

**Evaluation on an online ‘teachable moment’ dietary intervention**

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**Abstract**

**Purpose** - To evaluate an online ‘teachable moment’ intervention to promote healthy eating for overweight and food intolerance symptoms.

**Design/methodology/approach** – The study involves a 2 x 2 factorial design with two conditions: group (weight loss vs food intolerance) and condition (intervention vs control). The intervention aimed to generate a ‘teachable moment’ by providing knowledge regarding the relationship between food and the problem (overweight or food intolerance), focusing on the negative aspects of the problem, creating a behavioural model, and encouraging hope and reinvention. Participants receiving the intervention ( $n = 22$ ) completed measures of dietary behaviour and either weight or food intolerance symptoms before receiving the intervention and again one month later. Control participants ( $n = 20$ ) provided measures but did not receive the intervention.

**Findings** - There were no significant reductions in weight or food intolerance symptoms. However, compared to control participants, participants in the intervention conditions reported greater intentions to eat healthily ( $p = .01$ ) and improved healthy eating behaviour over time, following both an intention-to-treat ( $p = .046$ ) and explanatory analysis ( $p = .042$ ).

**Practical implications** - Encouraging individuals to perceive their everyday situation as a time for change and adopt healthier behaviour early on, may prevent future diet-related medical events. This has benefits for both the individual and for health care costs.

**Originality/value** - A quick and easy to administer online ‘teachable moment’ intervention improves dietary behaviour and can be minimally adapted to suit individuals with differing health needs.

## Introduction

### *The Importance of a Healthy Diet*

A healthy diet is essential for good health, disease prevention, and longevity, and can be used to manage a range of conditions, including cardiovascular disease, diabetes, and obesity (Jankovic *et al.*, 2014; The World Health Organisation [WHO], 2003). Additionally, a healthy diet is related to improved energy and emotional wellbeing (Milte *et al.*, 2015). Two areas in which a healthy diet is particularly important are weight-loss and food intolerance.

In the UK, 37% of adults are overweight, and 27% obese (WHO, 2013). Given that weight-loss reduces the risk of chronic diseases and premature death (Mokdad *et al.*, 2004), interventions that increase weight-loss are particularly useful. A recent systematic review highlights that lifestyle interventions focusing on dietary intake can effectively reduce weight (Dombrowski *et al.*, 2014).

A second area in which a healthy diet may be particularly important is food intolerance. Common food intolerance symptoms include headache, fatigue, vomiting, bloating, diarrhoea, and constipation (Brostoff and Gamlin, 1998), all of which can reduce health-related quality of life and increase medical costs (Lantéri-Minet *et al.*, 2011; Lea and Whorwell, 2001).

A key treatment for food intolerance symptoms is the identification and elimination of symptom-triggering foods, known as an elimination diet. Elimination diets often lead to significant improvements in food intolerance symptoms (e.g. Carroccio *et al.*, 2010; Carroccio *et al.*, 2011; Daher *et al.*, 2001; Dehghani *et al.*, 2012). Nevertheless, identifying which foods are problematic is time-intensive. Recent evidence indicates that a first step in the treatment of food intolerance is the maintenance of a healthy balanced diet (Ogden *et al.*, 2011; Pope, 2009). For two weeks participants maintained a healthy, balanced diet by increasing their intake of fruits, vegetables, fish, water, and fibre, as well as avoiding caffeine, fizzy drinks, alcohol, sugar, highly processed foods, fast foods, takeaway foods, very spicy foods, salt, and fat. Significant reductions were found in the number, frequency, and severity of a range of food intolerance symptoms, with seventy per cent of participants reporting improvements. Tyramine may also contribute to the pathogenesis of headaches, migraines, and tiredness. Tyramine naturally occurs in cheese, chocolate, red wine, and coffee (D'Andrea *et al.*, 2006). Headache and migraine sufferers have increased levels of tyramine (D'Andrea *et al.*, 2004), and ingestion of tyramine capsules can result in an increase in headaches compared to ingestion of a control capsule (Hanington, 1968). Furthermore, many headache sufferers report food as a headache trigger, with chocolate, cheese, and wine being the most commonly reported triggers (Finocchi and Sivori, 2012; cf. Salfield *et al.*, 1987).

Maintaining a healthy, balanced diet is therefore beneficial for both overweight individuals and those who suffer from food intolerance symptoms. Additionally, a low-tyramine diet may help alleviate some food intolerance symptoms. Given that significant improvements in several health problems can be achieved through maintaining a healthy balanced diet, participants with a range of health problems may all benefit from a single dietary intervention that differs only in terms of the focus of the motivation (with the goal being to either lose weight or improve symptoms).

### *Creating a Teachable Moment*

Knowledge alone, however, is often insufficient to bring about sustained behaviour change. For example, the rates of overweight and obesity continue to rise

despite it being well understood that increased weight is detrimental to health (Public Health England, 2015). Similarly, despite acknowledging symptom improvement whilst following an elimination diet, many participants with food intolerances continue to eat symptom-inducing foods (Mitchell *et al.*, 2011; Pope, 2009).

Social cognition models (SCMs) recognise the role of attitudes, beliefs, and intentions in changing behaviour (Conner and Norman, 2005). However, SCMs are limited in their ability to predict behaviours (Sniehotta, 2009), and even interventions that produce large changes in intentions often only have small-medium effects on behaviour (Webb and Sheeran, 2006). Furthermore, SCMs conceptualise behaviour change as a gradual process of a change in cognitions and the development of intentions. Recent research, however, suggests that behaviour change may occur in a more sudden way after triggering events. For example, many individuals who have successfully stopped smoking or lost weight and maintained these changes in the long term report that their behaviour change was not planned (West and Sohal, 2006) and was often preceded by significant events (such as illness or salient milestone) that motivated the change (Ogden and Hills, 2008). This is in line with a 'teachable moment' approach in which doctors acknowledge patients' increased willingness to change after significant medical events (e.g. Coa *et al.*, 2015). People are often unwilling to hear health promotion information and to change their behaviour (Epton *et al.*, 2015). Research suggests that at certain times people may be more open to health information due to a change in their health or emotional state. These have been labelled 'teachable moments' (Lawson and Flocke, 2009). A 'teachable moment' therefore represents a time when an individual is more receptive to messages of change. Clinicians, researchers, and educators working to develop ways to help people choose healthy behaviours can capitalise on this time of increased receptiveness.

However, not every behaviour change following a life event is maintained in the long-term and research suggests that translating an initial change into maintained change may be facilitated by holding a model of the problem that emphasises behaviour as both a cause *and* solution to the problem (Epiphaniou and Ogden, 2010; Ogden and Hills, 2008; Ogden and Sidhu, 2006). People have coherence between their beliefs about the causes and solutions to their symptoms. For example, believing obesity is caused by biological factors is related to a belief that obesity can be resolved through medication and surgery; believing obesity is caused by behavioural factors is related to a belief that exercise and diet are effective solutions (Ogden and Flannagan, 2008). Around half of the general population endorse a biological model of obesity, believing factors such as genetics, hormones, and metabolism are responsible for obesity (Ogden and Flannagan, 2008), and may therefore be less inclined to adopt behavioural solutions. A recent study, however, showed that such beliefs can change and indicated that manipulating beliefs regarding the cause of illness resulted in altered beliefs regarding solutions to that illness (Ogden and Jubb, 2008). In particular, encouraging participants to believe obesity is caused by factors such as eating the wrong foods and not doing enough led to an increased belief in changing diet and exercise patterns as appropriate obesity treatments.

The presence of both a life event and a behavioural model of overweight distinguished between successful dieters (maintained weight-loss for at least one year) and unsuccessful dieters, as well as successful dieters before and after their successful weight-loss (Epiphaniou and Ogden, 2010). Inspiring participants to imagine an alternative future and using the experience as an opportunity for reinvention may also help establish behaviour change (Ogden and Hills, 2008).

To date, research has described the mechanisms behind successful behaviour change, but has not examined whether a ‘teachable moment’ can be induced empirically, that is whether individuals can be encouraged to perceive their situation as a ‘teachable moment’, and therefore change their behaviour. Research has highlighted triggering events, such as illness and relationship breakdown. Clearly these situations cannot be engineered in the laboratory, yet it is important to consider what constitutes a ‘teachable moment’. Individuals may be encouraged to see their situation as a ‘teachable moment’ through carefully worded questions that encourage individuals to focus on the negative aspects of their problem (symptom focus).

The aim of the present study was to develop and test the effectiveness of an online, low cost, and easy to administer ‘teachable moment’ dietary-change intervention that can be tailored to different diet-related health problems, specifically weight loss and food intolerance. The intervention aims to encourage participants to perceive their everyday situation as a ‘teachable moment’ and an opportunity for change by including a focus on the problem, the creation of a behavioural model, and encouraging hope and reinvention. It was hypothesised that compared to participants in the control conditions, participants in the intervention conditions would have greater intentions to eat healthily, increased healthy eating behaviour, and an improvement in their problem (weight loss/symptoms).

## **Method**

### *Participants*

Staff and students at a University in the UK and staff at a primary school in the same town were recruited via posters placed around the university and school asking for participants who either wished to lose weight or improve symptoms related to food intolerance (headaches, migraines, tiredness, or digestive problems). Those with a history of an eating disorder, Crohn’s disease, Coeliac’s disease, renal failure, unexplained weight loss, and pregnant women were not eligible to participate. Eligibility screening was completed online and no data were collected for ineligible participants. After screening, sixty-seven participants (mean age 26 years; 6 male) took part in the study. Twenty undergraduate students participated in return for course credit; the remaining participants were not offered reimbursement. Favourable ethical opinion was obtained from the University Ethics Committee.

### *Design*

The study employed an experimental factorial design with two between-subject independent variables; group (weight loss vs food intolerance) and condition (intervention vs control). A within-subjects design was also used as participants provided baseline data at time 1 and follow-up data one month later (time 2).

### *Measures*

All measures were completed at both time points, except demographics and intentions, which were only completed at time one. Measures took around 15-20 minutes to complete. Participants completed the following measures:

#### *Demographics*

Participants described their age, gender, highest educational achievement, and ethnicity.

#### *Weight*

Participants in the weight loss group provided self-reported measures of their weight.

### *Symptoms*

Participants in the food intolerance group completed a symptoms questionnaire. This questionnaire was adapted from Ogden *et al.* (2011) and included a list of nine symptoms (headache, migraine, unexplained tiredness, nausea, vomiting, stomach ache, wind, diarrhoea, and constipation). Participants indicated whether they had experienced each symptom in the previous week (Yes/No), how severe the symptom was on a 5-point scale ('Not At All' to 'Very Much'), and how frequently they experienced it on a 5-point scale ('Never' to 'Very Often').

### *Behaviour*

The behaviour questionnaire was developed for this intervention. Participants rated the frequency of their (un)healthy eating behaviour over the past week using 10 items measured on a 6-point scale ('Not at all' to 'More than once a day'). All participants rated the following six items 'I have eaten fruit', 'I have drunk alcohol', 'I have eaten vegetables', 'I have eaten ready meals', 'I have eaten fast food or takeaway food', and 'I have cooked from scratch'. Participants in the weight loss group also rated the following four statements 'I have eaten meals high in fat or sugar between meals', 'I have skipped breakfast', 'I have drunk sugary drinks', and 'I have eaten fatty foods such as cream, fatty meats, and cheese'. Participants in the food intolerance group rated the following 'I have drunk caffeinated drinks', 'I have drunk decaffeinated or herbal teas', 'I have drunk fizzy drinks', and 'I have eaten chocolate'. After reversing reverse-coded items, items were summed to create a total behaviour score. A high score is indicative of greater healthy eating behaviour.

### *Intentions*

The intentions questionnaire was developed for this intervention. Participants rated their intentions to eat (un)healthily over the next week using 12 items measured on a 6 point scale ('Not at all' to 'More than once a day'). Ten items mapped onto the behavioural items e.g. 'I plan to eat fruit', and a further two items ('I plan to tell people that I am changing my diet' and 'I plan to make a shopping list and stick to it') related to behaviour change. After reversing reverse-coded items, items were summed to create a total intentions score. A high score is indicative of greater intentions to eat healthily.

### *Procedure*

Participants accessed the online questionnaire through a web-based link. After providing informed consent, participants indicated the area they would like to change (weight/symptoms) and completed baseline measures of their behaviour and either their weight or symptoms. At this point, participants were computer-randomised to either a control (weight loss:  $n = 20$ ; food intolerance:  $n = 7$ ) or intervention (weight loss:  $n = 16$ ; food intolerance:  $n = 16$ ) condition. Participants allocated to the control conditions rated their intentions immediately after the baseline measures. Participants in the intervention conditions received the intervention before rating their intentions. Those who agreed to the follow-up ( $n = 49$ ) were emailed a link to the questionnaire 28 days later and completed measures of their weight/symptoms and behaviour.

Participants allocated to the control conditions were offered the intervention at the end of the study.

### *The teachable moment intervention*

The intervention was designed to create a ‘teachable moment’ and increase motivation to change. The intervention consists of five parts: knowledge, symptom focus, behavioural models, hope, and reinvention. The knowledge part of the intervention was based on the healthy eating diet developed by Ogden *et al.* (2011) under the guidance of a nutritional consultant. The remaining motivational aspects of the intervention were based upon existing theories and research which highlight a key role for these factors in creating sustained behaviour change (Epiphaniou and Ogden, 2010; Ogden and Hills, 2008; Ogden and Jubb, 2008). The intervention lasts around 10-20 minutes and provides a quick, easy to administer, and user-friendly motivational tool to encourage healthy eating behaviour.

#### *Knowledge*

Participants were presented with information regarding the relationship between food and their problem. Weight loss participants read about the relationship between food and weight, and the difference between fad diets and healthy eating. Food intolerance participants read about what food intolerance is, common food intolerance symptoms, healthy eating as a treatment for food intolerance, and common symptom-triggering foods. All participants also read guidelines for healthy eating and tips on changing their diet. The healthy eating diet advised participants to increase the amount of fruit, vegetables, wholegrain starchy foods, and fish in their diet; to drink plenty of water; and to reduce sugar, salt, alcohol, highly processed foods, fast foods/takeaways, and saturated fat intake. Participants in the food intolerance group were also advised that spicy foods, cheese, chocolate, caffeine, and fizzy drinks can cause symptoms for some people, and that avoiding these may help their symptoms.

#### *Symptom focus*

*Weight Loss.* Participants were presented with a BMI chart and asked to determine their weight category (underweight, normal weight, overweight, obese). Participants were also asked to indicate (Yes/No) whether they had experienced negative symptoms due to their weight (e.g. breathlessness, feeling unattractive).

*Food intolerance.* Participants were asked to select which symptom they would most like to get rid of.

All participants were asked to indicate (Yes/No) whether they had experienced disruptions to their life due to their problem (e.g. unable to enjoy social activities) and to write down any other disruptions they had experienced due to their problem.

#### *Behavioural models*

To encourage participants to develop a model of causes and solutions to their problem that emphasises their behaviour (rather than biological factors), participants were asked questions to encourage them to consider the role of food and diet in their problem. Questions included ‘What do you think are the main causes of your weight [symptoms]?’; ‘What makes you think this?’; ‘What role do you think food has in causing your weight [symptoms]?’; ‘Do you know other people who are overweight [have similar symptoms]?’; ‘What is their diet like?’; ‘Do you know people who have changed their diet to lose weight [eliminated certain foods from their diet to improve their symptoms]?’; ‘Has their change in diet been successful?’; ‘Do you think your

diet makes your weight [symptoms] better or worse?'; and 'What effect do you think changing your diet would have on your weight [symptoms]?'.

### *Hope*

Participants were encouraged to develop a sense of hope that they could have an alternative, healthier future in which they weigh less [don't experience unpleasant symptoms]. This was achieved by providing case studies of similar others who had changed their diet and were no longer overweight [no longer experienced unpleasant symptoms]. Participants were asked to rate the extent to which they identified with them and the extent they would like to be like them. Case studies were matched to participants in terms of gender and problem (weight loss/symptoms).

### *Reinvention*

Participants were encouraged to see the experience of changing their diet as an opportunity to change how they see themselves. Participants were asked to imagine themselves in the future and list ways that their weight [symptoms], diet, and day-to-day activities may be different.

## **Results**

The results were analysed to describe participant demographics, and to assess the impact of the intervention on intentions to eat healthily, healthy eating behaviour at one-month follow-up, and target health outcome (weight or symptoms) at one-month follow-up.

### *Participant Demographics*

Demographics for the whole sample, weight loss, and food intolerance groups are shown in table 1. There were no significant differences between participants in the following: i) weight loss versus food intolerance groups; ii) control versus intervention conditions within the weight loss group; and iii) control versus intervention conditions within the food intolerance group. Of the initial sample of 67 participants, just under two-thirds (62.7%) completed measures at time two.

[Table 1]

### *Explanatory and Intention to Treat Analyses*

Explanatory analysis was based on data from participants who completed measures at both time points. However, due to dropout rates (37.3%; see figure 1), and in order to determine the true effects of the intervention, an intention-to-treat analysis was conducted for the variables that showed a significant relationship in the explanatory analysis. For the intention-to-treat analysis, missing data at time two was imputed from time one data ( $n = 21$ ).

[Figure 1]

### *Impact of the Intervention*

Non-normally distributed data were transformed (see tables for specific transformations). As specific hypotheses were made regarding the impact of the intervention on outcome variables, significance levels represent one-tailed tests.

For the analysis of intentions, a two-way independent factorial ANOVA was conducted with intentions as the dependent variable and condition and group as the



fixed factors. For weight, symptoms, and behaviour mixed design ANOVAs were conducted with outcome variables at time 1 and time 2 as the within subject variables and condition as the between subject variable (group was included as a between subject variable for the analysis of behaviour).

#### *Explanatory analysis*

*Intentions.* There was a significant main effect of condition (see table 2), with participants in the intervention conditions having higher intentions than participants in the control conditions (see figure 2). There was also a significant main effect of group, with participants in the food intolerance group having higher intentions than participants in the weight loss group. The Condition x Group interaction approached significance with a medium effect size, indicating that participants in the food intolerance intervention condition had higher intentions than participants in the weight loss intervention condition.

[Table 2]

[Figure 2]

*Healthy eating behaviour.* Participants in the control conditions did not increase their healthy eating behaviour, whereas participants in the intervention conditions increased their healthy eating behaviour over time (see table 3). There was a significant main effect of condition on healthy eating behaviour and a significant Time x Condition interaction of healthy eating behaviour (see figure 3). Healthy eating behaviour was correlated with participants' intention to eat healthily,  $r_s = .583$ ,  $p < .001$ . There was also a significant main effect of group on behaviour indicating that participants in the food intolerance group had greater healthy eating behaviour than participants in the weight loss group, although the Time x Condition x Group interaction was not significant.

[Table 3]

[Figure 3]

*Target health outcomes.* There were no significant main effects of time or condition on weight. Furthermore, there was no significant Time x Condition interaction for weight (see table 4).

[Table 4]

The total number of symptoms experienced by participants in the control condition remained unchanged, whereas the total number of symptoms experienced by participants in the intervention condition reduced over time, with a medium-large effect size. However, this difference was not significant (see table 5).

There were no significant main effects of time or condition on the frequency or severity of symptoms. Furthermore, there were no significant Time x Condition interactions.

[Table 5]

#### *Intention to Treat Analysis*

An intention to treat analysis was conducted for healthy eating behaviour. Similarly to the explanatory analysis, there was a significant main effect of group, a significant main effect of condition, and a significant Time x Condition interaction (see table 6), indicating that only participants in the intervention conditions increased their healthy eating behaviour over time.

[Table 6]

## Discussion

Maintaining a healthy, balanced diet is important for good health and may be particularly beneficial for a range of health problems, including overweight and food intolerance. Through adjusting the focus of the motivation to suit individuals with differing problems (overweight and food intolerance) the intervention successfully increased intentions to eat healthily in both groups. It was also successful in increasing healthy eating behaviour, with similar findings for the intention to treat and explanatory analyses. According to Cohen's (1992) guidelines, the intervention had medium and large effects on healthy eating behaviour and intentions respectively. Previous research has retrospectively described the mechanisms related to behaviour change and has suggested that teachable moments may trigger change that can be sustained in the longer term (Epiphaniou and Ogden, 2010; Ogden and Hills, 2008; Ogden and Jubb, 2008; West and Sohal, 2006). This study extends previous research to show that individuals can be encouraged to see everyday events as a 'teachable moment', and that this in turn can be used to produce changes in intentions and reported eating behaviours in two diet-related areas.

Despite these promising effects, and contradictory to previous research (Husted and Ogden, 2014; Ogden *et al.*, 2011), the intervention did not have a significant impact on weight or symptoms. Participants in the intervention condition of Husted and Ogden's (2014) study, who received a weight loss intervention embedded within a questionnaire, lost significantly more weight at three-month follow-up than participants in the control condition. The severity of the weight problem varied considerably between the two studies. Participants in Husted and Ogden's study were obese and had recently received weight loss surgery, whereas there was no weight pre-requisite for participation in the current study. Indeed, some participants who received the intervention identified themselves as having a healthy BMI. Unfortunately, only participants receiving the intervention provided their BMI (as part of the symptom focus aspect of the intervention). Therefore, a BMI measure was not available for participants in the control condition, preventing an evaluation of the intervention by BMI category.

In terms of food intolerance, the higher dropout rate in Ogden *et al.*'s (2011) study (46%) as compared with the food intolerance group of the current study (29%) may indicate that more participants who did not experience symptom improvement remained in the current study 'diluting' any effects that may have been found for a subset of the group. Indeed, the present study detected an overall (non-significant) reduction in symptoms for the food intolerance intervention group compared to the food intolerance control group, with a medium-to-large effect size.

The intervention may be more effective for individuals suffering from food intolerance symptoms compared to individuals wishing to lose weight. Firstly, the increase in intentions was larger in the food intolerance group than the weight loss group, and the group by condition interaction closely approached significance (with a medium effect size). And secondly, the intervention had a medium-to-large effect on

the number of symptoms participants experienced, whereas there were no reductions in weight.

There are several limitations of the study. Firstly, measures of weight were self-reported. The validity of future research could be improved by taking objective measures of weight. Secondly, the sample predominantly consisted of females, and there were not enough males to analyse the data by gender. Thus, it is possible that the conclusions drawn here only apply to females. Finally, the study only examined the effectiveness of the intervention over a one-month period. Maintaining a healthy diet in the long-term is a key challenge. A longer follow-up period is necessary to determine the true effects of the intervention on improving dietary behaviours. Further, it is possible that longer-term adherence to the diet may have a greater impact upon weight and symptoms.

The study did however employ a control group meaning the increase in healthy eating in the intervention conditions can be attributed to the intervention itself. Additionally, this was the first study to examine the impact of an online intervention on improving food intolerance symptoms. Crucially, although small-scaled, this study was the first to experimentally create a 'teachable moment', and preliminary findings highlight that this approach has benefits for dietary behaviour. Furthermore, the study showed that a single intervention could be minimally adapted to suit individuals with differing problems (overweight and food intolerance symptoms), with important dietary changes observed in both groups. Future research could examine whether this quick and easy to administer intervention has beneficial effects in other eating-related conditions, such as diabetes.

Individuals may be presented with a 'teachable moment' through significant life events. This research highlights that a 'lesser moment' (e.g. everyday situations) can be translated into a 'teachable moment' through focusing on the problem, creating a behavioural model of the problem, and encouraging hope and reinvention. The present findings have practical significance in terms of preventative health care. To date, research suggests that individuals who have experienced a recent medical event are more open to changing their behaviour. However, if individuals can be encouraged to perceive their everyday situation as a time for change and adopt healthier behaviour early on, it is possible that future diet-related medical events may be prevented. This has benefits for both the individual and for reducing health care costs. Health professionals could therefore apply this understanding to everyday situations, such as during routine medical check-ups or when a patient presents a new symptom, as a time to encourage a teachable moment and facilitate behaviour change, by offering the intervention at this time. The intervention presented in this study is quick and easy-to-administer, and can be adapted to encourage change in several diet-related areas.

In conclusion, the intervention successfully increased intentions to eat healthily as well as improving healthy eating among participants with differing problems (overweight and food intolerance symptoms). This is the first empirical study to experimentally induce a 'teachable moment' and use this to promote change. Nevertheless, the intervention had no significant effect on weight or food intolerance symptoms. Given the preliminary positive findings of the effect of the intervention on intentions and behaviour, it is anticipated that with a larger sample, more stringent inclusion criteria (e.g. BMI > 25), and a longer follow-up duration, the intervention will also have a positive effect on weight and food intolerance symptoms.

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**Table 1**  
**Demographics for whole sample, WL group, and FI group**

Variable	Whole sample ( <i>n</i> =67) <i>n</i> (%)	WL ( <i>n</i> =39) <i>n</i> (%)	FI ( <i>n</i> =28) <i>n</i> (%)	<i>U</i> / $\chi^2$
<b>Age</b>				
Mean	26.85	27.64	25.75	<i>U</i> = 519
SD	11.88	12.81	10.59	<i>p</i> = .729
<b>Gender</b>				
Male	6 (8.8)	3 (7.7)	3 (10.7)	$\chi^2(1) = .183$ <i>p</i> = .688 (Fisher's exact test)
Female	62 (91.2)	36 (92.3)	25 (89.3)	
<b>Ethnicity – 2 levels</b>				
White	50 (75)	29 (74)	21 (75)	$\chi^2(1) = .004$ <i>p</i> = .953
Non-white	17 (25)	10 (26)	7 (25)	
<b>Education – 2 levels</b>				
≥ Degree	38 (51)	20 (51.3)	14 (50)	$\chi^2(1) = .011$ <i>p</i> = .918
< Degree	33 (49)	19 (48.7)	14 (50)	



**Table 2**  
**Weight loss and food intolerance interventions: Intentions at Time 1**

Variable	Weight loss		Food intolerance		Main effect CONDITION	Main effect GROUP	Interaction C x G
	Control (n=20)	Intervention (n=16)	Control (n=7)	Intervention (n=16)			
<b>Intentions</b>							
Mean	57.60	58.75	59.57	65.88	$F(1,55) = 5.78$	$F(1,55) =$	$F(1,55) = 2.763$
SD	5.81	5.13	5.68	5.38	$p = .01$	8.608	$p = .051$
					$\eta_p^2 = .095$	$p = .003$	$\eta_p^2 = .048$
						$\eta_p^2 = .135$	

**Table 3**  
**Weight loss and food intolerance interventions: Behaviour between time 1 and time 2**

Variable	Weight loss				Food intolerance			
	Control (n=15)		Intervention (n=11)		Control (n=5)		Intervention (n=11)	
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
<b>Behaviour</b>								
Mean	46.73	46.87	47.82	50.36	52.20	50.00	54.55	56.45
SD	4.59	6.03	5.81	4.84	5.72	6.36	6.74	5.59
<b>Behaviour (square root transformed)</b>								
Mean	6.83	6.83	6.90	7.09	7.22	7.06	7.37	7.51
SD	.34	.46	.43	.34	.40	.46	.46	.37

**Table 3 (continued)**

Variable	Main effect TIME	Main effect CONDITION	Main effect GROUP	T x C	G x C x T
<b>Behaviour (square root transformed)</b>	$F(1,38) = .382$ $p = .27$ $\eta_p^2 = .010$	$F(1,38) = 3.892$ $p = .028$ $\eta_p^2 = .093$	$F(1,38) = 10.027$ $p = .002$ $\eta_p^2 = .209$	$F(1,38) = 3.147$ $p = .042$ $\eta_p^2 = .076$	$F(1,38) = .158$ $p = .347$ $\eta_p^2 = .004$

**Table 4**  
**Weight loss intervention: Weight between Time 1 and Time 2**

Variable	Control ( <i>n</i> =15)		Intervention ( <i>n</i> =11)		Main effect TIME	Main effect CONDITION	Interaction T x C
	Time 1	Time 2	Time 1	Time 2			
<b>Weight</b>							
Mean	65.85	66.00	71.00	72.50			
SD	10.40	10.41	11.63	11.91			
<b>Weight (log transformed)</b>							
Mean	1.82	1.81	1.84	1.84	$F(1,25) = 1.998$	$F(1,25) = .991$	$F(1,25) = 2.593$
SD	.06	.07	.06	.06	$p = .085$	$p = .165$	$p = .06$
					$\eta_p^2 = .074$	$\eta_p^2 = .094$	$\eta_p^2 = .094$

**Table 5**  
**Food intolerance intervention: Food intolerance symptoms between Time 1 and Time 2**

Variable	Control (n=5)		Interventio n (n=11)		Main effect TIME	Main effect CONDITIO N	Interactio n T x C																																	
	Tim e 1	Tim e 2	Tim e 1	Tim e 2																																				
<b>Total number of symptoms</b>	3.20	3.40	3.18	1.73	$F(1,14)$ ) = .81 $p =$ .192 $\eta_p^2 =$ .055	$F(1,14) =$ 1.857 $p = .097$ $\eta_p^2 = .117$	$F(1,14) =$ 1.40- $p = .128$ $\eta_p^2 = .091$																																	
Mea	1.64	2.61	1.54	1.49																																				
SD								<b>Mean Severity of symptoms</b>	3.43	2.97	3.00	3.01	$F(1,11)$ ) = .535 $p = .24$ $\eta_p^2 =$ .046	$F(1,11) =$ 1.06 $p = .163$ $\eta_p^2 = .088$	$F(1,11) =$ .403 $p = .27$ $\eta_p^2 = .035$	Mea	.64	.79	.69	.45	SD					<b>Mean frequency of symptoms</b>	3.40	2.70	2.88	2.72	$F(1,11)$ ) = 2.13 $p =$ .087 $\eta_p^2 =$ .162	$F(1,11) =$ .732 $p = .205$ $\eta_p^2 = .062$	$F(1,11) =$ .817 $p = .179$ $\eta_p^2 = .069$	Mea	.65	.59	.59	.86	SD	
<b>Mean Severity of symptoms</b>	3.43	2.97	3.00	3.01	$F(1,11)$ ) = .535 $p = .24$ $\eta_p^2 =$ .046	$F(1,11) =$ 1.06 $p = .163$ $\eta_p^2 = .088$	$F(1,11) =$ .403 $p = .27$ $\eta_p^2 = .035$																																	
Mea	.64	.79	.69	.45																																				
SD								<b>Mean frequency of symptoms</b>	3.40	2.70	2.88	2.72	$F(1,11)$ ) = 2.13 $p =$ .087 $\eta_p^2 =$ .162	$F(1,11) =$ .732 $p = .205$ $\eta_p^2 = .062$	$F(1,11) =$ .817 $p = .179$ $\eta_p^2 = .069$	Mea	.65	.59	.59	.86	SD																			
<b>Mean frequency of symptoms</b>	3.40	2.70	2.88	2.72	$F(1,11)$ ) = 2.13 $p =$ .087 $\eta_p^2 =$ .162	$F(1,11) =$ .732 $p = .205$ $\eta_p^2 = .062$	$F(1,11) =$ .817 $p = .179$ $\eta_p^2 = .069$																																	
Mea	.65	.59	.59	.86																																				
SD																																								

**Table 6**  
**Weight loss and food intolerance interventions: Behaviour between time 1 and time 2 (intention to treat)**

Variable	Weight loss				Food intolerance				Main effect CONDITION	Main effect GROUP	T x C
	Control (n=20)		Intervention (n=16)		Control (n=8)		Intervention (n=19)				
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2			
<b>Behaviour</b>											
Mean	46.05	46.15	46.94	48.69	50.63	49.25	53.32	54.42			
SD	4.16	5.36	5.57	5.38	5.42	5.50	7.70	7.43			
<b>Behaviour (sqrt transformed)</b>											
Mean	6.78	6.78	6.84	6.97	7.11	7.01	7.28	7.36	$F(1,59) =$ 3.374	$F(1,59) =$ 10.827	$F(1,59) = 2.934$
SD	.31	.41	.42	.39	.38	.40	.52	.50	$p = .036$ $\eta_p^2 = .054$	$p = .001$ $\eta_p^2 = .155$	$p = .046$ $\eta_p^2 = .047$

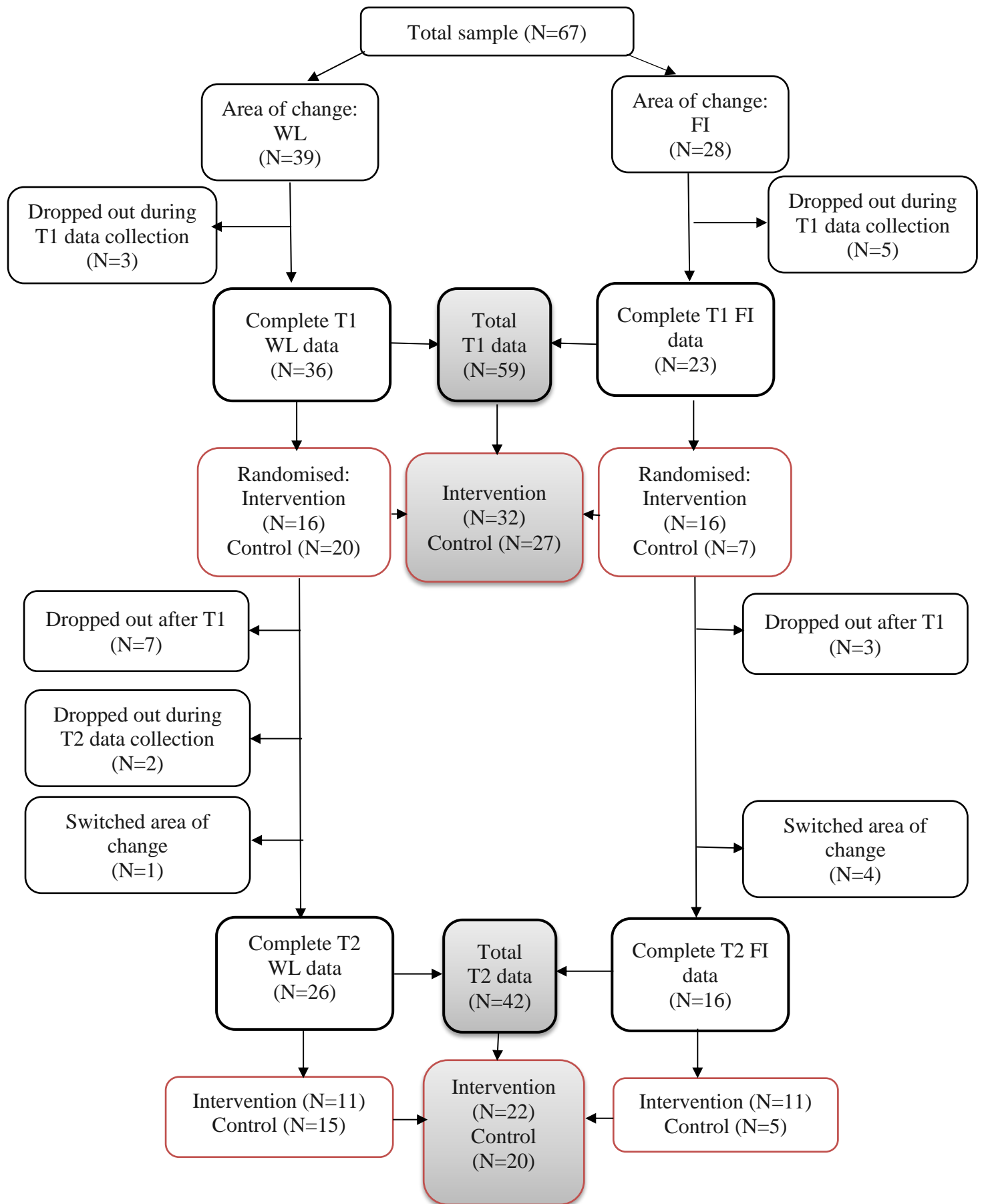


Figure 1. Flow chart of participants through the study

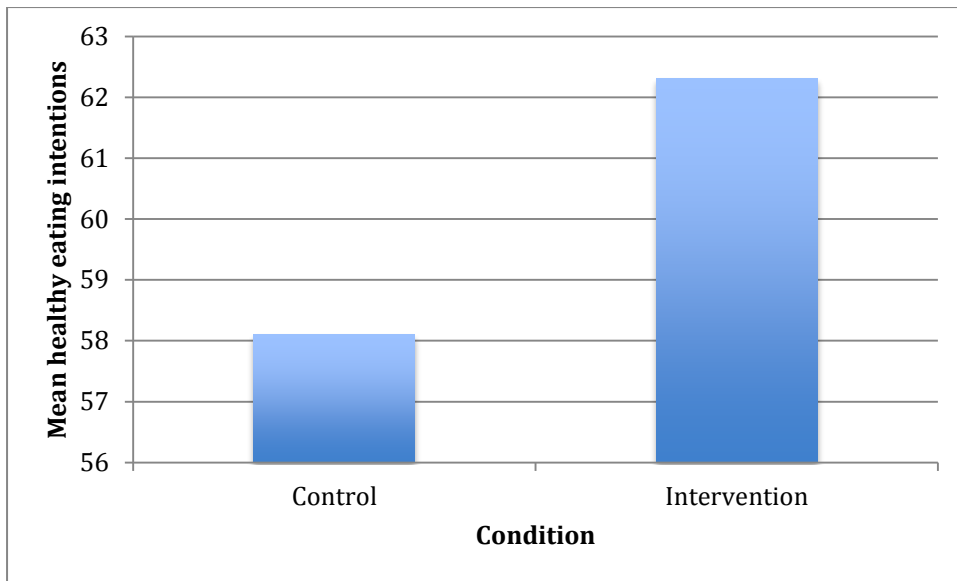


Figure 2. Healthy eating intentions by condition.

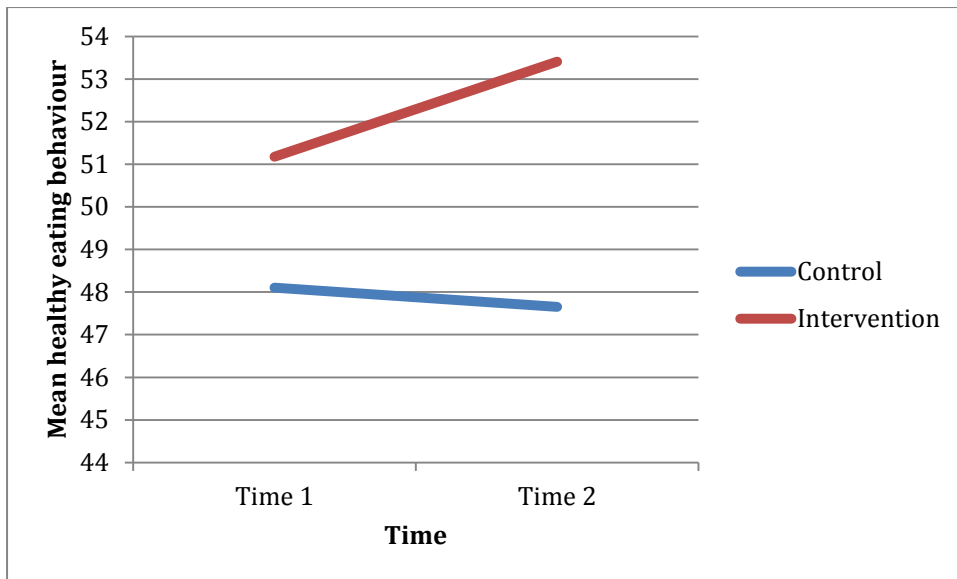


Figure 3. Healthy eating behaviour by time.