
Article:
Carfora, V, Caso, D and Conner, M orcid.org/0000-0002-6229-8143 (2016) Randomized controlled trial of a Messaging Intervention to increase fruit and vegetable intake in adolescents: Affective versus instrumental messages. British Journal of Health Psychology, 21 (4). pp. 937-955. ISSN 1359-107X

https://doi.org/10.1111/bjhp.12208

Running head: *Messages to increase fruit and vegetable intake*

Randomized controlled trial of a Messaging Intervention to increase fruit and vegetable intake in adolescents: Affective versus instrumental messages

Carfora V.[1], Caso D.[2] and Conner M.[3]

1Department of Humanities, University of Naples "Federico II", Naples, Italy.

[2]Department of Humanities, University of Naples "Federico II", Naples, Italy.

[3] School of Psychology University of Leeds, Leeds, UK.

Word count (exc. figures/tables): 7393

*Requests for reprints should be addressed to Carfora Valentina, Via Porta di Massa, 1, 80133 Naples, Italy (e-mail: valentine.carfora@unina.it).

Abstract

Objective. The present research aimed to test the efficacy of affective and instrumental text messages compared to a no message control as a strategy to increase fruit and vegetable intake (FVI) in adolescents.

Design. A randomized controlled trial was used test impact of different text messages compared to no message on FVI over a 2 week period.

Method. A total of 1065 adolescents (14–19 years) from a high school of the South of Italy completed the baseline questionnaire and were randomly allocated to one of three conditions: instrumental messages (N = 238); affective messages (N = 300); no messages (N = 521). Students in the message conditions received one message each day over a 2 week period. The messages targeted affective (affective benefits) or instrumental (instrumental benefits) information about FVI. Self-reported FVI at two weeks was the key dependent variable. Analyses were based on the N = 634 who completed all aspects of the study.

Results. Findings showed that messages significantly increased FVI, particularly in the affective condition and this effect was partially mediated by changes in affective attitude and intentions towards FVI.

Conclusion. Text messages can be used to increase FVI in adolescents. Text messages based on affective benefits are more effective than text messages based on instrumental benefits.

Keywords: affective messages; messaging; fruit and vegetable; healthy eating; behavior change

The eating habits acquired during adolescence are usually maintained into adulthood (Dietz, 1997), impacting on health in both the medium and longer term (Centers for Disease Control and Prevention, 2013). Therefore, promoting the development of healthy eating behaviors during adolescence is an important challenge in relation to promoting health. The present research tested a text-based intervention to increased fruit and vegetable consumption in adolescents.

It is recommended that individuals consume at least 5 servings of fruits and vegetables a day (USDA / USDHHS, 2010), as this level of fruit and vegetable intake (FVI) is the minimum necessary to provide the required nutrients (Mainvil et al., 2009; Pearson et al., 2009) and reduce health risks such as cancer and heart diseases (e.g., Dauchet, Amouyel, & Dallongeville, 2009; He, et al., 2007). Current FVI levels in adolescents tend to fall well below these recommended levels (OECD, 2012). For example, among teenagers in Campania, a region of South Italy, who represent the focus of the present research, only 7.6% of fifteen year olds and 5.5% of thirteen year olds eat more than one portion of vegetables per day and only 14.1% of thirteen year olds and 12.3% of fifteen year olds consume more than one portion of fruit per day (Angelini, Baldacchini, & Mignani, 2010).

Using text messages to change in health behaviours

Since adolescents use text messaging (or SMS) as a preferred method of communication (Hingle et al., 2013; Lenhart, 2012), such messaging could form the basis of an effective strategy to promote health behaviors such as FVI (e.g., Kornman et al., 2010; Woolford et al., 2010). Generally, text messages have shown efficacy in reaching a large number of individuals quickly and with low-cost (Kharbanda et al. 2010). For example, the study of Suffoletto et al. (2015) provided evidence that a text-message intervention can reduce young adults alcohol consumption. Text based messages have a variety of characteristics (such as duration of intervention, frequency of messaging, timing of delivery) that may make them useful with groups such as adolescents. A recent systematic review of reviews (Hall, Cole-Lewis & Bernhardt, 2015) reported that mobile text messaging interventions produced positive changes in a number of health behaviours. Moreover, a

meta-analysis of 38 studies using text messages to change health behaviours indicated small sized but significant effects (Orr & King, 2015). Although reviews (e.g. Shaw & Bosworth, 2012; Siopis, Chey & Allman-Farinelli, 2015) have reported text-based message to promote weight loss, none has focused specifically on FVI in adolescents. Studies have shown other types of message to promote FVI (e.g., Beresford et al., 2001; Churchill & Pavey, 2013; Van Duyn et al., 2001). For example, Luszczynska, Tryburc, and Schwarzer (2007) showed e-mail messages targeting self-efficacy increased FVI in adults.

Affective and instrumental attitudes

The present research focused on testing the effectiveness of text messages targeting attitudes and their underlying outcome expectancies (Ajzen, 1991). Although text message studies have successfully targeted a number of correlates of behaviour change (e.g., Louch, Dalkin, Bodansky, & Conner, 2013 targeted attitudes, norms and self-efficacy in order to promote appropriate insulin use in young adults) in studies using a limited number of text messages it may be more appropriate to focus on one key factor. Attitudes and outcome expectancies in particular have been the focus of a considerable proportion of health messages. We follow this tradition. A focus on attitude can be further justified based on the fact that attitude is often the strongest predictor of intentions for health behaviours (McEachan et al., 2011). In addition, attitude is a significant predictor both of intentions and behaviours even when controlling for other variables (e.g., Albarracin, Johnson & Zanna, 2005). In relation to FVI, a number of studies using the Theory of Planned Behaviour (Ajzen, 1991) have confirmed attitudes as key determinants of intentions to eat fruit and vegetables and other food choice behaviours (e.g., Blanchard et al. 2009a; Blanchard et al., 2009b; Conner, Norman, & Bell, 2002; Godin et al., 2010; Kothe, Mullan, & Amaratunga, 2011; Kothe & Mullan, 2014). With some studies (Brug, Lechner & De Vries, 1995; Lechner, Brug & De Vries, 1997) reporting a direct associations between attitude and FVI.

In focusing on attitudes we were interested to test the power of text messages targeting more traditional instrumental or cognitive outcomes like health with ones targeting more affective

influences like feeling good. This allowed us to compare the power of affective text messages to increase FVI when compared to more traditional instrumental messages. Correlational data has indicated the importance of affective influences on health behaviours (e.g., Blanchard et al., 2009a; Conner, McEachan, Taylor, O'Hara, & Lawton, 2015; Glasman & Albarracin, 2006; Lawton, Conner, & Parker, 2007; Lawton, Conner, & McEachan, 2009; ***; Nasuti & Rhodes, 2013; Rhodes, Fiala, & Conner, 2010; Trafimow et al., 2004). While intervention studies have indicated the power of affective messages to change health behaviours such as physical activity (Conner et al., 2011; Morris et al., 2015; Sirriyeh, Lawton, & Ward, 2010; see Rhodes, Fiala & Conner, 2010 for a review).

Present research

The present research tested the impact of affective and instrumental text messages about FVI compared to a no message control condition (three conditions) on changing FVI in a sample of Italian adolescents using a randomized controlled trial (RCT). There is no similar existing study in adolescents, although other work has focused on determinants of FVI in this group (e.g., Lien, Lytle & Komro, 2002), interventions to promote healthy eating more generally (e.g., Nicklas et al., 1998; French & Stables, 2003), or interventions for teenagers with eating problems, such obesity or overweight (e.g. Lubans et al., 2012; Woolford, et al., 2011). The current focus on a text messaging intervention to increase FVI in adolescents is novel. We predicted that receiving a text message (affective or instrumental) would produce greater increases in FVI compared to no message control condition. Based on previous work (e.g., Conner et al., 2011, Morris et al., 2015, Sirriyeh et al., 2010) we further predicted that affective text messages would be more effective than instrumental text messages in increasing FVI. Finally, we explored whether any effects of affective and instrumental text messages on FVI would be mediated by changes in affective or instrumental attitudes respectively (cp. Conner et al., 2011) and by intentions. We took advantage of recent work on testing for serial mediation (Hayes, 2013) to explore whether intervention effects were mediated by either the relevant attitude construct (e.g., affective attitudes for affective text messages

compared to control) or intentions and also whether the mediation was through the serial mediation path of intervention effect to attitude to intention to behaviour as would be predicted by the TPB (Ajzen, 1991).

Method

Sample

A high-school in Naples (Campania region, South Italy) contacted the University of _____ to help implement a project promoting fruit and vegetable intake in their students. The study was conducted in October 2014. To participate, students in the high-school were required to be between 13 and 19 years of age and in possession of a personal mobile phone with an Internet connection. Participation involved completing questionnaires on two occasions separated by two weeks and in the message conditions receiving daily text messages over these two weeks. At time 1 a total of 1225 students out of 1348 approached met eligibility criteria (age: M = 15.41, SD = 1.53 years) and completed questionnaires before being randomized (see below) to affective, instrumental or control groups. A further 169 students subsequently refused to participate leaving 1056 (297 in affective group, 9 refused to participate; 238 in instrumental group, 68 refused to participate; 521 in control group, 92 refused to participate). At time 2 a total of 634 (52% of original eligible sample) completed questionnaires (221 in affective group, 76 lost to follow-up; 205 in instrumental group, 33 lost to follow-up; 208 in control group, 313 lost to follow-up). In part the numbers lost to follow-up (particularly in control group) was attributable to a school trip restricting participation. Figure 1 shows the flow of participants through each stage of this intervention.

Procedure

This study was conducted following receipt of ethical approval by the _____ and by the board of the school. Students were contacted face-to-face by experimenters, who explained that the study was an examination of adolescents' healthy eating. Students were informed that the World Health Organization (2015) recommended eating at least five portions of fruit and vegetable per day (three portions of fruits and two of vegetables). A portion was specified as a fruit of medium size or

150 grams, at least 50 grams of raw vegetables or 250 grams of cooked vegetables. Participants then completed the questionnaire about FVI, provided demographic information and a mobile telephone number for the text messages and created a personal code to allow matching of time 1 and time 2 questionnaires. At time 2 participants completed a second questionnaire. Questionnaires were administered in classroom time.

A randomization sequence was created using Excel 2007 (Microsoft). Participants were allocated to the three conditions in the ratio 2:1:1 for control, affective and instrumental. This ratio was selected because we anticipated higher drop-out rates in control condition. These randomization ratios lead only to a modest loss in statistical power (e.g., Dumville et al., 2005; Pocock, 1995; Torgerson & Campbell, 2000). The same allocation ratio has been employed in other text message studies (e.g., Suffoletto et al., 2015 on binge drinking in young adults).

Intervention

For those in the two text message conditions, messages were delivered each morning for 14 days before the start of school. To reduce the likelihood of cross-contamination, students were explicitly requested not to discuss the contents of messages with other participants during the intervention. The messages were sent by Whatsapp, a well-known cross-platform mobile messaging application. Message content was created based on previous research (e.g. McEachan, Lawton, Jackson, Conner, & Lunt, 2008; Sirriiyeh et al., 2010) and following guidelines (e.g., Hingle et al., 2013) about the content of the text message interventions (i.e., such as simple messages, addressing the reality of adolescent lifestyles). No messages were sent in the control condition.

In the affective condition participants received text messages that focused on positive affective consequences of FVI (e.g. “a diet rich in fruits and vegetables promote emotional well-being being associated with a lower prevalence of anxiety and depression”; “the hormone of a “good mood", namely serotonin, naturally produced by the body is stimulated by the consumption of simple sugar, such as that contained in the fruit”; “a diet rich in fruits and vegetables, can help lower irritability, nervousness and confusion caused by stress”). In the instrumental condition

participants received text messages that focused on the physical benefits of FVI (e.g. "diet rich in vegetable and fruit reduces by 30-40% the probability of contracting cancer"; "the fibre of fruits and vegetables are essential for the proper functioning of the intestine and to reduce the absorption of excessive fat"; fruits and vegetables helps the supply of useful minerals for metabolism, for the proper development of the organism and for the functioning of nerve impulses in the brain and heart"). See Appendix A for full list of messages for each condition. The control group did not receive messages.

After completing the time 2 questionnaire participants received feedback on the results of the study (the control group also received further information on the benefits of FVI to match that contained in the texts).

Measures

The following measures were taken. *Demographics* (gender and age) at T1. *Intentions* (INT) to eat 5 portion of fruit and vegetable per day in the next two weeks were measured using three items on 7-point Likert scales (Armitage & Conner, 1999; e.g., "I intend to eat at least five portions of fruit and vegetables per day over the next two weeks…definitely do not – definitely do"; all scored 1–7; with higher scores indicating stronger intention) at both time points. Cronbach's alpha was .91 and .94 for T1 and T2 respectively. *Perceived behavioral control* (PBC) was measured by seven items (Armitage & Conner, 1999a; e.g., "Over the next two weeks, will you feel to have personal control on eating five servings of fruits and vegetables a day?... strongly disagree - strongly agree"; all scored 1–7; higher scores indicated greater control) at both time points. Cronbach's alpha was .85 and .87 for T1 and T2 respectively. *Affective attitudes* were assessed by three items (Armitage & Conner, 1999; e.g., "Eating at least five portion of fruit and vegetable per day in the next two weeks is… unenjoyable–enjoyable; unpleasant- pleasant; boring–exciting"; all scored 1–7; higher scores indicated more positive attitude) at both time points. Cronbach's alpha was .75 and .73 for T1 and T2 respectively. *Instrumental attitude* was assessed by three items (Armitage & Conner, 1999; e.g., "Eating at least five portion of fruit and vegetable per day in the

next two weeks is… not worthwhile–worthwhile; worthless-valuable"; harmful–beneficial"; all scored 1–7; higher scores indicated more positive attitude) at both time points. Cronbach's alpha was .78 and .80 for T1 and T2 respectively. *Subjective norm* was assessed by four items (Armitage & Conner, 1999; e.g., "People who are important to me want me to eat at least five portions of fruit and vegetables per day over the next two weeks…strongly disagree- strongly agree"; all scored 1–7; higher scores indicated greater subjective norm) at both time points. Cronbach's alpha was .80 and .75 for T1 and T2 respectively.

Self-reported behavior was assessed with two items (one for fruit consumption and second for vegetable consumption) and averaged. Response formats were formed by 6-points ranging from 1 portion to more than 5 portions per day (e.g., "In the last two weeks how many portions of fruit do you eat per day?"). At time 1 this was used as a measure of past behaviour, while at time 2 it was used as the key dependent variable.

Data analysis

Analysis of intervention effects on FVI and all descriptive analyses were conducted in SPSS 17.0. Multivariate, univariate and Chi-square analyses were used to check for any biases in randomization or drop-out. MANCOVA was used to test for differences in FVI across conditions controlling for baseline (T1) FVI. Finally, we used multiple mediation analyses, using bootstrapping in SPSS to test whether differences between conditions was mediated by affective and instrumental attitudes and intentions controlling for past behaviour.

Results

Preliminary analysis

Multivariate and univariate analyses at baseline (T1) showed that there were no significant differences in intention, perceived behavioural control, subjective norm, affective and instrumental attitudes, FVI and age among the three conditions ($p > .54$). Chi-square also indicated that there were no significant differences in gender ($p > .14$). These findings suggested that randomization was adequate (Table 1) and the three conditions were matched on baseline measures.

Repeating these analyses, there were no differences in age and gender between those who did not meet inclusion criteria and those who participated to interventions (*p*s > .79). Comparing those who responded to questionnaires at both time points and those who dropped out between time 1 and 2, indicated that there were no significant differences in age, gender and in the TPB variables or FVI at baseline (*p*s > .49). These results suggested that the final analyzed sample was representative of the initial sample. Further analyses indicated that there were also no significant differences between those retained and lost to follow-up within each condition on the above variables (*p*s > .50).

Main analysis

Table 2 reports the mean scores on TPB variables at T2. MANOVA revealed a significant overall effect of condition ($F(12,1254) = 4.93$; $p = .001$, $\eta 2 = .04$). Univariate Fs indicated significant effects of condition for intention ($F(1,634) = 16.32$; $p = .001$, $\eta 2 = .05$), perceived behavioural control ($F(1,634 = 3.74$; $p = .05$, $\eta 2 = .01$), subjective norm ($F(1,634) = 5.06$; $p = .01$, $\eta 2 = .02$), affective attitude ($F(1,634) = 8.45$; $p = .001$, $\eta 2 = .03$), and instrumental attitude ($F(1,634) = 10.46$; $p = .001$, $\eta 2 = .03$). Post hoc tests (Tukey) showed that intentions were significantly higher in the affective condition than either of the control or instrumental conditions (*p*s < .001), which did not significantly differ from one another. Similarly, post hoc tests indicated that perceived behavioural control ($p < .05$), subjective norm ($p < .001$), and affective attitude ($p < .001$) were significantly higher in affective compared to control conditions and that no other differences were significant. Post hoc tests also showed that instrumental attitude was significantly higher in the affective compared to the control condition ($p < .001$) and significantly higher in the instrumental compared to the control condition ($p < .001$), although the affective and instrumental conditions did not significantly differ from one another.

MANCOVA on FVI at T2, controlling for past behaviour (T1 FVI), showed significant effects of the covariate, past behaviour ($F(1,664) = 265.68$; $p = .001$, $\eta 2 = .29$) and a significant effect of condition ($F(2,664) = 2.7$; $p = .001$; $\eta 2 = .05$). Estimated marginal means for FVI at T2

were 4.56 (Std. Error = .12; 95% C.I., 4.31 - 4.80) for the control group, 5.51 (Std. Error = .11; 95% C.I., 5.28 - 5.73) for the affective group, and 5.05 (Std. Error = .1; 95% C.I., 4.80 - 5.30) for the instrumental group. Post hoc tests (Tukey) revealed that, controlling for past behaviour, there was a significant differences in FVI at T2 between the control and affective groups (mean difference = -0.98; p = .001; i.e., affective group higher than control), between the control and instrumental groups (mean difference = -0.60; p = .01; i.e., instrumental group higher than control), and between the affective and instrumental groups (mean difference = .39, p = .05; i.e., affective group higher than instrumental group).

Mediation analyses

Sequential mediation analyses, using bootstrapping in SPSS, tested if controlling for past behaviour (FVI at T1) the effect of intervention compared to control group on FVI at T2 was sequentially mediated via attitude and intention (both at T2). For the comparison of affective messages against control conditions (Figure 2) we tested the mediating effect of the affective attitude (i.e., the attitude measuring corresponding to the messages), controlling for past behaviour and instrumental attitude and also controlling for instrumental condition against control condition. While for the comparison of instrumental messages against control conditions (Figure 2) we tested the mediating effect of instrumental attitude (i.e., the attitude measuring corresponding to the messages), controlling for past behaviour and affective attitude and also controlling for affective condition against control condition. The indirect effects were considered significant if bootstrapped 95% confidence intervals (CI) did not include zero. Figure 2 shows that for comparisons of the affective message against control conditions each of the three mediated pathways was significant and the total indirect effect was significant (.41; 95% CI, .26–.58). The path between conditions and FVI at T2 controlling for past behaviour was reduced by controlling for the mediators (Figure 2) but remained significant (.50; 95% CI, .18–.82) indicating any mediation was partial. Examination of the mediated paths indicated that the strongest mediated effect was for the simple mediation path from condition to FVI via intention (.32; 95% CI, .19–.47). The second strongest mediation path

was the simple mediation path from condition to FVI via affective attitude (.06; 95% CI, .01–.12). The sequential mediation chain from condition to FVI via affective attitude and then intention was the smallest effect, although also significant (.03; 95% CI, .01–.08);

Figure 2 shows the results of the tests of mediation for the comparison of the instrumental versus control conditions. The only significant bootstrapped unstandardized indirect effect was for the sequential mediation chain from condition to FVI via instrumental attitude and then intention (.04; 95% CI, .01–.08). The bootstrapped indirect effects were not significant for the simple mediation path from condition to FVI via instrumental attitude (-.00; 95% CI, -.04–.03) or the simple mediation from condition to FVI via intention (.04; 95% CI, -.19–.17). In addition, the total indirect effect was significant (.07; 95% CI, -.06–.22), the direct path between condition and FVI controlling for mediators, past behaviour and instrumental against control condition remained significant (.35; 95% CI, .03–.68) and was not reduced compared to the path from condition to FVI not controlling for mediators, past behaviour (Figure 2).

Finally, we compared the impact of each message condition compared to control on T2 affective and instrumental attitude controlling for baseline levels of these variables. The impact of the affective messages was larger on affective ($\eta 2$ = .04) compared to instrumental ($\eta 2$ = .03) attitude and the reverse was true for the effect of instrumental messages (affective attitude $\eta 2$ = .01; instrumental attitude $\eta 2$ = .04).

Discussion

Affective versus instrumental attitudes intervention on fruit and vegetable intake

The present research describes a test of the effects of different persuasive messages designed to increase FVI in high-school students on changes in FVI over a 14-day period using an RCT. Participants at baseline reported an FVI below that recommended (i.e., at least five portions per day). Following the intervention both affective and instrumental groups significantly increased their daily FVI compared to control (i.e., to a mean level above the recommended minimum). Analyses indicated that these increases were significant in both the two message groups compared

to a control no message group. Therefore, adolescents exposed to the intervention increased their FVI. These findings are consistent with research indicating the efficacy of text messages in improving health behaviours (e.g., Hall, Cole-Lewis & Bernhardt, 2015; Louch et al., 2013; Siopis, Chey & Allman-Farinelli, 2015) and with studies on the efficacy of paper and pencil messages (Beresford et al., 2001; Churchill & Pavey, 2013; Van Duyn et al., 2001) or computer-tailored messages to promote FVI (Brug et al., 1998; Latimer et al., 2008; Luszczynska, Tryburc & Schwarzer, 2007; Oenema, Tan & Brug, 2005).

Additionally, when intervention groups were compared, the affective intervention was significantly more effective in increasing FVI compared to the instrumental group. Thus, affective text messages would appear to be the most efficacious intervention for this behaviour with this sample of adolescents. These findings support results that showed the importance of affective compared to instrumental attitudes in other health behaviours (e.g. Courneya & Friedenreich, 1997), such as physical activity (e.g., Conner et al., 2011; Morris et al., 2015), driving above the speed limit and smoking cessation (Lawton, Conner & Parker, 2007). This extends these findings to healthy eating. Indeed, the findings presented here are consistent with research showing that for many health behaviours affective-based messages may be more effective in generating behaviour change (Morris et al., 2015). The current research supports the contention that affective influences may be important causal determinants of health behaviours that could be usefully targeted in interventions.

Our mediation analyses (Figure 2) indicated that the effectiveness of instrumental messages compared to no messages was partially mediated by a sequential impact of messages on instrumental attitudes and intentions as the TPB would predict. Although it is worth noting that the total mediated effect was not statistically significant. More importantly, in the present context, the impact of the affective messages compared to no messages on FVI was partially mediated through three significant pathways (Figure 2). Consistent with the TPB was a serial mediation path through affective attitudes and intentions, although this was the smallest mediated path (and the one with the

most links). The affective messages also impacted FVI through effects on intentions and through effects on affective attitudes. The latter pathway, in particular, is consistent with a growing number of studies showing affective attitudes to directly impact on health behaviours (controlling for intentions) in a way that instrumental attitudes do not (****).

Limitation and methodological issues

There are several potential limitations for this study. First, the text messages employed in the current research might be criticized as not being purely affective or instrumental (see Appendix for all items). This is a common problem in this area (Conner et al., 2011; Sirriyeh et al., 2010) with generating realistic persuasive messages for use in real world situations that are purely affective or instrumental in nature. Nevertheless we would argue that, at the very least, our affective messages had more of an affective 'flavour' than the instrumental messages and that the instrumental messages had more of an instrumental 'flavour' than the affective messages. Particularly, the analyses (Figure 2) showed that affective messages increased both affective and instrumental attitudes, which impacted on FVI at T2 through intentions. Importantly, instrumental messages did not generate a change in affective attitude. This may be considered to be both as a limitation in the creation of affective messages and a suggestion that affective messages, but not instrumental messages, improve both instrumental and affective attitudes towards healthy eating. Nevertheless, the most salient result is that affective attitude can be changed by affective messages and exert a direct effect (not via intentions) on post-intervention behaviour. This is consistent with suggestions from various correlational studies (Lawton et al., 2009; Lowe et al., 2002; Rhodes, 2006). These evidences provides some support for the affective and instrumental content of the messages. Second, though the messages were matched as much as possible across groups, the messages on affective consequences of FVI were generally focused on the more short-term benefits when compared to the instrumental messages. In this regard, Hall and Fong (2007) note the importance of more immediate compared to temporally distant outcomes for health behaviours. They showed that dietary behaviours are viewed as connected to many proximal costs outcomes (e.g., inconvenience

and loss of pleasure) and only weakly to distal benefits (e.g., longer life span and decreased risk for disease). Further research could seek to assess the relative importance of proximal versus affective outcomes in determining health behaviours (cf. Morris et al., 2015).

Third, the study used a passive control group, which received no text messages and was therefore not matched to other conditions on amount of contact time or the receiving of texts. We judged that it was more appropriate to send no texts to this group rather than texts irrelevant to FVI. It might be useful to confirm that our positive effects observed both in affective and instrumental conditions are not simply attributable to receiving a text, to increased contact with the experimenter or some enhanced Hawthorne effect. The differences between two message conditions would argue against some of these alternative explanations of our findings.

Fourth, the sample was restricted to a single city in the South of Italy, therefore the results may not be generalizable to other samples. Fifth, the measurement of behaviour used simple self-report items. Thus, the findings need confirming with more objective measures. Although truly objective measures of daily food consumption are difficult to generate, confirming the present findings using more standardized measures of intake such as food diaries (e.g. Brouwer & Mosack, 2015) or Food Frequency Questionnaires (Willett & Lenart, 1998) would be useful. Sixth, the follow-up period was only 14 days. It would be valuable to verify the findings, with a longer follow-up period, to test if the effects of these messages persists. This is particularly important given the fact that any health consequences of fruit and vegetable consumption are associated with prolonged periods of consumption. Finally, given that messages were sent each morning there is the possibility that adolescents in different groups discussed the content of the messages despite instructions not to do so. Although this might be expected to lead to a reduction in the differences in conditions it might be useful for future research to use a cluster randomized controlled design (with clusters based on not interacting groups, e.g., schools) to further test these effects.

Future direction and practical implications

Despite these methodological concerns, from an applied perspective, the current findings could support new policy recommendations based on the use of messaging interventions to promote healthy eating in a young people. Specifically, the current research underlined the need to emphasize enjoyment and social benefits of FVI rather than pointing to physical/health risks. More generally, in addition to proximal versus distal outcomes and affective versus instrumental outcomes, Rhodes and Conner (2010) point to the importance of positive versus negative outcomes. The present research would point to text messages particularly focusing on affective, proximal, and positive outcomes as a useful focus with adolescents in relation to FVI.

Finally, there is evidence about how hyper-responsivity to immediate contingencies, which is a high response to sensory input also described as "sensory defensiveness" (Knickerbocker, 1980), impacts on human behaviour (e.g., Loewenstein et al.,2003) and about how individual differences in time perspective (e.g., Hall & Fong, 2003) are associated with health behaviors (e.g., Fong & Hall, 2003). It could be interesting for future research to consider the impact of other possible individual difference, such as levels of self-identity as health eater (e.g. ***** 2015) and levels of risk awareness (Mullan, Wong, & Kothe, 2013). Furthermore, since adolescents spent several hours on Internet each day (e.g., Caso, 2015), it could be newsworthy to try to replicate this intervention using a social network or to differentiate the adolescents' FVI considering people with whom they share meals (Guidetti, Cavazza & Graziani, 2014). Finally, future research could measure the intensity with which adolescents use the mobile phone or text messaging and monitor how much they read the sent messages and if they found them helpful.

Conclusion

In summary, the present research supported the hypothesis that it could be useful to use text messages that target affective beliefs (e.g., fun and good mood) in order to increase FVI rather than instrumental beliefs (e.g. reduction of cancer risks). Further research exploring affective influences on health behaviours in intervention studies could be worthwhile.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211. doi:10.1016/0749-5978(91)90020-t

Ajzen, I., & Fishbein M. (2005). The influence of attitude on behavior, in D. Albarracin, B. T. Johnson & M. P. Zanna (Eds.), *Handbook of attitudes and attitude change: Basic principles* (pp. 173-221). Mahwah, NJ: Erlbaum. doi:10.1093/ijpor/edh109

Albarracin, D., Johnson, B. T., & Zanna, M. P. (Eds.) (2005). *The handbook of attitudes.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc. doi:10.1093/ijpor/edh109

Angelini, P., Baldacchini, F., & Mignani, R. (2010*). Stili di vita e salute dei giovani in età scolare. Rapporto sui dati regionali HBSC 2009-2010.* Direzione Generale Sanità e Politiche Sociali, Regione Emilia-Romagna. Bologna: Centro Stampa Giunta Regione Emilia-Romagna.

Armitage, C. J., & Conner, M. (1999). Distinguishing perceptions of control from behavior: Predicting consumption of low-fat diet using the theory of planned behavior. *Journal of Applied Social Psychology, 29*(1), 72-90. doi:10.1111/j.1559-1816.1999.tb01375.x

Beresford, S. A. A., Thompson, B., Feng, Z., Christianson, A., McLerran, D., & Patrick, D. L. (2001). Seattle 5 a day worksite program to increase fruit and vegetable consumption. *Preventive Medicine, 32*(3), 230-238. doi:10.1006/pmed.2000.0806.

Blanchard, C. M., Fisher, J., Sparling, P. B., Shanks, T. H., Nehl, E., Rhodes, R. E., Courneya, K. S., & Baker, F. (2009a). Understanding adherence to 5 servings of fruits and vegetables per day: A theory of planned behavior perspective. *Journal of Nutrition Education and Behavior, 41*(1), 3-10. doi:10.1016/j.jneb.2007.12.006

Blanchard, C. M., Kupperman, J., Sparling, P. B., Nehl, E., Rhodes, R. E., Courneya, K. S., & Baker, F. (2009b). Do ethnicity and gender matter when using the theory of planned behavior to understand fruit and vegetable consumption? *Appetite*, *52*(1), 15-20. doi:10.1016/j.appet.2008.07.001

Brouwer, A. M., & Mosack, K. E. (2015). Expanding the theory of planned behavior to predict healthy eating behaviors. *Nutrition & Food Science*, *45*(1), 39-53. doi:10.1108/NFS-06-2014-0055

Brug, J., Glanz, K., Van Assema, P., Kok G., & van Breukelen, G. J. P. (1998).The impact of computer-tailored feedback and iterative feedback on fat, fruit, and vegetable intake. *Health Education & Behavior, 25*(4)*,* 517-531. doi:10.1177/109019819802500409

Brug, J., Lechner, L., & De Vries, H. D. (1995). Psychosocial determinants of fruit and vegetable consumption. *Appetite,* 25(3), 285-296. doi:10.1006/appe.1995.0062

Caso, D. (2015). L'uso di Internet e il benessere psicosociale in adolescenza: Uno studio correlazionale [Internet use and psychosocial well-being in adolescence: A correlational study]. *Psicologia della Salute, 2,* 141-155. doi:10.3280/PDS2015-002008

Centers for Disease Control and Prevention. (2013). *Youth risk behavior surveillance - United States*. Retrieved from http://www.cdc.gov/healthyyouth/data/yrbs/index.htm

Churchill, S., & Pavey, L. (2013). Promoting fruit and vegetable consumption: The role of message framing and autonomy. *British Journal of Health Psychology, 18*(3), 610-622. doi:10.1111/bjhp.12007

Conner, M., McEachan, R., Taylor, N., O'Hara, J., & Lawton, R. (2015). Role of affective attitudes and anticipated affective reactions in predicting health behaviors. *Health Psychology, 34*(6)*,* 642-652. doi:10.1037/hea0000143. Epub 2014 Sep 15.

Conner, M., Norman, P., & Bell, R. (2002). The theory of planned behavior and healthy eating. *Health Psychology*, *21*(2), 194-201. doi:10.1037/0278-6133.21.2.194

Conner, M., Rhodes, R., Morris, B., McEachan, R., & Lawton, R. (2011). Changing exercise through targeting affective or cognitive attitudes. *Psychology & Health*, *26*(2), 133-149. doi:10.1080/08870446.2011.531570

Conner, M., & Sparks, P. (2015). The theory of planned behaviour and reasoned action approach. In M. Conner and P. Norman (Eds.), *Predicting and changing health behaviour:*

Research and practice with social cognition models (3rd Ed.; pp. 142-188). Maidenhead: Open University Press.

Courneya, K. S., & Friedenreich, C. M. (1997). Relationship between exercise pattern across the cancer experience and current quality of life in colorectal cancer survivors. *The Journal of Alternative and Complementary Medicine*, *3*(3), 215-226. doi:10.1089/acm.1997.3.215

Dauchet, L., Amouyel, P., & Dallongeville, G. (2009). Fruits, vegetables and coronary heart disease. *Nature Reviews Cardiology*, *6*(9), 599-608. doi:/10.1038/nrcardio.2009.131

Dietz, W. H. (1997). Periods of risk in childhood for the development of adult obesity - What do we need to learn? *American Society for Nutritional Services*, *127*, 1884S-1886S.

Dumville, J. C., Hahn, J. N. V., Miles, D. J., & Torgerson, D. J. (2006). The use of unequal randomisation ratios in clinical trials: A review. *Contemporary Clinical Trials*, *27*(1), 1-12. doi:10.1016/j.cct.2005.08.003

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. (2000). The affect heuristic in judgements of risks and benefits. *Journal of Behavioral Decision Making*, *13*(1), 1-17. doi:10.1002/(sici)1099-0771(200001/03)13:1<1::aid-bdm333>3.0.co;2-s

Fong, G. T., & Hall, P. A. (2003). Time perspective: A potentially important construct for decreasing health risk behaviors among adolescents. In D. Romer (Ed.), *Reducing adolescent risk: Toward an integrated approach* (pp. 106-112). London: Sage Publications. doi:10.4135/9781452233611.n13

French, S. S., & Stables, G. (2003). Environmental interventions to promote vegetable and fruit consumption among youth in school settings. *Preventive Medicine*, *37*(6), 593-561. doi:10.1016/j.ypmed.2003.09.007

Glasman, L. R., & Albarracin D. (2006). Forming attitudes that predict future behavior: A meta-analysis of the attitude–behavior relation. *Psychological Bulletin*, *132*(5), 778-822. doi:10.1016/j.ypmed.2003.09.007

Godin, G., Amireault, S., Bélanger-Gravel, A., Vohl, M., Pérusse, L., & Guillaumie, L.

(2010). Prediction of daily fruit and vegetable consumption among overweight and obese individuals. *Appetite, 54*(3), 480-484. doi:10.1016/j.appet.2010.01.018

Guidetti, M., Cavazza, N., & Graziani, A. R. (2014). Healthy at home, unhealthy outside: Food groups associated with family and friends and the potential impact on attitude and consumption. *Journal of social and clinical psychology, 33*(4), 343-364. doi:10.1521/jscp.2014.33.4.343

Hall, A., Cole-Lewis, H., & Bernhardt, J. M. (2015). Mobile text messaging for health: A systematic review of reviews. *Annual Review Public Health*, *36*(1), 393-415. doi:10.1146/annurev-publhealth-031914-122855.

Hall, P. A., & Fong, G. T. (2003). The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology and Health*, *18*(6), 685-706. doi:10.1080/0887044031000110447

Hall, P. A., & Fong, G. T. (2007). Temporal self-regulation theory: A model for individual health behavior. *Health Psychology Review*, *1*(1), 6-52. doi:10.1080/17437190701492437

Hingle, M., Nichter, M., Mederiros, M., & Grace, S. (2013). Texting for health: The use of participatory methods to develop healthy lifestyle messages for teens. *Journal of Nutrion Education & Behavior, 45*(1), 12-19. doi:10.1016/j.jneb.2012.05.001

Kharbanda, E. O., Stockwell, M. S., Fox, H. W., & Rickert, V. I. (2009). Text4Health: A qualitative evaluation of parental readiness for text message immunization reminders. *American Journal of Public Health, 99*(12), 2176-2178. doi:10.2105/ajph.2009.161364

Knickerbocker, B. M. (1980). *A holistic approach to learning disabilities*. Thorofare, NJ: Slack.

Kornman, K. P., Shrewsbury, V. A., Chou, A.C., Nguyen, B., Lee, A., O'Connor, J., Steinbeck, K. S., Hill, A. J., Kohn, M. R., Shah, S., & Baur, L. A. (2010). Electronic therapeutic contact for adolescent weight management: The Loozit study. *Telemedicine and e-Health*, *16*(6), 678-668. doi:10.1089/tmj.2009.0180

Kothe, E. J., & Mullan, B. (2014). A randomised controlled trial of a theory of planned behaviour to increase fruit and vegetable consumption. Fresh facts. *Appetite*, *78*, 68-75. doi:10.1016/j.appet.2014.03.006

Kothe, E. J., Mullan, B. A., & Amaratunga, R. (2011). Randomised controlled trial of a brief theory-based intervention promoting breakfast consumption. *Appetite*, *56*(1), 148-155. doi:10.1016/j.appet.2010.12.002.

Latimer, A. E., Williams-Piehota, P., Katulak, N. A., Cox, A., Mowad, L., Higgins, E. T., & Salovey, P. (2008). Promoting fruit and vegetable intake through messages tailored to individual differences in regulatory focus. *Annual Behavior Medicine*, *35*(2), 363-369. doi:10.1007/s12160-008-9039-6

Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, *28*(1), 56-65. doi:10.1037/a0013424

Lawton, R., Conner, M., & Parker, D. (2007). Beyond cognition: Predicting health risk behaviors from instrumental and affective beliefs. *Health Psychology*, *26*(3), 259-267. doi:10.1037/0278-6133.26.3.259

Lechner, L., Brug, J., & De Vries H. (1997). Misconceptions of fruit and vegetable consumption: Differences between objective and subjective estimation of intake. *Journal of Nutrition Education, 29*(6), 313-320. doi:10.1016/s0022-3182(97)70245-0

Lenhart, A. (2012). *Teens, smartphones & texting*. Washington: Pew Internet & American Life Project.

Lien, N., Lytle, L. A., & Komro, K. A. (2002). Applying theory of planned behaviour to fruit and vegetable consumption of young adolescents. *American Journal of Health Promotion, 16*(4), 189-197. doi:10.4278/0890-1171-16.4.189

Loewenstein, G., Read, D., & Baumeister, R. (2003). *Time and decision: Economic and psychological perspectives on intertemporal choice.* New York, NY: Russell Sage Foundation.

doi:10.1016/j.socec.2004.04.003

Louch, G., Dalkin, S., Bodansky, J., & Conner, M. (2013). An exploratory randomised controlled trial using short messaging service to facilitate insulin administration in young adults with type 1 diabetes. *Psychology, Health & Medicine*, *18*(2), 166-174. doi:10.1080/13548506.2012.689841

Lowe, R., Eves, F., & Carroll, D. (2002). The influence of affective and instrumental beliefs on exercise intentions and behavior: A longitudinal analysis. *Journal of Applied Social Psychology*, 32, 1241-1252. doi: 10.1111/j.1559-1816.2002.tb01434.x

Lubans, D. R., Morgan, P. J., Okely, A. D., Dewar, D., Collins, C. E., Batterham, M., Callister, R., & Plotnikoff, R. C. (2012). Preventing obesity among adolescent girls: One-year outcomes of the nutrition and enjoyable activity for teen girls [NEAT girls] cluster randomized controlled trial. *Archives of Pediatrics and Adolescent Medicine Journal*, *166*(9), 821-827. doi:10.1016/j.jsams.2012.11.806

Luszczynska, A., Tryburc, M., & Schwarzer, R. (2007). Improving fruit and vegetable consumption: A self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research, 22*(5)*,* 630-638. doi:10.1093/her/cyl133

Mainvil, L., Lawson, R., Horwath, C. C., McKenzie, J. E., & Reeder, A. I. (2009). Validated scales to assess adult self-efficacy to eat fruits and vegetables. *American Journal of Health Promotion*, *23*(3), 210-217. doi:10.4278/ajhp.061221154

McEachan, R. R. C, Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviors with the Theory of Planned Behavior: A meta-analysis. *Health Psychology Review*, *5(2)*, 97-144. doi:10.1080/17437199.2010.521684

McEachan, R. R., Lawton, R. J., Jackson, C., Conner, M., & Lunt, J. (2008). Evidence, theory and context: Using intervention mapping to develop a worksite physical activity intervention. *BMC Public Health, 8*(1)*,* 326. doi:10.1186/1471-2458-8-326

Morris, B., Lawton, R., McEachan, R., Hurling, R., & Conner, M. (2015). Changing self-reported physical activity using different types of affectively and cognitively framed health messages, in a student population. *Psychology, Health & Medicine*, *21*(2), 198-207. doi:10.1080/13548506.2014.997762

Mullan, B., Wong, C. L., & Kothe, E. J. (2013). Predicting adolescent breakfast consumption in the UK and Australia using an extended theory of planned behaviour. *Appetite*, *62,* 127-132. doi:10.1016/j.appet.2012.11.021

Nasuti, G., & Rhodes, R. E. (2013). Affective judgment and physical activity in youth: Review and meta-analyses. *Annals of Behavioral Medicine*, *45*(3)*,* 357-376. doi:10.1007/s12160-012-9462-6

Nicklas, T., Johnson, C. C., Myers, L., Farris, R. P., & Cunningham, A. (1998). Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5 - A fresh nutrition concept for students. *American School Health Association*, *68*(6), 248-253. doi:10.1111/j.1746-1561.1998.tb06348.x

OECD (2012). *Health at a Glance: Europe 2012*, OECD Publishing. doi:10.1787/9789264183896-en

Oenema, A., Tan, F., & Brug, J. (2005). Short-term efficacy of a web-based computer-tailored nutrition intervention: Main effects and mediators. *Annual Behavior Medicine, 29*(1), 54-63. doi:10.1207/s15324796abm2901_8

Orr, J. A., & King, R. J. (2015). Mobile phone SMS messages can enhance healthy behaviour: A meta-analysis of randomised controlled trials. *Health Psychology Review, 9*(4), 397-416, doi:10.1080/17437199.2015.1022847

Pearson, N., Timperio, A., Crawford, D., & Biddle, S. J. H. (2009). Family correlates of fruit and vegetable consumption in children and adolescents: A systematic review. *Public Health Nutrition*, *12*(02), 267-283. doi.org/10.1017/s1368980008002589

Pocock, S. J. (1995). *Clinical trials: A practical approach*. Chichester: John.

Rhodes R. E., & Conner, M. (2010). Comparison of behavioral belief structures in the physical activity domain. *Journal of Applied Social Psychology, 40*(8), 2105-2120. doi:10.1111/j.1559-1816.2010.00652.x

Rhodes, R. E., Fiala B., & Conner, M. (2009). A review and meta-analysis of affective judgments and physical activity in adult populations. *Annals of Behavioral Medicine*, *38*(3), 180-204. doi:10.1007/s12160-009-9147-y

Rhodes, R.E., Blanchard, C.M., & Matheson, D.H. (2006). A multi-component model of the theory of planned behaviour. *British Journal of Health Psychology*, 11, 119–137. doi: 10.1348/135910705x52633

Shaw, R., & Bosworth, H. (2012). Short message service (SMS) text messaging as an intervention medium for weight loss: A literature review. *Health Informatics Journal, 18*(4), 235-250. doi:10.1177/1460458212442422

Siopis, G., Chey, T., & Allman-Farinelli, M. (2015). A systematic review and meta-analysis of interventions for weight management using text messaging. *Journal of Human Nutrition and Dietetics*, *28*, 1-15. doi:10.1111/jhn.12207

Sirriyeh, R. H., Lawton, R. J., & Ward, J. K. (2010). Physical activity and adolescents: An exploratory randomised controlled trial (RCT) investigating the influence of affective and instrumental text messages. *British Journal of Health Psychology*, *15*(4), 825-840. doi:10.1348/135910710x486889

Suffoletto, B., Kristan, J., Chung, T., Jeong, K., Fabio, A., Monti, P., & Clark, D. B. (2015). An interactive text message intervention to reduce binge drinking in young adults: A randomized controlled trial with 9-month outcomes. *PLOS ONE, 10*(11), e0142877. doi:10.1371/journal.pone.0142877

Torgerson, D., & Campbell, M. (2000). Unequal randomisation can improve the economic efficiency of clinical trials. *PharmacoEconomics & Outcomes News, 282*(1), 4-4. doi:10.1007/bf03267445

Trafimow, D., Sheeran, P., Lombardo, B., Finlay, K. A., Brown, J., & Armitage, C. J. (2004). Affective and cognitive control of persons and behaviours. *British Journal of Social Psychology*, *43*(2), 207-224. doi:10.1348/0144666041501642

U.S. Department of Agriculture and U.S. Department of Health and Human Services (USDA/USDHHS). (2010). *Dietary guidelines for Americans*. Washington, DC: U.S. Retrieved from http://www.cnpp.usda.gov/DietaryGuidelines

Van Duyn, M. A. S., Kristal, A. R., Dodd, K., Campbell, M. K., Subar, A. F., Stables, G., Nebeling, L., & Glanz, K. (2001) Association of awareness, intrapersonal and interpersonal factors, and stage of dietary change with fruit and vegetable consumption: A national survey. *American Journal of Health Promotion, 16*(2)*,* 69-78. doi:10.4278/0890-1171-16.2.69

Willett, W., & Lenart, E. (1998). Reproducibility and validity of food-frequency questionnaires. In W. Willett (Ed.), *Nutritional epidemiology*, (*2nd Ed.),* (pp. 101-147). New York: Oxford. doi:10.1093/acprof:oso/9780195122978.003.06

Woolford, S. J., Barr, K. L., Derry, H. A., Jepson, C. M., Clark, S. J., Strecher, V. J., & Resnicow, K. (2011). OMG do not say LOL: Obese adolescents' perspectives on the content of text messages to enhance weight loss efforts. *Obesity, 19*(12), 2382-2387. doi:10.1038/oby.2011.266

World Health Organization (2015). *Obesity and overweight. Fact sheet N°311*. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/

Table 1. Means and standard deviations of measured variables at T1 in each condition

	Control (N = 208)		Affective (N = 221)		Instrumental (N = 205)	
Variables	Mean	SD	Mean	SD	Mean	SD
Intention	3.78	1.75	3.87	1.61	3.68	1.72
PBC	4.54	1.26	4.65	1.29	4.63	1.38
Subjective norm	4.27	1.42	4.16	1.32	4.06	1.43
Affective attitude	3.83	1.62	4.02	1.60	3.87	1.53
Instrumental attitude	5.31	1.42	5.45	1.49	5.25	1.55
FVI	3.83	1.72	3.76	1.55	3.95	1.78

Table 2. Means and standard deviations of measured variables at T2 in each condition

	Control (N = 208)		Affective (N = 221)		Instrumental (N = 205)	
Variables	Mean	SD	Mean	SD	Mean	SD
Intention	3.48	1.62	4.34	1.55	3.76	1.68
PBC	4.40	1.24	4.74	1.30	4.67	1.33
Subjective norm	3.89	1.36	4.29	1.31	4.19	1.34
Affective attitude	3.82	1.45	4.41	1.56	4.09	1.49
Instrumental attitude	4.97	1.75	5.62	1.44	5.52	1.43
FVI	4.52	2.31	5.49	2.00	5.11	2.07

Figure 1. Flow of participants through each stage

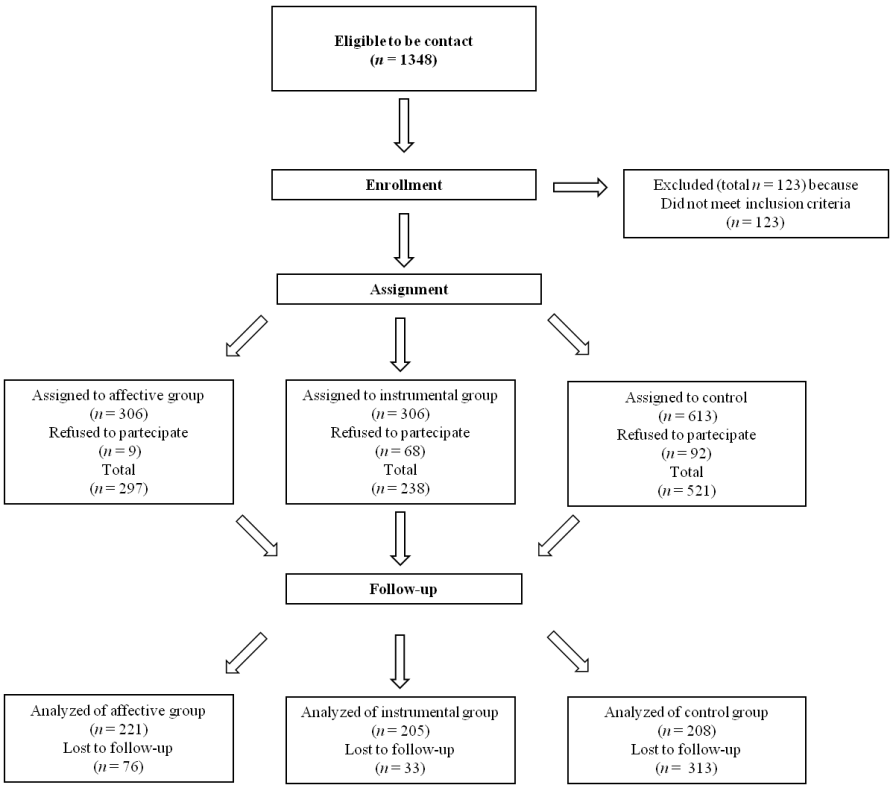
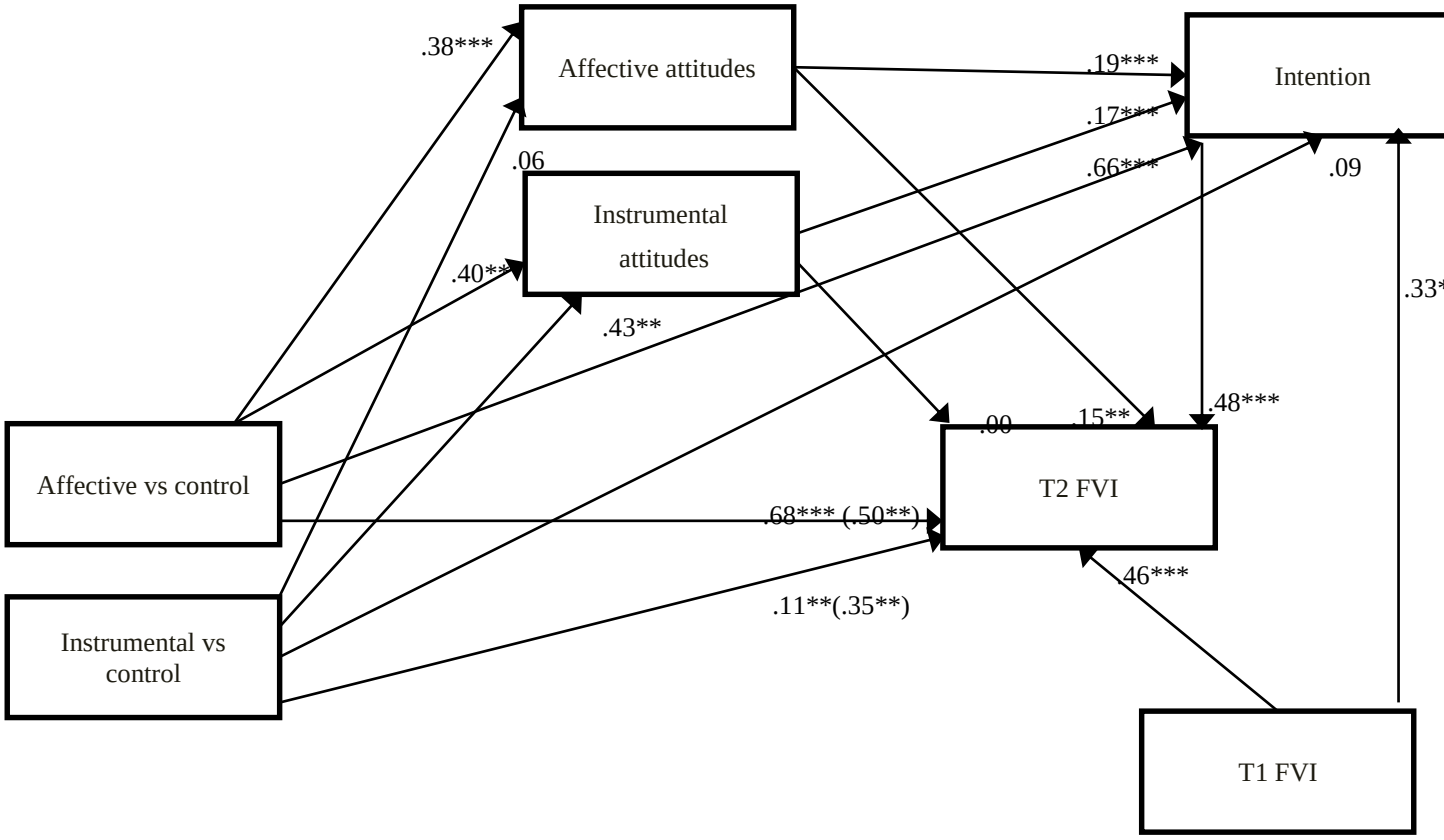


Figure 2. Mediation effects showing paths between variables: affective group versus control group and instrumental group versus control group.



Note: all paths controlled for past behaviour; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. T1 = time 1; T2 = time 2. Values in brackets indicate effect of condition on T2 FVI only controlling for T1 FVI.

Appendix A. Text messages for each group

Day	**Affective group**	**Instrumental group**
1	A diet rich in fruit and vegetables promotes emotional well-being and is associated with lower levels of anxiety and depression.	An increased intake of fiber (typical in those who eat at least five portions of fruit and vegetables a day) is a protective factor against both colon cancer and breast cancer.
2	Serotonin, "the hormone of happiness", is naturally produced by the body; and stimulated by the consumption of simple sugars, such as those contained in fruit.	With small, daily changes, such as eating extra fruit, the cause of premature death from any physical cause can be reduced by as much as 20%
3	A diet rich in fruit and vegetables can help lower irritability, nervousness and confusion caused by stress.	Fruit and vegetables help supply the minerals needed for metabolic processes, the proper development of the organism and the functioning of nerve impulses in the brain and heart.
4	Five servings of fruit and vegetables a day will help you feel more energetic! Fruits and vegetables slow down digestion, ensuring a steady supply of energy during the day.	The fibers contained in fruit and vegetables are essential for proper intestinal functioning and for reducing excessive fats absorption.
5	Five servings of fruit and vegetables a day help reducing fatigue: try to replace sweets, which cause an increasing of the blood sugar level and its collapse, leading to fatigue and bad mood.	Yellow-orange vegetables (such as oranges, lemons, tangerines, grapefruit, apricots, peaches, carrots, peppers, squashes, loquats, corn and melons) are rich in nutrients with antioxidant properties, fundamental for the health of bones and articulations.
6	Eating five servings of fruit and vegetables a	A diet rich in vegetables and fruit reduces

	day helps in preventing apathy, drowsiness and slow down!	the probability of cancer arising by 30-40%.
7	Eating five servings of fruit and vegetables a day is associated with optimism! People who show a positive attitude towards everyday life have higher levels of carotenoids, which can be taken by eating fruit and vegetables.	Five servings of fruit and vegetables per day allow you to absorb calcium: it is essential for the bone tissue, the cardiovascular system and blood clotting. You can find it not only in milk and cheese, but also in some green leafy vegetables (arugula and spinach) and in tree nuts (almonds and hazelnuts).
8	Eating five servings of fruit and vegetables a day is not only good for health but also promotes relationships: people who eat them are more beautiful. This was demonstrated by a British research, which showed that eating plenty of fruit and vegetables supposedly gives people a golden glow that makes them more attractive.	Numerous studies have shown that a diet rich in vegetables and fruit protects against the arising of numerous diseases widespread in developed countries, like different forms of cancer and cardiovascular diseases; and also cataracts, diseases of the respiratory and digestive systems (such as diverticulosis and constipation).
9	A study on 80,000 British people, found that higher consumption of fruit and vegetables coincides with a higher sense of satisfaction and well-being. A diet rich in vegetables may have a beneficial effect on mood not only in the long term, but also day-to-day, influencing the positive emotions of individuals daily.	Eat at least five servings of fruit and vegetables a day helps prolonging the life span. The umpteenth confirmation comes from a study that involved 71,706 people, which spanned for 13 years: people who had never eaten fruit and vegetables lived three years less and had a mortality rate 53% higher than those who ate five servings a

		day.
10	Eating five servings of fruit and vegetables a day can increase your self-esteem. A healthy diet, combined with physical activity, will help you feel better about yourself. Excessive consumption of junk food will make you gain weight and feel sluggish and sick. Eating the right foods, such as fruit and vegetable, will give you more energy and you feel calmer. If you feel better, you judge yourself with less severity.	The low consumption of fruit and vegetables is responsible, worldwide, approximately for 31% of coronary heart disease and for about 11% of stroke. If every citizen of the European Union consumed at least 600 grams of fruit and vegetables a day, more than 135,000 deaths a year from cardiovascular disease would be avoided.
11	Members of the University of Leiden in the Netherlands, found out that a substance that can be found in spinach (as well as in other fruits and vegetables, such as bananas, nuts and avocados) is likely responsible for the production of two important neurotransmitters in the brain. These neurotransmitters facilitate faster transmission of nerve impulses, improving your reflexes and making you more snappy.	The beneficial effects of the consumption of five servings of fruit and vegetables is also linked to the protective effect of some of the components found in this class of food. These components, called "radical scavengers", have mainly and anti-oxidant effect, and counteract free radicals, which are responsible for the processes of premature aging and a series of reactions at the origin of various forms of cancer.
12	Protein consumption is closely related to the physical and mental well-being. Rich sources of protein are not only meat, fish, eggs, milk and cheese, but also fruit and vegetables.	The lack of vitamins can cause serious illnesses. Vitamin A helps sight and the integrity of the mucous membranes; it is contained in yellow-orange fruits and vegetables.

	For example, the amino acid tryptophan (found in bananas, dried fruit and vegetables such as spinach, cabbage, asparagus) has satiating and calming properties, modulates the mood and both emotional and sexual functions.	Vitamin C (found in kiwis, oranges, mandarins, strawberries, tomatoes, peppers, etc.) has a key role in the integrity of blood vessels and helps the immune system in defending the body against infection; it is also contained in some green leafy vegetables.
13	A proper intake of vitamins is essential for proper psychophysical functioning. Particularly, lack of vitamins of the B group (found in oranges, lemons, mandarins, apples, nuts, artichokes, carrots, zucchini ...) is associated with anxiety, fear, mood problems, dementia and / or psychotic disorders.	Do not underestimate white fruit and vegetables (like garlic, white onion, cauliflower, fennel, pears, leeks, mushrooms and celery)! They are rich in substances capable of reinforcing the defenses of our immune system, and are able to lower cholesterol levels and blood pressure.
14	Recent researches have shown a strong correlation between generous consumption of fruit and vegetables and the appearance of positive feelings in the next twenty-four hours; related especially to the reduction of anxiety and, more generally, to a greater serenity.	Vegetables, thanks to their therapeutic properties, can give various benefits: the strengthening of the immune system, regulation of blood pressure, cholesterol and blood sugar, prevention of cardiovascular diseases.

CONSORT 2010. Checklist of information to include when reporting a randomised trial

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	2
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	3-6
	2b	Specific objectives or hypotheses	6-7
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	8-10
Participants	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	n/a
	4a	Eligibility criteria for participants	8
	4b	Settings and locations where the data were collected	8-9
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	10-11
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	13
	6b	Any changes to trial outcomes after the trial commenced, with reasons	n/a
Sample size	7a	How sample size was determined	8
Randomisation:			
Sequence	8a	Method used to generate the random allocation sequence	9-10
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	9-10
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	n/a
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	9
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	n/a
	11b	If relevant, description of the similarity of interventions	n/a
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	13-16
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	16-18

Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	40
	13b	For each group, losses and exclusions after randomisation, together with reasons	40
Recruitment	14a	Dates defining the periods of recruitment and follow-up	8-10
	14b	Why the trial ended or was stopped	n/a
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	38
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	40
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	13-16
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	n/a
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	16-18
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	n/a
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	20-22
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	20
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	18-20
Other information			
Registration	23	Registration number and name of trial registry	n/a
Protocol	24	Where the full trial protocol can be accessed, if available	n/a
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	none