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Self-regulation and the intention behaviour gap: Exploring dietary behaviours in university students

Barbara Mullan[1], Vanessa Allom[1], Amy Brogan[1], Emily Kothe[2], Jemma Todd[1]

[1]School of Psychology, University of Sydney, Australia

[2] School of Psychology, Deakin University, Australia

Correspondence should be addressed to: Barbara Mullan, School of Psychology, The University of Sydney, NSW 2006, Australia (e-mail: barbara.mullan@sydney.edu.au).

ABSTRACT

The aim of this study was to explore whether two aspects of self-regulation (impulsivity and temporal orientation) could reduce the intention-behaviour gap for two dietary behaviours: fruit and vegetable consumption and saturated fat consumption. Australian undergraduate students (N=154) completed questionnaires (the Barratt impulsiveness scale and the consideration of future consequences scale) and intention measures, and one week later behaviour was measured using the Block rapid food screener. After controlling for demographics, intention was associated with fruit and vegetable consumption, but the self-regulation measures did not further improve the variance accounted for. For saturated fat, gender was associated with consumption, such that males tended to consume more saturated fat. Intention was significantly associated with consumption, and impulsivity further improved the model such that those who were more impulsive tended to consume more saturated fat. These findings suggest that health protective and health risk behaviours, such as those investigated in the current study, may have different determinants.

Keywords: Dietary behaviour; executive function; impulsivity; temporal orientation; intention.

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There is strong evidence to support a causal relationship between diet and chronic diseases such as cancer and coronary heart disease (Mente, de Koning, Shannon, & Anand, 2009). Consequently, dietary guidelines have focused on reducing saturated fat intake and increasing fruit and vegetable consumption (National Health and Medical Research Council, 2003; World Health Organization, 2008). In Australia, the national guidelines suggest adults should consume two servings of fruit and five servings of vegetables each day, and to limit saturated fats to under 10% of the daily energy intake (National Health and Medical Research Council, 2003). Similar guidelines exist for the UK and the USA (Food Standards Agency, 2007; US Department of Agriculture & US Department of Health and Human Services, 2010).

Despite these recommendations, very few Australian adults appear to adhere to these guidelines (Australian Bureau of Statistics, 2009). According to data from the 2004-05 National Health Survey, 80-90% of Australians usually consume inadequate serves of vegetables and over 50% usually consume inadequate serves of fruit. (Ezzati, Lopez, Rodgers, & Murray, 2005; McLennan & Podger, 1998). Australian data has estimated that Australian adults consume an average of 13% of their total energy intake as saturated fat (Australian Bureau of Statistics, 1998). This is equivalent to an average daily consumption of 33g of saturated fat.

Similarly poor adherence has also been documented in other high-income countries. In the UK, most individuals eat 20% more than the recommended amount of saturated fat (Balc, 2013), whilst in the USA 12-15% of energy came from saturated fat (German & Dillard, 2004). For fruit and vegetables, 31% of adults in the UK met the guidelines

(Department of Health, 2012) and only 33% and 27% of adults in the USA consumed at least two serves of fruit and three serves of vegetables per day, respectively (Centre for Disease Control and Prevention, 2007). Given the importance of fruit and vegetable consumption and limiting saturated fat intake in preventing chronic diseases, combined with low adherence rates to the recommended guidelines in high-income countries including Australia, it appears of paramount importance to explore the correlates of healthy eating, which may in turn inform interventions designed to improve dietary behaviour and healthy eating.

Social cognition models have been used extensively in an attempt to understand the cognitions underlying health behaviour. One of the most frequently applied models is the theory of planned behaviour (TPB: Ajzen, 1991). The central tenet of the TPB is that intentions are the most proximal determinant of future behaviour. To date, studies have examined the efficacy of the TPB in predicting dietary behaviours including fruit and vegetable consumption (Bogers, Brug, Van Assema, & Dagnelie, 2004), low-fat food consumption (Armitage & Conner, 1999) as well as saturated fat consumption across a range of contexts (Conner, Norman, & Bell, 2002). A recent systematic review of the application of social cognition models to the prediction of fruit and vegetables consumption found that the theory accounted for an average of 45% of the variance in fruit and vegetable consumption in non-student populations (Guillaumie, Godin, & Vézina-Im, 2010). Research conducted among Australian university students has shown that the model accounts between 11 and 17% of the variance in fruit and vegetable consumption (Allom & Mullan, 2012; Kothe, Mullan, & Butow, 2012).

There is a small but growing body of research that has used the TPB to explore saturated fat consumption. In a sample of university students, Armitage and Conner (1999) found that intention was a significant predictor of eating a low-fat diet, accounting for 18% of the variance in behaviour. Another more recent study, using a sample of patients diagnosed with Type 2 diabetes and/or cardiovascular disease, found that the model accounted for 14% of the variance to consume a low fat diet at 1-month follow-up (White, Terry, Troup, Rempel, & Norman, 2010). Additionally, de Bruijn, Kroeze, Oenema, & Brug (2008) found that both intention and perceived behavioural control were significant negative predictors of saturated fat intake, accounting for 8% of the variance in saturated fat intake. Mullan and Xavier (In Press) found the TPB variables predicted 25% of variance in saturated fat consumption. Although promising, these studies vary widely in the proportion of variance accounted for by the TPB, and further research is warranted to clarify the role of TPB variables as correlates of saturated fat consumption.

While research employing the TPB has found that forming an intention to perform a behaviour is beneficial to the actual performance of that behaviour, there remains inconsistency such that often intention can be better explained than behaviour (McEachan, Conner, Taylor, & Lawton, 2011). Further, intention is not always translated into behaviour (Webb & Sheeran, 2006). This results in a theoretical ‘gap’ between intention and behaviour (Sniehotta, Scholz, & Schwarzer, 2005). This gap is evident in studies which have applied the TPB to fruit and vegetable consumption and to saturated fat intake (Ding, Mullan, & Xavier, In Press; Kothe et al., 2012; Mullan & Xavier, In Press). Consequently, research has attempted to disentangle the relationship between intention and behaviour by testing additional post-intentional variables.

Recent research suggests that the translation of intention into action might be related to a person’s ability to self-regulate their behaviour. Self-regulation has been defined as the wilful regulation of internal drives in response to environmental triggers, on managing behaviour patterns (Baumeister, Schmeichel, & Vohs, 2007). Research has found aspects of self-regulation to be important for a range of health behaviours, including breakfast consumption (Wong & Mullan, 2009), sleep hygiene (Todd & Mullan, 2012), binge drinking

(Mullan, Wong, Allom, & Pack, 2011) and fruit and vegetable consumption amongst certain populations (Allom & Mullan, 2012).

One important aspect of self-regulation is impulse control. Although no one definition exists for impulsivity, the literature has frequently referred to impulsivity as the failure of inhibition, such that impulsivity reflects a reactive 'go' response to a cue, whereas inhibition refers to the ability to refrain from responding to a cue (Perry & Carroll, 2008). Self-report measures of impulsivity, such as the Barratt impulsiveness scale (BIS; Patton, Stanford, & Barratt, 1995) have been used to assess individuals' perceptions of their own ability to self-regulate, and has been used to explore risk-taking behaviours in young adults (Stanford, Greve, Boudreaux, Mathias, & Brumbelow, 1996). Impulsivity is often referred to as being unable to stop behaviour with negative outcomes, and thus has been primarily researched in the context of health risk behaviours such as alcohol and drug use (Nigg et al., 2006) and sexual risk-taking (Pack, Crosby, & Lawrence, 2001). Regarding eating behaviours, research has found that those who are impulsive tend to eat more (Guerrieri, Nederkoorn, & Jansen, 2007), and one study found impulsive buying helped to explain unhealthy snacking behaviour (Verplanken, Herabadi, Perry, & Silvera, 2005), however healthy behaviour was not investigated. As health protective behaviours often have neutral or undesirable immediate consequences, it may be that impulse control is less important for these behaviours. On the other hand, it may be possible that a degree of impulsivity is necessary in order to respond to the environment and enact positive behaviours. To date these alternatives have not been explored in the context of dietary behaviours.

Another aspect of self-regulation involves the ability to keep future goals in mind, in spite of immediate hedonic benefits. For example, chronic diseases are primarily a long-term consequence, and the health benefits of engaging in health behaviours are often only evident in the long term, whereas engaging in unhealthy eating has immediate pleasurable consequences. Research has found that those who are able to keep distant consequences in mind are better able to translate their intentions into behaviour than those who only consider immediate consequences (Rabinovich, Morton, & Postmes, 2010), and that the degree to which individuals consider the future consequences of their actions is a strong predictor of a range of health behaviours (Strathman, Gleicher, Boninger, & Edwards, 1994) and even Body Mass Index (Zhang & Rashad, 2008). In the context of dietary behaviours, the short-term consequences of eating fruit and vegetables may be discouraging, such as not enjoying the taste or finding them difficult to prepare, however the long-term benefits include the reduction of risk of many chronic diseases. For those who are able to keep the future consequences in mind, it may be easier to overcome the short-term negative consequences, whereas those who focus more on the short-term consequences may be discouraged from consuming fruit and vegetables. In contrast, the short-term consequences of eating foods high in saturated fat may be motivating, such as enjoying the taste and ease of access or preparation. Those able to keep the future consequences in mind may find it easier to resist the temptation to consume saturated fat, whereas those who have a short-term focus may find the appeal of these foods too great to resist. Therefore, the extent to which future consequences are kept in mind may help to explain the degree to which individuals eat an adequate quantity of fruit and vegetables, and restrict their saturated fat consumption.

To date, no studies have compared the importance of impulsivity in both health risk and health protective behaviours, and whether it serves to moderate the intention-behaviour gap for these behaviours. Furthermore, no studies to date have explored the role of temporal orientation on different eating behaviours and the intention-beahviour gap. This study therefore expanded the previous literature to explore whether these two aspects of self-regulation were associated with fruit and vegetable and saturated fat consumption, and whether they could help in bridging the intention-behaviour gap.

Previous research has suggested gender differences in self-regulation. In a meta-analysis conducted by Byrnes, Miller, and Schafer (1999) males tended to engage in greater risk-taking than females across a range of behaviours. A more recent meta-analysis exploring gender differences in impulsivity found that although gender differences were present, the effects were stronger for motivational components of behavioural control, rather than executive forms (Cross, Copping, & Campbell, 2011). Motivational systems were described as including the suppression of reactivity in the pursuit of longer-term goals, whereas executive systems were described as pertaining to impulsivity and response inhibition; and therefore gender differences may be more observable in temporal-orientation based measures such as the consideration of future consequences scale (Strathman et al., 1994), compared to impulsivity based measures such as the BIS (Patton et al., 1995).

Gender differences in health behaviours have also been found, such that females tend to consume more fruit and vegetables and less unhealthy foods than males (Logi Kristjánsson, Dóra Sigfúsdóttir, & Allegrante, 2010). Similar gender differences have been found in intentions, with females having stronger intentions to consume fruit and lower intentions to eat chips than males (Dennison & Shepherd, 1995). Although gender does not offer a strategy for changing health behaviour, if differences in gender occur in self-regulation, intentions or dietary behaviours, then identifying these differences may help in developing tailored interventions.

The present research

The aim of the present research was to explore whether two aspects of self-regulation (impulsivity and temporal orientation) could help to close the intention-behaviour gap for two dietary behaviours; fruit and vegetable and saturated fat consumption. A secondary aim was to explore whether the associations between intention, self-regulation and dietary behaviours differed for males and for females. It was hypothesised that intention and both aspects of self-regulation would be directly associated with behaviour, and also that self-regulation would moderate the relationship between intention and behaviour. It was also hypothesised that females would consume more fruit and vegetables and less saturated fat than males. As no previous literature has explored interactions between gender, self-regulation and intention for the specified behaviours to draw on, hypotheses regarding these relationships were exploratory.

METHOD

Participants

A total of 179 undergraduate students from a wide range of faculties at an Australian University were initially recruited, and 154 participants (86%) completed the study. Attrition was primarily due to technical difficulties faced by participants rather than unwillingness to complete the study. Participants were awarded course credit for participation in the research. This research was approved by the University's Human Ethics Committee.

Procedure

Participants were recruited to the study via a web based research management system. A prospective design was employed with data collected at two time points, one week apart. In session one, participants completed a questionnaire measuring demographic information, intention to consume fruit and vegetables and avoid saturated fat, and self-report psychometric measures of impulsivity and temporal orientation. In session two, one week later, participants completed a self-report measure of eating behaviour assessing their fruit and vegetable consumption and saturated fat intake over the previous week.

Measures

Intention

Intention to consume fruits and vegetables was measured with 14 items. Participants were asked to indicate the number of servings of fruit and the number of servings of vegetables that they intended to consume on each day over the following week, e.g. *'During the next week, how many serves of fruit and vegetables do you intend to eat? Monday: Fruits ___, Vegetables*___'. The fruit items and vegetable items were then added, and averaged over the seven days to create an average daily fruit and vegetable consumption score, with higher scores indicating greater intentions to eat fruit and vegetables. Cronbach's α was .949 for the fruit and vegetable items. Intention to avoid consuming saturated fat was measured as the mean of three items on a 7-point Likert scale: '*I expect to avoid saturated fat every day*;' (1 = Extremely Unlikely; 7 = Extremely Likely), '*I want to avoid saturated fat every day*;' (1 = Definitely False; 7 = Definitely True), '*I intend to avoid saturated fat every day*;' (1 = Strongly Disagree; 7 = Strongly Agree). Higher scores indicated greater intention to avoid saturated fat. Cronbach's α was.768 for the saturated fat items. Three additional intention items were also included, e.g. '*I intend to eat some fruit and vegetables/ avoid saturated fat every day*' (1 = Strongly Disagree; 7 = Strongly Agree); however, these items are not reported as upon consultation they were deemed to not meet the TPB guidelines for question specificity.

Impulsivity

The Barratt impulsiveness scale (Patton et al., 1995) was included as a self-report measure of impulsivity. The BIS-11 is a 30-item questionnaire which assesses self-reported impulsivity. All items are rated on a 4-point Likert scale (1 = Rarely/Never, 4 = Almost Always/Always). An impulsivity score is calculated as the mean of all items, with higher scores indicating greater impulsivity. Cronbach's α for the BIS-11 items was .757.

Temporal Orientation

The consideration of future consequences scale (CFC; Strathman et al., 1994) was included as a measure of temporal orientation. The CFC is a 12-item questionnaire which evaluates the extent to which people consider distant versus immediate consequences of potential behaviour. All items are rated on a 5-point Likert scale (1 = Extremely Uncharacteristic of Me; 5 = Extremely Characteristic of Me). A CFC score is calculated as the mean of all items, with higher scores indicating greater future orientation. Cronbach's α for the CFC items was .809.

Eating behaviour

The Block rapid food screener (Block, Gillespie, Rosenbaum, & Jenson, 2000), which has been validated against the 1995 Block 100-item Food Frequency Questionnaire was used to measure fruit and vegetable and saturated fat intake. The rapid food screener is comprised of a 17-item Meats/ Snacks section designed to capture dietary fats, and a 7-item Fruit/Vegetable section, from which participants are asked to indicate the frequency of consumption. The time frame was modified to reflect consumption over the previous week, to better fit current consumption. Response options on the Meat/Snacks section were also modified to reflect consumption over the previous week. Consequently, the Meat/Snack score was adjusted to fit the validated formula. Scores from the food screener were then translated into estimates of daily intake using the validated formulae for fruit and vegetable servings and grams of saturated fat. The fruit and vegetable serving calculations were in accordance with the US Department of Agriculture and the US Department of Health and Human Services (2010) guidelines. Higher scores for fruit and vegetable serves and saturated fat grams reflected greater consumption.

Data Analysis

Pearson product correlations were computed to demonstrate the relationships between impulsivity, temporal orientation, intention, fruit and vegetable consumption and saturated fat intake. Identical hierarchical regression analyses were also conducted to measure the value of intention, impulsivity and temporal orientation for fruit and vegetable and for saturated fat intake, controlling for demographics. Ethnicity was grouped into Australian, Asian, and ‘other’, and then dummy coded into two variables, one with Asian as the reference group, and one with Australian as the reference group, and were added in the first step along with gender as control variables. BIS, CFC and intention were mean centred and product interactions of BIS and CFC with intention were computed and added consecutively to explore whether self-regulation aspects moderated the intention-behaviour relationship (Keith, 2006). Finally, simple slope analyses were conducted in order to test whether or not the regressions at high and low levels of the moderator variable were significant (Holmbeck, 2002).

RESULTS

Sample Characteristics

Of the 154 participants who completed the study, the age range was 17-43 (M = 20.3, SD = 4.18). The majority were female (74%), identified as Australian (42%) or Asian/Australian-Asian (38%) and were living at home with their parents (77%). Participants consumed a mean of 4.0 (SD = 1.63) servings of fruit and vegetable per day, and 22.7 (SD = 6.67) g of saturated fat per day.

Gender differences in saturated fat consumption were found; males consumed 27.70 g (SD = 6.44) of saturated fat per day, which was greater than the average of 21.00 g (SD = 5.84) for females, $t_{(152)}$= -6.070, p<.001. Males consumed 4.28 servings (i = 1.57) of FV per day while females consumed 3.90 servings (SD = 1.65) of FV per day, however, this difference was not significant, $t_{(152)}$ = -1.283, p = .201. Therefore, in addition to controlling for ethnicity and gender, interaction terms of gender with intention and self-regulation were added into the regression analysis for saturated fat consumption, but not for fruit and vegetable consumption.

Descriptive Statistics

Table 1 presents the Pearson product correlation matrix between impulsivity, temporal orientation, intention and behaviour. The BIS and the CFC were significantly negatively correlated, indicating that those high in impulsivity tended to be more present-orientated. The BIS was significantly positively correlated with saturated fat consumption, indicating that those higher in impulsivity tended to consume more saturated fat. The BIS did not however correlate with either intention measure or fruit and vegetable consumption. CFC was significantly positively correlated with fruit and vegetable intention and fruit and vegetable consumption, indicating that those who were future minded were more likely to both intend to and actually consume fruit and vegetables. However, the CFC did not correlate with saturated fat consumption intention or behaviour. Intention and behaviour were correlated for both fruit and vegetable and saturated fat consumption. Fruit and vegetable intention and saturated fat intention were not correlated. Finally, fruit and vegetable and saturated fat consumption were significantly positively correlated, indicating that those who ate more fruit and vegetables also tended to consume more saturated fat.

INSERT TABLE 1 HERE

Fruit and vegetable consumption

Hierarchical linear regression was used to determine whether intention, BIS scores, CFC scores, and the intention-BIS/CFC interactions were associated with fruit and vegetable consumption, controlling for gender and ethnicity (See Table 2). The demographic variables did not account for variance in fruit and vegetable consumption in the first step. Intention was significantly associated with fruit and vegetable consumption when added in the second step, accounting for 7.6% of the variance in behaviour, such that those who intended to consume more fruit and vegetables tended to do so. Neither BIS nor CFC scores increased the variance accounted for when added in the third and fourth steps. The interaction between BIS scores and intention did not account for a significant amount of variance in behaviour in step five. Similarly, the interaction between CFC scores and intention did not account for additional variance in behaviour in the final step. Overall, the model accounted for 12.6% of the variance in fruit and vegetable consumption.

INSERT TABLE 2 HERE

Saturated fat consumption

A similar hierarchical linear regression was used to determine whether intention, BIS and CFC scores were associated with saturated fat intake, controlling for gender and ethnicity (see Table 3). However, as gender was associated with saturated fat consumption, two-way interaction terms of gender with intention, BIS and CFC scores, as well as three-way interaction terms of gender, intention and BIS/CFC were added in the model. Demographic variables accounted for 19.5% of the variance in saturated fat consumption. Gender (but not ethnicity) was significantly independently associated with saturated fat consumption, indicating that males were more likely to consume saturated fat than females. Intention was significantly associated with saturated fat intake, accounting for an additional 4.8% of the variance in behaviour, such that those who had greater intentions to avoid foods containing saturated fat tended to consume less saturated fat. When added to the model in step three, BIS scores accounted for an additional 2.7% of variance in behaviour and were significantly associated with saturated fat intake. Thus, those with greater impulsivity tended to consume more saturated fat. CFC scores were not significantly associated with saturated fat intake in step four. Further, in steps five and six, the interaction between intention and BIS scores and the interaction between intention and CFC scores did not add to the variance accounted for in saturated fat intake. In step seven, the two-way interactions of gender with intention, BIS and CFC were added. The overall model remained significant, but did not significantly improve the prediction of saturated fat consumption, and none of the two way gender interaction terms were significant. In the final eighth step, three way gender, intention and BIS/CFC interaction terms were added, which did not significantly improve the model, and the interaction terms were not significant contributors. Overall, the model accounted for 31.8% of the variance in saturated fat consumption.

INSERT TABLE 3 HERE

DISCUSSION

The primary aim of the current study was to explore whether self-regulation was associated with fruit and vegetable intake and saturated fat consumption. Specifically, the study was designed to explore the role of impulsivity and future orientation in moderating the intention-behaviour gap for these behaviours. It was expected that intention would be associated with behaviour for both fruit and vegetable intake and saturated fat intake, but that the components of self-regulation included in the study would account for additional variance in behaviour and moderate the intention behaviour relationship. In addition, this study explored gender differences in the ability of self-regulation to moderate the intention-behaviour gap.

Consistent with these hypotheses, intention accounted for a significant proportion of variance in both fruit and vegetable consumption and saturated fat intake. This is in accordance with models such as the TPB (Ajzen, 1991), in which intention is considered a proximal determinant of behaviour. However, for both fruit and vegetable and saturated fat consumption, the intention-behaviour gap was large, with intention only accounting for 7.6% of variance in fruit and vegetable intake and 4.8% of variance in saturated fat intake, once the influence of demographic variables had been accounted for. This finding is inconsistent with previous research that has found intention to be a strong predictor of fruit and vegetable consumption in adults; a meta-analysis conducted by Guillaumie et. al. (2010) found that intention accounted for 45% of the variance in fruit and vegetable consumption across studies including non-student adult samples. However, the findings do add to a general pattern of results which have indicated that intention is a weaker predictor fruit and vegetable consumption in young adults and university student samples; only 11-17% of the variance was accounted for by intention to consume fruit and vegetables in two recent Australian studies (Allom & Mullan, 2012; Kothe et al., 2012). The proportion of variance in saturated fat consumption accounted for by intention is lower than in previous studies, where intention and perceived behavioural control have been found to together account for 8-25% of variance in saturated fat intake (de Bruijn et al., 2008; Mullan & Xavier, In Press).

It has previously been suggested that self-regulation may help to account for the intention-behaviour gap for both fruit and vegetable consumption and saturated fat intake. However, the findings from the present study do not support a central role for these aspects of self-regulation in determining fruit and vegetable consumption. Contrary to hypotheses, neither impulsivity nor temporal orientation helped to account for variance in fruit and vegetable consumption in the current study. These self-regulatory variables were not significantly associated with fruit and vegetable consumption once the role of intention had been considered and did not moderate the intention-behaviour relationship. The study also examined the influence of self-regulation on saturated fat consumption. Consistent with expectations, impulsivity was found to be significantly associated with saturated fat intake; the construct accounted for an additional 2.7% of variance in saturated fat intake. However, future orientation was not associated with saturated fat intake and neither factor moderated the intention-behaviour relationship.

While neither factor was found to be significantly associated with fruit and vegetable consumption once intention had been accounted for, previous research has found that self-regulation can be a significant predictor of fruit and vegetable consumption and of the intention-behaviour relationship. For example, Hall, Fong, Epp, & Elias (2008) found that inhibition had a direct impact on fruit and vegetable consumption and moderated the intention-behaviour relationship. Similarly, cognitive flexibility and task switching has been associated with higher fruit and vegetable consumption and decreased unhealthy snacking (Allan, Johnston, & Campbell, 2011), and planning ability has been linked to increased consumption of breakfast and shown to moderate the intention-behaviour relationship for that behaviour (Wong & Mullan, 2009). As such, there may still be scope to consider the role of self-regulation broadly, although perhaps not impulsivity or future orientation, as a correlate of these dietary behaviours and of the intention-behaviour relationship in future studies.

These results add to the body of evidence seeking to understand the influence of impulsivity on food choice. Impulsivity was significantly associated with saturated fat consumption, such that those who were higher in impulsivity tended to consume more saturated fat. This is in accordance with the hypotheses as those who found it more difficult to resist temptation tend to consume more foods that are higher in saturated fat. The finding that impulsivity was significantly associated with higher saturated fat intake is consistent with previous research that has found that impulsivity is a significant predictor of the consumption of palatable food in bogus taste tests (Appelhans et al., 2011), reported calorie intake from away-from-home and ready-to-eat foods (Appelhans et al., 2012), and unhealthy snacks (Verplanken et al., 2005) . It is also consistent from experimental studies that have found that experimental manipulations of impulsivity lead to changes in caloric intake from unhealthy snacks (Guerrieri, Nederkoorn, & Jansen, 2012; Guerrieri, Nederkoorn, Schrooten, Martijn, & Jansen, 2009). The study is the first to expressly investigate the link between impulsivity and fruit and vegetable consumption.

On the basis of the current findings it would appear that while impulsivity may play a role in determining individuals consumption of foods high in saturated fats, this construct is not associated with fruit and vegetable consumption. The results of the current study have interesting implications for interventions aimed at changing dietary behaviour. Standard impulsivity training tends to train individuals to increase inhibition and reduce impulsivity, and has been effective for health risk behaviours such as consuming unhealthy foods (Houben & Jansen, 2011) and alcohol (Houben, Nederkoorn, Wiers, & Jansen, 2011). While these methods may have limited feasibility in the context of public health they provide valuable support for a causal role for impulsivity in determining food choice. Other interventions that help to compensate for poorer self-regulation (i.e. higher impulsivity) such as implementation intentions (Webb & Sheeran, 2003) may be an important area for development given the relationship between saturated fat intake and impulsivity observed in the current study.

Temporal orientation was not significantly associated with saturated fat consumption or fruit and vegetable consumption once intention had been controlled for, which was unexpected. Given the strong link between dietary behaviour and a range of chronic health conditions, especially coronary heart disease (Centre for Disease Control and Prevention, 2012), it was predicted that those who were more focused on the long-term consequences of their actions would choose to eat less saturated fat and consume greater quantities of fruit and vegetables, however this was not found. This is inconsistent with previous research that has indicated that those who consider long-term consequences are better able to translate their intentions into behaviour than those who focus instead on short-term consequences

(Rabinovich et al., 2010). It is interesting to note that despite the fact that temporal orientation was not a significantly associated with fruit and vegetable consumption once intention had been accounted for, the constructs were positively correlated. It may be that the influence of future orientation on fruit and vegetable consumption is mediated through intention, meaning that the relationship is not significant once intention has been controlled taken into account. One possible explanation for the lack of relationship between temporal orientation and saturated fat intake is that the current sample tended to consume less saturated fat than population averages (Australian Bureau of Statistics, 1998). It may therefore be that within this study, individuals may have had a distal temporal orientation, but did not consider risk of chronic diseases as a result of their saturated fat intake as relevant to them. It is also possible that individuals are driven by positive rather than negative consequences of their behaviour, which may explain why temporal orientation was important for fruit and vegetable consumption (before accounting for intention) but not saturated fat consumption. A recent meta-analytic review found that gain-framed messages are more effective in health prevention behaviour (Gallagher & Updegraff, 2012), which may explain why in the current study the positive long-term benefits of fruit and vegetable consumption were important whereas the negative long-term outcomes of saturated fat consumption were not.

The final purpose of the present research was to explore gender differences in the relationships between intention and impulsivity. Of interest, gender differences were found in saturated fat consumption, with males consuming an average of 6.7 g more saturated fat than females per day, although there were no differences in fruit and vegetable consumption. Gender differences in the ability of self-regulation to moderate the intention-behaviour relationship were also not found. Although these findings are in support of previous literature that has found that males tend to consume more unhealthy foods than females (Logi Kristjánsson et al., 2010), that no gender differences were found in fruit and vegetable consumption was surprising. Furthermore, that gender was not associated with measures of intention or self-regulation is in contrast to previous literature, in which males generally have greater impulsivity and greater intentions to eat unhealthy foods than females (Cross et al., 2011; Dennison & Shepherd, 1995). Alternative explanations for the differences in saturated fat consumption need to be explored, as doing so may provide ways to better target the increased levels of saturated fat consumption observed in males in the current study.

Strengths and limitations of the current study

Unlike many other studies which have investigated single domains of self-regulation and/or single dietary behaviours, this study investigated the role of two facets of self-regulation in two different eating behaviours. This allows for consideration of the differential effects of intention and self-regulation on health risk and health protective dietary behaviour. The study also explored gender differences in the role of self-regulation and intention in predicting these different eating behaviours, which may help in the development of tailored healthy eating interventions. There are also theoretical implications, as for saturated fat the current research appears to support models such as the temporal self-regulation theory (Hall & Fong, 2007), in which self-regulation and intention are important determinants of health behaviour; whilst the findings for fruit and vegetable consumption support primarily intention-based models such as the TPB (Ajzen, 1991). Future research could compare these models in the context of health risk and health protective dietary behaviours.

The Block rapid food screener is a validated measure (Block et al., 2000), and although the measure may be less responsive to small variations in fruit and vegetable consumption and saturated fat consumption than other potential self-report measures it is likely to be more accurate than single item measures. This is particularly relevant for food consumption behaviours, were consumption quantity can be difficult to report on and may be influenced by memory biases or inaccurate knowledge about which food items contain fruit and vegetables or saturated fat. This method offers a better measure of fruit and vegetable consumption than that used in comparable studies. This may account for the lower than expected variance in behaviour that was accounted for by intention in the present study (Allom & Mullan, 2012; Kothe et al., 2012). However, while this measure offers a more valid indicator of fruit and vegetable and saturated fat intake than other self-report measures, the use of any self-report measure of behaviour is subject to bias. Although not feasible in the context of the present study, the use of objective measures would improve the methodological quality of future research in this domain.

There are some other limitations to the present study, and to the literature in this field more broadly, that should be taken into account when interpreting these findings. Firstly, the sample was predominantly young adult females who lived at home with their parents. This age group has previously been found to have poorer dietary habits than older adults, meaning that understanding predictors of dietary behaviour in this sample is important. Nevertheless, although this study is useful for exploring the correlates of dietary behaviour for this sample, generalisations to other samples may be limited. Another consequence of the use of such a sample is a more limited variation in scores on some measures than might have been expected from a more socio-demographically diverse sample. Lack of variation on key measures may have reduced the capacity to detect the true relationship between these constructs. While understanding consumption patterns within demographic sub-groups is important – future research should investigate these relationships in the context of a more representative sample.

Consistent with the majority of previous research which has sought to test the strength of the intention-behaviour relationship (McEachan et al., 2011), analyses in the present study tested the associations between current intention and behaviour, especially since the study did not include a baseline measure of behaviour. Establishing which variables are associated with consumption is important, especially in a new field of research such as the link between self-regulation and dietary behaviour. However, future research should explore the factors that determine *change* in dietary intake in order to offer a more robust test of the relationship between self-regulation and intake of fruit and vegetables and saturated fat. This is an important field of research since the variables that are associated with health behaviours are not necessarily those associated with health behaviour change. For example, a recent TPB based intervention study for fruit and vegetable consumption found that intention was associated with consumption both before and after the intervention, but did not relate to the change in fruit and vegetable consumption (Kothe et al., 2012). Although previous studies have provided evidence that change in intention and impulsivity are associated with change in dietary behaviour, measurement of intention to change saturated fat and fruit and vegetable consumption would represent a valuable advance in the field.

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Table 1

Means, standard deviations, and Pearson's correlations of self-regulation, intention and behaviour measures for fruit and vegetable consumption and saturated fat consumption

	BIS	CFC	INTFV	INTSF	FV	SF
BIS	-					
CFC	-.502**	-				
INTFV	-.138	.235**	-			
INTSF	.011	.078	.046	-		
FV	-.023	.165*	.284**	.043	-	
SF	.184*	-.126	.014	-.260**	.183*	-
M	2.13	3.42	3.98	4.37	4.00	22.74
SD	0.28	0.56	1.68	1.41	1.63	6.67

Note. BIS = Scores on Barratt Impulsiveness Scale, CFC = score on Consideration of Future Consequences Scale, INTFV = intention to consume fruit and vegetables, INTSF = intention to avoid saturated fat; FV = fruit and vegetable consumption, SF = saturated fat consumption. $n = 154$, *$p < .05$, ** $p < .01$.

Table 2

Hierarchical regression analysis for the prediction of fruit and vegetable consumption

Step	Predictor	R^2	ΔF	df	β
1	GENDER	.016	0.817	147	.112
	AUS_DC				.029
	ASIAN_DC				.000
2	INTENTION	.093	12.294**	146	.292**
3	BIS	.093	0.060	145	.094
4	CFC	.108	2.377	144	.157
5	INTxBIS	.125	2.856	143	.165
6	INTxCFC	.126	0.146	142	.040

Notes. AUS_DC = dummy coded ethnicity with Australian as reference group, ASIAN_DC = dummy coded ethnicity with Asian as reference group, BIS = scores on Barratt impulsiveness scale, CFC = scores on consideration of future consequences scale. β= standardised regression co-efficient for the additional variable included.
Overall R^2 = .126, ** significant at the .01 level.

Table 3

Hierarchical regression analysis for prediction of saturated fat intake

Step	Predictor	R^2	ΔF	df	β
1	GENDER	.195	12.13**	150	.393**
	AUS_DC				.024
	ASIAN_DC				.033
2	INTENTION	.244	9.55**	149	-.643**
3	BIS	.271	5.57*	148	.084*
4	CFC	.272	.19	147	-.038
5	INTxBIS	.281	1.71	146	-.530*
6	INTxCFC	.283	.42	145	.240
7	GENxINT	.300	1.19	142	.431
	GENxBIS				.374
	GENxCFC				.120
8	GENxINTxBIS	.318	1.85	140	.477
	GENxINTxCFC				.311

Notes. AUS_DC = dummy coded ethnicity with Australian as reference group, ASIAN_DC = dummy coded ethnicity with Asian as reference group, BIS = scores on Barratt impulsiveness scale, CFC = scores on consideration of future consequences scale, GEN= gender. β= standardised regression co-efficient for the additional variable included. Overall R^2 = .318, * significant at the .05 level, ** significant at the .01 level.