key contributing factor that influences food choices. So, this estimate corresponds with considerable evidence and reflects an accurate estimate of reality.

Role of demographic factors

In all but one instance, there were no significant associations between any of the demographic variables (age, gender, education, income, having children under the age of 18) and whether one wanted to see smart applications, financial or behavioural interventions used to influence choices. The only exception was the significant association ($p = .011$) between income and whether one wanted financial interventions to be used, though this should be interpreted with caution, given the exceedingly small numbers of participants indicating the highest income levels.