Motivating Fruit and Vegetable Consumption Using Self-Identity

by

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ABSTRACT

MOTIVATING FRUIT AND VEGETABLE CONSUMPTION USING SELF-IDENTITY

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Background:  Fruit and vegetable (F&V) consumption has numerous health benefits. Studies have employed the Theory of Planned Behaviour (TPB) to increase F&V intake, but with only moderate success. The self-as-doer self-identity (SDSI) has individuals turn their goals into identities. When added to the TPB, SDSI may increase the effectiveness of the TPB.

Methods: 47 participants were recruited and randomly assigned to control or intervention arm. To create the SDSI on the intervention arm, F&V consumption goals were turned into identities. All participants recorded food intake and degree to which they related with their SDSI over six weeks.

Results: Change in F&V consumption of the control and intervention group from baseline at week 6 was 0.57±0.39 (NS) and 2.52±0.39 (p<0.0001) servings respectively.

Conclusions: Completion of the SDSI building exercise increased F&V intake. The role of SDSI in the TPB was partially supported by identity predicting intention but not behaviour.
Dedication

To my parents, David and Alexandra Jenkins, who not only told me to eat my fruit and vegetables, but taught me why. Thank you for everything.
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I would like to thank my supervisor Dr. Lisa Duizer for her enthusiasm and support throughout this process. Her willingness to embrace the unfamiliar gave me the courage to pursue the ideas that have made this thesis what it is today.

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<td>ANCOVA</td>
<td>analysis of covariance</td>
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<td>ANOVA</td>
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<td>BMI</td>
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<td>fruits and vegetables</td>
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<td>self-as-doer self-identity</td>
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Chapter 1- Summary

The consumption of fruits and vegetables (F&V) in cohort studies has been associated with numerous health benefits, including a reduced risk of gastro-intestinal cancer, cardiovascular disease and obesity. However increasing F&V consumption by the general population has met with little success. Lack of education does not appear to be a major barrier since individuals attending university also consume considerably fewer F&V than is recommended for the maintenance of good health. The transitional period from living at home with family to living independently at university is a crucial time for the development of life-long habits related to F&V consumption. Therefore, to provide insights that might have general application, the present study focuses on finding ways to motivate individuals attending university to increase their F&V consumption.

Studies using the Theory of Planned Behaviour (TPB) to increase F&V consumption have had moderate short-term success. The TPB proposes that individuals will intend to perform any behaviour if they feel the behaviour is easy to perform, the outcome of the behaviour will be favourable, and others in their social group will approve of the behaviour. However, as the success of this model has only been moderate, other factors may be at work to influence F&V consumption, and health food consumption in general.

A promising new factor that been shown to increase the predictive power of the TPB is self-identity. Self-identity, most simply, is the type of person you see yourself as. In order to maintain identity, as for example, a healthy type of person, healthy behaviours, like running, and eating fruit, must be performed. Through this process, identity shapes behaviour. Previous research has shown that a specific type of self-identity, called a “self-as-doer” identity can be a useful tool when creating behavioural change. The self-as-doer self-identity has individuals turn their goals, (e.g. eat more vegetables), into identities, (i.e. vegetable-eater). The direct link between goal and identity adds additional motivation to engage in specific goal-related
behaviours through the need to maintain identity. However, until now no studies have applied
the self-as-doer self-identity specifically to F&V consumption.

Therefore in the present study participants were instructed to create self-as-doer self-
identities centered around F&V to motivate increases in consumption. Over the course of a
six-week intervention, 47 participants recorded their F&V intake and the degree to which they
related with their self-as-doer identities, with the goal of investigating whether having these
identities could predict F&V consumption above and beyond what is already predicted by the
TPB. The study also measured cognitive flexibility (or the ability to adapt behaviour to new
situations) since it has been found to moderate the effect of intentions on behaviour, an area in
which the TPB is weak.
Chapter 2 - Literature Review

2.1. Introduction

Diets rich in fruits and vegetables (F&V) have been associated with many health benefits, mainly through prevention of disease (Liu, 2003; Lock, Pomerleau, Causer, Altmann, & McKee, 2005). The micronutrients, antioxidants and phytochemical compounds found in F&V have been associated with decreased risk of cardiovascular disease, specifically cerebrovascular accident (He, Nowson, & MacGregor, 2006; Joshipura et al., 2001). The regular consumption of F&V has also been associated with a reduced incidence of cancers of the digestive tract (Vainio & Weiderpass, 2006).

The relatively low caloric density of F&V may also contribute to weight control. Studies have demonstrated that the consumption of F&V may help prevent weight gain (Mozaffarian, Hao, Rimm, Willett, & Hu, 2011) and is inversely related to obesity (Bes-Rastrollo, Martínez-González, Sánchez-Villegas, de la Fuente Arrillaga, & Martínez, 2006).

In response to this growing body of evidence, Health Canada increased the minimum number of servings of F&V for Canadians in 2012. Instead of recommending a minimum of 5 servings for those over the age of 4, Health Canada now makes specific suggestions based on age and sex for intake levels. The new recommendations for adults aged 19-50 are now 7-8 servings for women and 8-10 for men (Black & Billette, 2013).

However, despite the known benefits of F&V consumption, 74% of Canadians are not consuming the recommended number of servings as outlined in Canada’s Food Guide (Black & Billette, 2013). Therefore, effective strategies to increase the amount of F&V consumed by Canadians are urgently needed, to meet the new recommendations laid out by Health Canada. The inadequacy of dietary F&V intake represents a serious deficiency in the diets of Canadians and one that leaves them vulnerable to preventable disease.
2.2. Factors affecting Food Choice

2.2.1. Barriers

In the exploratory stages of F&V research, qualitative investigation revealed that cost, taste, texture, appearance, convenience and safety were primary determinants of consumption (Glanz, Kristal, Tilley, & Hirst, 1998; Haynes, Randall, & Reicks, 1994; Keim, Stewart, & Voichick, 1997). Research today is largely focused on barriers to consumption. Many barriers have been identified, ranging from the personal to the environmental. Personal barriers have been found to include a lack of nutrition knowledge, skill to prepare food and cost (Maher et al., 2010). Additionally, finding time to purchase and prepare healthy meals is an increasing problem for most individuals (Rolnick et al., 2009). This coupled with the convenience and widespread availability of unhealthy or fast foods has resulted in fewer F&V in the diet (Barroso, Peters, Johnson, Kelder, & Jefferson, 2010; Nielsen, Siega-Riz, & Popkin, 2002). Over the last 20 years individuals have shifted from having the majority of their calories come from food prepared inside the home, to food prepared by fast food restaurants (Nielsen et al., 2002).

Environmental barriers that have been identified with F&V intake include, a lack of availability of fresh F&V and an absence of places where they are sold (Taylor, Poston, Jones, & Kraft, 2006). One factor that may reduce the impact of these barriers to F&V consumption is motivation (Barroso et al., 2010; Taylor et al., 2006). For example, being motivated to learn how to prepare healthy meals can help one overcome a lack of food skill. Although little research has been done in this area, motivation has already been found to predict the adoption of low-fat, high-fibre diets as well as F&V consumption (Patterson, Kristal, Lynch, & White, 1995; Trudeau, Kristal, Li, & Patterson, 1998).

2.2.2. Food preference

Food preference has also been found to influence consumption of F&V (Deshpande, Basil, & Basil, 2009; Gough & Conner, 2006). Food preferences are set at a young age and influence the types of foods consumed later in life (Kemm, 1987; Northstone & Emmett, 2005). As
such, they are heavily influenced by family preferences (Aldridge, Dovey, & Halford, 2009; Bourcier, Bowen, Meischke, & Moinpour, 2003). When individuals reach the age when food choices may be made independently, new food preferences can be made. One such time is the transition from living at home to living independently, a shift that often occurs for individuals when they begin university. Individuals at this stage are also undergoing what has been termed as an “age of identity exploration” (Arnett, 2006, p.8), where they are engaging in a variety of new activities in an effort to uncover who they are (Arnett, 2000). During this period of exploration they are developing new habits related to spending, entertainment and food choice. However this new freedom often results in a significant reduction in the amount of F&V consumed (Freedman, 2010)

2.2.3. **Transition to University**

A cross-sectional study examining the eating habits of college-aged individuals found that on average, they consumed less than 2 servings of fruit and less than 2 servings of vegetables a day (Nelson & Story, 2009). For university students in particular, the transition from home to university has negative consequences for F&V consumption. The percentage of young adults who meet the 2010 guidelines for fruit and vegetable consumption drops by 25% after the transition to university (Freedman, 2010). However, for students who remained at home during their university career, F&V intake was relatively stable (Freedman, 2010). These findings suggest the process of leaving home and making independent choices results in the decrease in F&V consumption, not simply the transition to university (Freedman, 2010). These conclusions are supported by the fact that university aged individuals who do not attend the university but are living on their own, also consume fewer F&V than when they lived at home (Nelson & Story, 2009). These studies indicate that, although young adults have the freedom to establish new healthy eating habits, they are not making healthy food choices. As this “age of identity exploration” (Arnett, 2006, p. 8) is crucial in the development of future habits, research into the mechanisms that motivate young adults to make healthy food choices is needed.
2.3. The Evolution of Theory of Planned Behaviour

2.3.1. Theory of Reasoned Action

In the domain of health psychology, interventions that use psychological models to change behaviour are often more successful than those that do not (Fishbein, 2000; Noar & Zimmerman, 2005). One of the most successful models for the prediction of health behaviours is the Theory of Planned Behaviour (TPB). A systematic review conducted by Guillaumie, Godin, & Vézina-Im, (2010) found that the variance accounted for by the TPB was greater than any other model being used in the domain of health psychology.

The TPB grew out of the Theory of Reasoned Action (TRA) (Figure 1) developed by Ajzen and Fishbein in 1980. Underpinning both models is the notion that humans are rational beings who base their actions on the perceived outcomes of their behaviour. When the perceived outcome of the behaviour is favourable, individuals will form intentions to enact said behaviour. Therefore the model proposes that behaviour can be predicted by one’s intention to perform that behaviour. Whether an individual will form intentions to perform behaviour is dependent on an individual’s subjective norms and attitudes surrounding the behaviour. Subjective norms take into account whether others will perceive the behaviour in question favourably or unfavourably. Attitudes involve beliefs about whether the outcome of the behaviour will be positive or negative. If both attitudes and subjective norms are favourable, intentions will form to enact the behaviour. Thus, according to the TRA, intentions are predicted by subjective norms and attitudes. However, in practice, the TRA has had only moderate success at predicting intentions (Åstrosm & Rise, 2001; Boyd & Wandersman, 1991).
Figure 1. The Theory of Reasoned Action (Ajzen & Fishbein, 1980)
2.3.2. **Theory of Planned Behaviour**

Since its creation, the Theory of Reasoned Action has been expanded to include perceived behavioural control, which is the degree to which an individual feels behaviour will be easy or difficult to perform (Ajzen & Madden, 1986; Ajzen, 1991). When perceived behavioural control was added, the model was re-named the Theory of Planned Behaviour, see *Figure 2* (Ajzen, 1985). Perceived behavioural control was added to increase the predictive ability of the TRA for intentions and behaviour. It was argued that intentions are only relevant for behaviour when external constraints, such as time and opportunity, and internal constraints, such as knowledge and skills, were perceived to be under the control of the individual (Ajzen & Madden, 1986; Ajzen, 1991).

A high degree of perceived behavioural control has been found to increase the likelihood that behaviour will be performed (Armitage & Conner, 2001; Murnaghan et al., 2010; Rise, Sheeran, & Hukkelberg, 2010). Within the TPB, perceived behavioural control is often one of the strongest predictors of intentions and has been found, in some instances, to predict behaviour directly (Armitage & Conner, 2001; Strating, Van Schuur, & Suurmeijer, 2006).
Figure 2. The Theory of Planned Behaviour, (Ajzen, 1985).
The TPB has been used widely in health research to predict a wide range of behaviours from quitting smoking (Murnaghan et al., 2010), recycling (Terry, Hogg, & White, 1999), condom use (Muñoz-Silva, Sánchez-García, Nunes, & Martins, 2007), organic vegetable consumption (Sparks & Shepherd, 1992) and eating a low fat diet (Sparks & Guthrie, 1998). The components of the TPB have been used to predict intentions to eat a healthy diet (Blanchard, Fisher, et al., 2009; Povey, Conner, Sparks, James, & Shepherd, 2000; Sjoberg, Kyungwon, & Reicks, 2008) which in turn have successfully been used to predict healthy eating behaviour (Jemmott et al., 2011; Murnaghan et al., 2010). The components of the TPB (attitudes, beliefs and perceived behavioural control) have also been able to predict healthy eating behaviour regardless of gender and ethnicity, suggesting that the components of the TPB are universally applicable (Blanchard, Fisher, et al., 2009; Blanchard, Kupperman, et al., 2009). Interventions targeting the components of the TPB have also been able to create successful and sustained changes in healthy-eating behaviour (Gratton, Povey, & Clark-Carter, 2007; Jackson et al., 2005).

The ability of the TPB to predict behaviour seems to be increasing as more studies are done, therefore it is necessary to rigorously refine its relation to F&V consumption to determine whether it is a useful tool for increasing F&V intake (Guillaumie et al., 2010). Preliminary work suggests the TPB can be used to predict F&V consumption (Gratton et al., 2007; Jackson et al., 2005). However, the predictive power of the model is only moderate (~$R^2 = .30$) indicating there may be factors involved in F&V consumption that the TPB does not currently measure (Guillaumie et al., 2010). Recently, researchers have begun to question whether there are other factors that may aid in the prediction of intention and behaviour (Armitage & Conner, 1999; A Brouwer, 2012; Guillaumie et al., 2010; Rise et al., 2010). One of the emerging areas of interest is self-identity. Researchers have begun to test whether self-identity can account for additional variance in the TPB and whether it can add to the prediction of healthy eating behaviours (Armitage & Conner, 1999; Åstrosm & Rise, 2001).
2.4. **Self-Identity**

Self-identity is an enduring set of characteristics that an individual believes they possess (Armitage & Conner, 1999). These characteristics or identities, have a direct influence on behaviour of the individual, with the individual striving to match their behaviour with their identity (Armitage & Conner, 1999). An individual can have many identities, ranging from the broad, e.g. “Canadian” to the specific, e.g “recycler” (Burke & Reitzes, 1991; Stryker, Burke, & Burke, 2011; Stryker, 1987). Identities are used to situate the self in relation to the world and are associated with different meanings (Burke & Reitzes, 1991; Stryker, Burke, & Burke, 2011; Stryker, 1987). These meanings are derived from social roles and activated by social-environmental cues (Burke & Reitzes, 1991; Stryker et al., 2011; Stryker, 1987). “Canadian’s are friendly” is an example of a meaning derived from a social role. When the salience of this social role is made more prominent, for example by being abroad, the social role and associated behaviour are activated. According to identity theorists, this would result in a greater effort being made to be friendly (Stets & Burke, 2003). In this way the meanings associated with different identities also create expectations for behaviour, and identity provides a framework on which to model behaviour. Studies have shown that university aged students who have identities centered around healthy eating, consume significantly more fruits and vegetables than those who do not (Strachan & Brawley, 2009).

Additionally, research has found that the more central a behaviour is to an individual’s self-identity, the more likely they are to act out that behaviour in order to promote identity-congruency (Burke & Harrod, 2005; Stets & Burke, 2003). Identity-congruence operates in a similar fashion to Festinger’s (1957) principle of cognitive consistency, where individuals strive to find consistency between their beliefs, attitudes and behaviour. When consistency is violated it creates an uncomfortable psychic state known as cognitive dissonance. In terms of identity-congruence, when beliefs about the self do not match behaviour, the need to avoid cognitive dissonance motivates the individual to either change their behaviour to match their identity, or change identity to match their behaviour (Callero, Howard, & Piliavin, 1987; Strachan, Brawley, Spink, & Jung, 2009). When an individual places value on seeing
themselves in a certain way, they must then change their behaviour to match their identity in order to comfortably maintain that identity (Charng, Piliavin, & Callero, 1988; Ryan & Deci, 2005). In this way identity regulates behaviour through the need for identity-congruency. Individuals who strongly endorse a particular identity are more likely to behave in a way that corresponds with their identity-related expectations (Ryan & Deci, 2005). As a result of the ability of self-identity to predict behaviour, it has been proposed as a potential new component of the TPB.

2.5. Self-Identity and the Theory of Planned Behaviour

2.5.1. Self-identity as a separate construct

When the TPB was created it was stated that variables could be added to the model if they added predictive power (Ajzen, 1991, 2011). In order for self-identity to be incorporated into the TPB it needs to be established as a separate construct from the already existing similar predictors of intentions-attitudes and subjective norms, while also predicting unique variance in intentions and behaviour (Figure 3).
Figure 3. Self-Identity and the Theory of Planned Behaviour
2.5.2. Subjective norms and Self-identity

When researchers first tried to incorporate self-identity into the TPB it was as a component of subjective norms. It was thought that adding self-identity to subjective norms might increase this component's predictive power, as subjective norms have often been found to be the weakest predictors of intentions (Godin & Kok, 1996; Sheppard, Hartwick, Warshaw, & Hartwick, 1988). It was proposed that breaking subjective norms into “social influence norms” and “self-representational norms” or self and group identity norms respectively, would help subjective norms account for more variance in intentions and behaviour (Abraham, Sheeran, & Johnston, 1998). However, recent research has not supported self-identity’s inclusion in subjective norms. A 2001 study done by Astrom & Rise, suggests that self-identity is a factor unto itself. The researchers tested whether self-identity added any unique variance to the prediction of intentions to eat a healthy diet. They found self-identity predicted an additional 4% of the variance in intentions, separate from the components of the TPB, and specifically subjective norms. They argued that subjective norms should be conceptualized as the motivation one feels to behave in ways that are congruent with the expectations of the society in which one lives, as well as the opinions of those who are important to the individual. On the other hand, they proposed that self-identity be defined as the motivation one feels to behave in ways congruent with the identity one holds. In this way self-identity was differentiated from subjective norms in that it was found to uniquely contribute to intentions to eat a healthy diet.

2.5.3. Self-Identity and Attitudes

In 2010, Rise and colleagues conducted a meta-analysis consisting of 33 studies looking at self-identity and its ability to predict intentions. Although a modest amount of shared variance has been found between self-identity and attitudes, self-identity was found to significantly predict intentions when attitudes are controlled for, suggesting self-identity contributes uniquely to the prediction of intention (Rise et al., 2010). In this way self-identity can be
considered as a construct, separate from attitudes and subjective norms that adds predictive power to the TPB.

2.5.4. **Self-Identity and the Theory of Planned Behaviour’s ability to predict Behaviour**

For self-identity to be incorporated into the model it must be able to predict behaviour across a wide range of circumstances. When self-identity was added to the TBP it contributed uniquely to the prediction of dieting behaviour (Armitage & Conner, 1999; Sparks & Guthrie, 1998), physical activity (Theodorakis, 1994), donating blood (Charng et al., 1988), school retention (Biddle, Bank, & Slavings, 1987), and voting (Granberg & Holmberg, 1990). These effects were found even when controlling for past behaviour. This finding is significant as it has been argued that through self-perception processes, individuals form identities by making inferences based on past behaviour (Bem, 1972). If this hypothesis were true, then self-identity would explain no unique variance after controlling for past behaviour and the components of the TPB. Although the two concepts were found to share a small amount of variance ($R^2 = .11$), self-identity predicted 9% of the variance in behaviour when controlling for past behaviour and the TPB. The formation of self-identity has been distinguished from past behaviour by defining it as a cognitively active process, not simply a reflection of past behaviour (Sparks & Guthrie, 1998). Rise and colleagues (2010) conducted a meta-analysis of 40 studies in which they found self-identity predicted 6% of the variance in intentions after controlling for the components of the TPB.

Finally, the relationship between self-identity and behaviour is largely mediated by intentions, which corresponds with conceptual structure of the TPB (Rise et al., 2010). This growing body of evidence supports the inclusion of self-identity in the TPB as it is able to predict intentions for a large variety of behaviours, contributes uniquely to the prediction of intentions and is separate from the established components of the TPB (Figure 3). The ability of self-identity to predict health behaviours has lead researchers to investigate the possibility that self-identity could be manipulated to motivate behaviour change.
2.6. Motivation and The Self-as-Doer Theory

A small body of research has found motivation to be a useful tool in the prediction of F&V consumption (Fuemmeler et al., 2006; Richards, Kattelmann, & Ren, 2006; Trudeau et al., 1998). One of the ways motivation may help to increase F&V consumption is by reducing some of the barriers to consumption. For example, being motivated to learn how to prepare new foods or find healthy options when eating out, could result in increased F&V consumption. It has been argued that motivation is an important factor in the prediction of intentions, and that self-identity is a unique source of motivation (Brug, 2008). However, only a few studies have investigated the link between motivation and self-identity.

2.6.1. Developing the Self-as-Doer

A pioneering study by Houser-Marko & Sheldon, (2006) proposed a concept that combined motivation with self-identity: the self-as-doer theory. Like identity theory, the self-as-doer proposes that the degree to which individuals identify with a role determines how motivated they are to act out related behaviours. However, the self-as-doer theory also proposes that individuals describe themselves as a “doer” of behaviour based on their goals. In this way, goals are combined with identities and behaviour is motivated by the need to achieve identity congruence between goals and behaviour. The self-as-doer is a way of creating a specific type of self-identity that has been found to motivate behaviour by incorporating goals into identity.

Therefore, if one had the goal of running each day, one may come to see oneself as “a runner”, or the “doer” of the behaviour. According to the self-as-doer theory, seeing oneself as “a runner” would further motivate running behaviour in order to promote identity congruence. In this way, the self-as-doer self-identity provides a direct link between identity and the behaviour upon which the identity is based. Having such a specific identity and one so closely related to behaviour insures that the specific “goal” behaviour is enacted to maintain identity congruence. In terms of the self-as-doer’s place in the TPB, it would be seen as a specific
kind of self-identity. As such, it would behave like self-identity, and predict behaviour through the prediction of intentions (Figure 4).

![Diagram](image)

Figure 4. Self-as-doer Self-Identity in the Theory of Planned Behaviour

2.6.2. **Ensuring the Self-as-doer is a Unique Motivational Construct**

As self-identity has been established as a separate constructed adding unique variance to the TPB, it is assumed that the self-as-doer, as a type of self-identity, will also add unique variance to the prediction of F&V consumption. However, in order for the self-as-doer self-identity to be studied as a concept capable of motivating behaviour in new ways, it must first
be differentiated from existing explanations of motivation. Through a series of 3 mini studies Houser-Marko & Sheldon were able to differentiate the “self-as-doer” from existing explanations of behaviour as well as demonstrate its ability to predict behaviour. The first study had participants transform their academic goals into doer phrases and rate their endorsement of each phrase during their first semester and last semester three and a half years later. The second study had a similar design but focused on individuals exercise goals, allowing the importance of the self-as-doer construct to be evaluated in the domain of health behaviour where persistence is a problem. The final study primed individuals with a self-as-doer identity by having them read a story about persistence and write a paragraph in which they applied the moral of the story to themselves or to a friend. They then completed a short task of physical persistence. The results of the studies are discussed below.

In the first study Houser-Marko & Sheldon, examined the self-as-doer in relation to the established, motivational constructs of felt commitment (or resolve to pursue a goal) (Brunstein, 1993), self-concordance (or the need to pursue goals in-line with personal beliefs (Ryan & Deci, 2005, Chapter 3), and future expectancy (or the pursuit of goals when expected outcomes are favourable)(Bandura, 1989). When these existing motivational constructs were controlled for, having a self-as-doer identity related to academic achievement predicted the GPA scores of university students three and a half years later (Houser-Marko & Sheldon, 2006). The ability of the self-as-doer to predict behaviour over a considerable length of time suggests that doer identities are relatively stable and enduring aspects of identity. When the researchers controlled for two of the Big Five personality traits: Neuroticism and Openness, having an exercise based self-as-doer identity was still found to be a significant predictor of exercise behaviour (Houser-Marko & Sheldon, 2006). When creating new constructs related to wellbeing, it has become standard practice to ensure no overlap between these two specific traits occurs. This is because Openness has been found to correspond with a willingness to pursue new goals, while Neuroticism can bias responses to questions surrounding mood and wellbeing. Thus, being able to differentiate the self-as-doer from these traits is important, especially because the self-as-doer construct will be used to motivate health behaviours.
In the second study Houser-Marko & Sheldon examined the self-as-doer in relation to past behaviour or habits. Habits are behaviours triggered by situational cues and do not require conscious effort to initiate (Wood, Witt, & Tam, 2005). Unlike the self-as-doer habits do not link sense of self with a particular behaviour that may provide unique motivation resources. When past exercise habits were controlled for, the self-as-doer was found to be a significant predictor of goal progress and attainment, suggesting that doer identification has effects that go beyond previous experience with a behaviour (Houser-Marko & Sheldon, 2006). This argument has implications for interventions as it suggests that adopting a doer identity in the present may allow individuals to “go beyond their own past” and change their behaviour for the better (Houser-Marko & Sheldon, 2006, p. 1044). In terms of fruit and vegetable consumption, having a doer identity as a “vegetable eater” may help in overcoming past habits and increasing vegetable consumption.

In their final study, Houser-Marko & Sheldon (2006) demonstrated that the motivational resources provided by seeing oneself as the “doer” of behaviour can be made available to anyone, not just those that already see themselves as the “doer” of a behaviour. They found that individuals who related the theme of persistence directly to themselves persisted longer in a task of physical endurance than those that related that theme to a friend. In this way the researchers demonstrated that having an explicit link between self-concept and behaviour provides additional motivational resources. Furthermore, that this link need not already exist but can be created was also demonstrated.

The self-as-doer self-identity has also been conceptually differentiated from implementation intentions (Houser-Marko & Sheldon, 2006). Although similarities between the concepts exist, at its core, implementation intentions facilitate goal achievement by linking specific behaviours with future situations (Gollwitzer & Brandstätter, 1997; Gollwitzer, Fujita, & Oettingen, 2004). For example, an individual who wanted to eat more fruit may create the implementation intention “If I’m hungry after dinner, then I’ll have an apple”. By creating
“if… then” scenarios, implementation intentions seek to make behaviour automatic. This differs from the self-as-doer theory, which links sense of self (ie apple eater), rather than future scenarios, with behaviour. In this way the self-as-doer theory involves personal identity, while implementation intentions do not.

2.6.3. Creating a Self-as-Doer Identity

A doer identity is created when individuals identify behavioural goals, for example eating more vegetables, determine the degree to which current behaviour (low vegetable consumption) matches this goal, and establishes what it might take to identify more strongly with the behaviour in question (purchase more vegetables to become a vegetable eater). Although somewhat similar to motivational interviewing (Miller & Rollnick, 2002), this process focuses on building identities based on behavioural goals. In this way the doer identity can draw on existing self-representations regarding vegetable consumption. Additionally the process of conceptualizing what it means to be a “Vegetable Eater” may promote greater identification with different and more consistent behaviours related to the overall goal, like trying new vegetables.

2.6.4. Self-as-doer and Diet Interventions

Research investigating the use of the self-as-doer to promote diet change is limited. Therefore, the goal of the present study is to build an intervention using the self-as-doer as a motivational tool to help increase participants’ F&V consumption.

In diabetic patients, identifying as “a doer of self-care behaviour” has been found to predict healthy eating behaviours (Brouwer & Mosack, 2012). More recently, a large-scale study at the University of Wisconsin-Milwaukee investigated whether having a self-as-doer identity would predict the consumption of healthy foods for university-aged women (Brouwer & Mosack, 2015). Healthy foods were defined as low-fat dairy, vegetables, fruits, and whole grains. A reduction in sugar-sweetened beverages was also encouraged. Consumption was measured using a 4-day food diary, and a modified food frequency questionnaire that was filled out at the end each day diet was tracked. Three levels of treatment were present in the study. Women either created self-as-doer identities (n=28) related to healthy eating, or
received nutritional counselling (n=28), or received no intervention (n=23). Over the course of 6 weeks, women who created self-as-doer identities increased their overall healthy food consumption, while the other two groups decreased their consumption. However, no significant differences existed between the three treatment groups when healthy foods were broken down into their individual components of low-fat dairy, F&V, and whole grains. Although the self-as-doer group increased their F&V consumption relative to the education and control groups, the increase was not great enough to be statistically significant. The broad range of the study objectives may be one of the reasons significance was not observed. Having an identity as a healthy-eater encouraged participants to make changes to all aspects of their diet, without focusing on any one aspect in particular. Having an identity as a healthy eater may not be specific enough to motivate F&V consumption. Therefore the current study seeks to determine whether having a more specific self-as-doer identity can promote more specific dietary change.

Over the course of the Wisconsin-Milwaukee study, the self-as-doer group also increasingly identified themselves as healthy-eaters. However increases in healthy eater identity were seen across all three treatment groups, such that no one group was significantly higher at any time point. A possible explanation for this result could be the limited reinforcement for the identity building activity. The self-as-doer task to build healthy-eater identity was the only identity exercise administered throughout the entire study and the task was completed on only one occasion during the second visit. Identity was measured immediately after and not again until five weeks later. One can speculate that, if during the intervening weeks, activities had been done to strengthen identity; the self-as-doer group may have significantly increased their healthy eater identity to a greater extent than the education and control groups. The present study will therefore add exercises throughout the study, aimed at strengthening F&V eater identities.

As no differences were found to exist between the control and the education groups in terms of consumption, the present study did not include an education group. However, as
previous studies have indicated a strong effect of nutrition knowledge on healthy eating behaviours (Carcaise-Edinboro, McClish, Kracen, Bowen, & Fries, 2008; Oenema, Brug, & Lechner, 2001), nutrition knowledge was measured for all participants to ensure no significant differences exist between the control and experimental group.

The Wisconsin-Milwaukee study also focused exclusively on building self-as-doer identities in women, to reduce potential sources of variance. Although differences between men and women have been found in terms of willingness to make dietary change (Wardle et al., 2004), how men respond to the self-as-doer is of interest. Therefore, the present study will include men.

Finally, the study's timeframe of five weeks may have prevented differences between the three treatment groups from being expressed. Although F&V consumption and healthy eater identity were not found to be significantly different between the three groups over the course of the five-week study, the results trended towards significance. This effect was seen most clearly in the final week of the study when differences between the self-as-doer group and the education and control groups were the most pronounced. These results can be understood when we consider the fact that identity takes time to develop (Kearney & O’Sullivan, 2003) and preparing new fruits and vegetables takes time to learn (Barroso et al., 2010). As the difference between the three groups increased as the study continued, the present study will expand the timeframe of the intervention by one visit for a total of six weeks.

2.7. TPB Intention Behaviour Gap

In the domain of health research it is common to use intentions as a stand-in for behaviour. One of the reasons for this is that for certain behaviours, like dietary change, intentions are easier to measure than actual behaviour. In addition, intention, when examined in the context of the TPB, has been established to be predictive of behaviour. However research has demonstrated that intentions are not always a suitable substitute for behaviour, as intentions do not always completely predict behaviour. A meta-analysis of 185 independent
studies, examining various health behaviours, found that the TPB was able to predict 39% of the variance in intentions while only 27% of the variance in behaviour (Armitage & Conner, 2001). The results of this study suggest that a theoretical “gap” may exist between intentions and behaviour. The “gap” between intention and behaviour is largely due to the presence of “inclined abstainers” or individuals who intend to act, yet fail to do so (Orbeil, Hodglns, & Sheeran, 1997). However, this does not mean intentions are not a valuable tool in predicting health behaviours. Individuals with no intentions to perform a particular behaviour are seldom found performing that behaviour. Thus it can be assumed that intentions are a necessary component for behaviour. In order to understand why those with intentions to perform a particular behaviour fail to follow through, the processes that bridge the gap between intentions and behaviour must be examined (Abraham et al., 1998). It has been proposed that the “gap” between intention and behaviour constitutes the volitional stage. The volitional stage is the post-intentional period in which the intended behaviour must be planned, initiated and maintained in order for the behaviour to be observed (Heckhausen, 1991). This model assumes the mediation of the intention-behaviour gap by volitional factors like self-efficacy (perceived ability to perform a behaviour), action planning and self-regulatory processes (e.g. ability to inhibit counterproductive behaviour), which would aid in the planning, initiation and maintenance of behaviour. The importance of volitional processes in translating intentions into behaviour was demonstrated by a study investigating exercise behaviour in cardiac rehabilitation patients (Sniehotta, Scholz, & Schwarzer, 2005). The researchers found that having a detailed action plan, perceived self-efficacy and self-regulatory ability mediated the relationship between intentions and behaviour. Specifically, they found self-regulatory ability important in the breaking of old habits, and necessary for overcoming situational cues for unhealthy behaviour. When self-regulation was added to the TBP, it was able to explain unique variance in exercise and diet behaviour, above and beyond what was predicted by intentions (Hall, Fong, Epp, & Elias, 2008). Individual differences in self-regulatory ability have also been found to predict whether intentions will be transformed into behaviour (Hall et al., 2008). Recently a study by Allom & Mullan (2012), investigated whether these volitional processes were also important when the behaviour in question was fruit and vegetable...
consumption. They found that when intentions were low, habits predicted high consumption of fruits and vegetables. These results correspond with previous findings, which state that when intentions are low there is no need for self-regulatory processes to mediate behaviour (Suchy, 2009). When intentions were high, the researchers found that a self-regulatory process known as cognitive flexibility moderated the relationship between intentions and behaviour.

2.8. Cognitive Flexibility

Cognitive flexibility is the ability to adapt behaviour to new situations (Spiro, Feltovich, Jacobson, & Coulson, 1992). In the context of goal achievement, cognitive flexibility allows individuals to imagine several different ways to reach their goals. In addition, being highly cognitively flexible aids in problem solving by generating alternative solutions when the original plan for behaviour falls through (Sniehotta et al., 2005). In terms of dietary change, cognitive flexibility may help to translate intentions into behaviour by finding ways for intentions to be expressed even when barriers are present.

2.8.1. Iowa Gambling Task

One of the most studied measures of cognitive flexibility is the Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994). The strength of the Iowa gambling task (IGT) lies in the fact that it imitates real-life decision making, by punishing or rewarding individuals based on the decisions they make. In this task, participants “gamble” by choosing from four decks of cards. Two of the decks give immediate large rewards but cause participants to lose “money” in the long run. The other two decks give smaller immediate rewards but result in more “money” in the long run. In order to be successful at the IGT one must choose long-term rewards over immediate rewards. This task taps into our prefrontal “reflective” system of behaviour that is responsible for controlling basic impulses and the flexible pursuit of long-term goals (Bechara, 2005). The IGT first requires participants to inhibit their impulses to choose immediate, highly gratifying, rewards and to consider whether other options are actually more beneficial. In other words they must shift from the selection of immediate, highly gratifying, rewards to long-term rewards. To do this, participants must weigh short-term gains against long-term losses. Participants with high cognitive flexibility
are better able to evaluate the outcomes of their choices, and adapt their behaviour accordingly (Bechara, 2005). The ability to select smaller immediate rewards for the attainment of larger delayed rewards has unique applications in terms of fruit and vegetable consumption. While fruits and vegetables are not as immediately rewarding as their high-calorie alternatives, they offer the much larger delayed reward of good health. Thus, one of the ways cognitive flexibility may aid in the translation of intentions to behaviour is by inhibiting impulsive choices for unhealthy foods, and allowing for the consideration of healthier alternatives. Although previous studies have investigated self-regulatory processes as mediators of behaviour, there is no reason to believe that cognitive flexibility is related to the formation of intentions to eat F&V, and therefore should be conceptualized as a moderator. The current study will investigate whether cognitive flexibility moderates the relationship between intentions and behaviour, by measuring cognitive flexibility using the IGT. If cognitive flexibility is found to moderate the intention behaviour gap, a stronger relationship between identity and behaviour is proposed as those with high cognitive flexibility will be better able to express their F&V eater identities in terms of F&V consumption.

2.9. Conclusion

In conclusion, adequate intake of fruits and vegetables is important in the prevention of many types of cancers and the prevention of obesity. Previous research has supported the role of self-identity as a significant predictor of the consumption of fruits and vegetables, as well as one that adds value to the predictive power of the TPB. However, few studies have examined how identity and motivation work together in the pursuit of specific goals. This represents a deficit in the research to date and one that the present study attempts to fill. Until now most research in the domain of F&V consumption has been cross-sectional in nature (Guillaumie et al., 2010). Therefore the present study will investigate whether self-identity can be manipulated to build F&V eater identities (self-as-doer identities) and whether this manipulation will result in increased F&V consumption, intentions to eat F&V, as well as F&V eater identities. Whether self-identity as a self-as-doer is responsible for these changes
will also be explored by investigating whether self-identity as a self-as-doer can predict the intentions and consumption beyond the effects of the TPB. Finally, the ability of cognitive flexibility to moderate the intention-behaviour gap using the IGT will also be examined.

Therefore, the current study has two main research questions. The first concerns the effectiveness of the self-as-doer intervention to increase self-identity as a healthy, fruit or vegetable eater, intentions and behaviour. The second concerns the intervention (self-as-doer task) and explores why it was successful by determining whether intentions and behaviour are predicted by the change in self-as-doer self-identity, as the TPB would suggest.

Therefore to assess the effectiveness of the intervention (self-as-doer task):

1. Does the intervention increase consumption of F&V?
2. Does the intervention increase self-as-doer self-identity?
3. Does the intervention increase participants intentions to eat F&V

To explore why the intervention was effective:

4. Does self-identity, in the form of self-as-doer predict the change in intention and consumption seen over the course of the study?

Finally:

5. Does cognitive flexibility moderate the intention-behaviour gap?

To ensure no differences exist between the experimental and control groups at baseline, measures of nutrition knowledge, year of study, intentions, attitudes, perceived behavioural control, F&V consumption and F&V eater identities will be compared.
Figure 5. Hypothesis Visually
Chapter 3- Methods

3.1. Participants

Eating habits of men and women have been found to differ with respect to dieting behaviour (Wardle et al., 2004), nevertheless both men and women were included in this study to increase applicability of the results to the general population. Previous studies have found that individuals who are thinking about changing their diet are more likely to be engaged in the study as well as generate better diet goals (Brouwer & Mosack, 2015). In this study therefore, only individuals specifically interested in increasing their F&V consumption were selected for the study.

3.1.1. Power Calculation

We estimated that we would need 44 participants to detect a 1.5 serving increase in reported fruit and vegetable intake assuming a standard deviation of effect of 2 servings. The literature does not provide data for smaller studies, (< 1000 participants), for the standard deviation for the difference in change from baseline between treatments, but, where reported, the standard deviation of treatment effect ranged from 1.1 to 1.94 servings (Bradbury et al., 2006; John, Ziebland, Yudkin, Roe, & Neil, 2002; McCall et al., 2009). We therefore selected 2.0 servings as a conservative estimated standard deviation on which to base our calculation. Since we are using a repeated measures ANOVA where a modest correlation is expected between repeated measures we used an r-value of 0.6 with alpha = .05 and beta = .8. With these assumptions we would need 20 participants per treatment condition (total n= 40) to detect a 1.5-serving difference between-treatments. A modest dropout rate of 10% might be expected from studies of this sort requiring recruitment of at least 44 participants. We recruited a total of 47 participants for our study.

3.1.2. Recruitment

A rolling-recruitment was used to enlist individuals in the study. To attract potential participants, flyers were posted on campus advertising a study looking at factors involved in F&V consumption. These flyers directed interested individuals to an online screening
questionnaire (Appendix A). Ineligible participants received an email explaining they had not qualified. Eligible participants were contacted by email and a time was arranged for them to complete their first visit. The entire study consisted of five visits over the course of eight weeks, with the intervention period consisting of three visits over the course of six weeks (for overview see Figure 6).

The study was approved by the University of Guelph ethics board, (#14FE042) and all enrolled participants completed a consent form.
Figure 6. Study Design Flow Chart
3.1.3. **Inclusion/Exclusion Criteria**

Inclusion criteria assessed by the online screening questionnaire (Appendix A) were as follows: the participant was interested in increasing their F&V consumption, currently an undergraduate student at the university between the ages of 18-25, and had a cellphone on which they were willing to receive text messages. The online screening questionnaire’s exclusion criteria assessed whether potential participants had disordered eating patterns. If present, the participant was deemed ineligible.

Additional inclusion/exclusion criteria assessed using information gathered at Week -2 & 0 were as follows: only participants living on campus or in student housing were deemed eligible, as research has shown that individuals start to make their own food choices after they leave home (Freedman, 2010). If participants were found to still live at home they were deemed ineligible. In addition, participants who had a baseline level of F&V consumption above what is recommended by Canada’s food guide were deemed ineligible, as no further increase is recommended.

3.2. **Protocol**

3.2.1. **Visit 1/ Week -2: Initial Screening**

When participants first entered the lab they were taken through the general consent form by the researcher, and any questions were answered. If unsure about their participation, participants were encouraged to take the consent form home with them and discuss participation in the study with their family or with others around them if they so wished.

Once consent was obtained, baseline measures were taken. These measures included online questionnaires assessing participants’: self-identity (healthy-eater, fruit-eater and vegetable-eater), the components of the Theory of Planned Behaviour (attitudes, subjective norms and perceived behaviour control) as they related to the consumption of F&V. Using the online questionnaire format nutrition knowledge was also assessed, as it is known to influence F&V
consumption (Carcaise-Edinboro et al., 2008; Oenema et al., 2001). Using the computer program Pebl, participants also completed the Iowa Gambling Task to measure their cognitive flexibility. More details on the individual questionnaires are given below in section 3.3 labeled “Measures”.

Finally, participants were given instructions for filling out their 3-day food diaries to be completed the following week. Determining dietary intake accurately and reliably is a difficult task owing to the complexity of diet behaviour (Willett 1998). Food diaries are one of the most heavily studied and relied upon methods of assessing intake. Although this self-report measure is subject to forgetfulness and bias (Willett, 2001) to date there is no more accurate alternative. Three-day food diaries, that include two weekdays and one weekend day, have been shown to be sufficiently representative of dietary intake (Guest, 1992, p. 154–191; Willett, 1998). The second appointment was then scheduled. Before leaving the lab, participants were informed that they would receive reminder emails each day they were to track their diet, as well as the day before their next appointment.

3.2.2. Visit 2/ Week 0: Baseline

When participants returned to the lab for their second visit they were randomly assigned to either the control or experimental group using the flip of a coin. Those in the experimental group signed a new consent form in which the self-as-doer activities were present. Food Diaries from both the experimental and control group were then collected and reviewed by the researcher and the participant. All participants were given the opportunity to ask questions relating to the food diaries. Instructions for filling out food diaries were repeated if requested. New food diaries for the coming week were issued and Visit 3 was scheduled.

Outcome measures of identity, and the Theory of Planned Behaviour were not collected at this time as they were assumed to be equivalent to the measures taken at Visit 1/ Week -2. The participants in the control group then left the lab. The participants in the experimental group stayed and completed the self-as-doer task (Appendix B). In this task participants
created the self-as-doer identities that would be the focus of the intervention. Participants were asked to generate six goals they had related to fruit and vegetable consumption. Using these goals, participants created self-as-doer phrases by adding “–er” to the end of each verb. For example, the goal of “eating more vegetables” became “vegetable eater”. In this way, the participant described himself or herself as the “doer” of the behaviour. The type of phrase created varied among participants from the very specific “Garbanzo Bean Muncher” to the very general “F&V Variety Eater”. Participants also created doer phrases with temporal aspects e.g. “After Dinner Fruit-Eater” and doer phrases that related to certain methods of F&V preparation e.g. “F&V Smoothie-Maker”.

After these doer phrases were generated, participants rated how well these phrases described themselves using a 5-point Likert scale, where a rating of 1 indicated that the phrases did not describe them well and a rating of 5 indicated that the phrase described them well. The researcher then focused on the three doer phrases that the participant rated the lowest. For each of the three lowest rated phrases participants were asked to describe what being the doer of the phrase would look like to them. For example “Imagine you are a vegetable eater. What does that look like to you? Take me through a day where you are a vegetable eater.” At this time participants were also asked what it would take to describe themselves fully as the doer of the phrases that they created. For example, “You rated yourself as a 1 as a vegetable eater, what would it take to see yourself as a vegetable eater to a greater degree, for example a 4 or a 5?” While participants were answering these questions, the researcher took notes summarizing what the participant said. At the end of the exercise a summary sheet outlining the three doer phrases, what they meant to the participant and the actions necessary to strengthen these doer identities was given to the participant. Finally, participants were encouraged to think about their doer phrases over the coming weeks as they made food choices.
3.2.3. **Visit 3/ Week 2**

All participants came to the lab. The previous week’s food diaries were collected and new ones were distributed using the same procedure described in Visit 2/ Week 0. All participants filled out surveys on the computer assessing the outcome measures of self-identity (healthy eater, vegetable eater, fruit eater), as well as the components of the Theory of Planned Behaviour (attitudes, subjective norms and perceived behaviour control). The experimental group then completed an identity strengthening exercise. This task involved participants writing three short, point form paragraphs in which they described the various ways they had enacted each of their self-as-doer identities over the past week. As the theoretical premise of the self-as-doer is linking identity with specific behaviour will provide unique motivational resources, seeing examples of congruent behaviour should serve to strengthen the self-as-doer identity (Houser-Marko & Sheldon 2006).

3.2.4. **Visit 4/ Week 4**

All participants came to the lab. The previous week’s food diaries were collected again and new ones were distributed using the same procedure described in Visit 2/ Week 0. All participants filled out surveys assessing outcome measures using the same procedure described in Visit 3/ Week 2. All participants then were allowed to leave the lab. For the final identity strengthening exercise the experimental group received a text the day prior to tracking their diet, which reminded them of their self-as-doer goals. For example, “Hi _____, just a reminder of your goal to be a veggie snacker, fruit dessert haver, & colourful F&V eater, in the upcoming week.” Incorporating technology into interventions has been found to sustain participant engagement in studies (Marciel, Saiman, Quittell, Dawkins, & Quittner, 2010), thus a text message was sent during the fifth week of the study.

3.2.5. **Visit 5/ Week 6**

All participants returned to the lab. The final week’s food diaries were collected and reviewed. All participants filled out the final surveys assessing outcome measures using the same procedure described in Visit 3/ Week 2. Participants were then debriefed about the
purpose of the study, expected outcomes and the treatment group to which they were randomized. Questions about the study were answered. The most commonly asked question was regarding the purpose of the Iowa Gambling Task. Compensation for the study was either mailed to the participants or given in cash upon completion. Participants received $15 for each visit they attended; regardless of whether or not they completed the visit.

3.2.6. Follow-up

Participants were contacted by email and self-reported measures of height and weight at the time of the study were collected. BMI was computed using these results.

3.3. Measures

Copies of the measures used in the study are included in the Appendices.

3.3.1. Disordered Eating

Disordered eating patterns were identified using the S.C.O.F.F as part of the online screening questionnaire (Appendix A) (Perry et al., 2002). The S.C.O.F.F asks five, yes or no questions related to eating behaviours, from which it gets its name: “Do you make yourself Sick because you feel uncomfortably full?”, “Do you worry that you have lost Control over how much you eat?”, Etc. If an individual is found to answer “yes” to two or more questions, it is considered “quite likely” they have disordered eating patterns. The reliability and validity of this measure, compared to the criteria in the DSM-IV, has been established for similar populations (Hill, Reid, Morgan, & Lacey, 2010).

3.3.2. 3-Day Food Diary

Over the course of three days, participants recorded the type and amount of food consumed on the sheets provided (Appendix C). Instructions for the 3-day food diaries included explaining what constitutes a serving of F&V according to Canada’s Food Guide, as well as demonstration using a Food Model. Furthermore, a tip sheet, outlining easy ways to estimate portion size, was also given to participants at this time (Appendix C). To ensure participants were fully comfortable with the food diary format, participants and the researcher
filled out a practice food diary together, using the participants’ intake from the day before. Participants then selected three days (one weekend day and two week days) on which to track their diet and were instructed to keep the selected days constant throughout the study, as it is recommended that tracking days be the same before and after an intervention (Willett, 1998). They were then given their 3-day food diaries, labeled with the days on which they were to be completed. They were told that each day would begin at 12:01 am and end at 11:59 pm.

A serving of F&V was defined according to the guidelines set out by Health Canada. The number of servings of F&V consumed was calculated by entering the various food items into the recipe analyzer (eaTracker: https://www.eatracker.ca/), on the Dietitians of Canada website. Each food item was entered into eaTracker twice by two independent researchers. If discrepancies in the number of serving occurred the item was entered a third time.

For the purpose of this study, F&V were classified botanically, with tomatoes and avocados being considered fruit. What contributed towards a serving of F&V was based upon inclusion criteria outlined in Canada’s Food Guide. For example jams, jellies and candies made from “100% fruit juice” were not considered fruit. Baked potatoes were considered vegetables, but French-fries were not. Similarly corn was considered a vegetable, however popcorn was not.

3.3.3. Nutrition Knowledge

Nutrition knowledge was assessed using the validated nutrition knowledge questionnaire developed by Dickson-Spillmann, (2011). The questionnaire was developed to test general consumer knowledge of nutrition. Using a true/false format it includes questions like “Fat is always bad for your health, you should avoid it as much as possible” which false, and “Pasta with tomato sauce is healthier than pasta with mushroom and cream sauce” which is true. Correct responses were summed for a total nutrition knowledge score, with higher scores indicating a greater degree of nutrition knowledge. See Appendix D.
3.3.4. **Theory of Planned Behaviour**

All components of the TPB were measured and developed according to the recommendations outlined in Fishbein & Ajzen, (2011). Previous studies have developed items reflecting healthy diet behaviour (Armitage & Conner, 1999; Åstrosm & Rise, 2001). The present study has adapted these items so they apply directly to F&V consumption. See Appendix E.

3.3.5. **Intentions**

Participants used a 7-point likert scale (where 1 indicated strongly disagree and 7 indicated strong agree) to rate the extent to which they agreed with items measuring their intent to eat F&V: “I intend to eat F&V”, “I plan to eat F&V” and “I want to eat F&V”. Responses were averaged with higher scores indicating greater intentions.

3.3.6. **Attitudes**

Indirect and direct measures of attitudes were measured by asking participants to rate on a 7-point (-3 to 3+) semantic differential scale whether “My eating F&V is…” anchors used were: bad/good, harmful/beneficial, unpleasant/pleasant, un-enjoyable/enjoyable, foolish/wise and unnecessary/necessary. Responses were averaged with higher scores indicating more positive attitudes towards eating F&V.

3.3.7. **Perceived behavioural control**

Participants’ perceived behavioural control was assessed using a 7-point likert scale to respond to statements and questions including: “How much do you feel that whether you eat F&V is beyond your control” and “I believe I have the ability to eat F&V”. The anchors for each question varied, however a score of 1 always indicated a lower rating and a score of 7, always a higher rating. Responses were averaged with higher scores indicating a greater degree of perceived behavioural control.
3.3.8. **Subjective norms**

Participants were asked to respond to the following questions using a 7-point likert scale: “People who are important to me think I (should not eat F&V/should eat F&V),” “People who are important to me would (disapprove of my eating F&V/approve of my eating F&V).” Finally, participants were asked what degree (strongly disagree to strongly agree) they agreed with the following statements: “People who are important to me want me to eat F&V”. Responses were averaged with higher scores indicating favourable subjective norms for F&V consumption.

3.3.9. **Self-Identity: Healthy Eater Identity, Fruit Eater Identity and Vegetable Eater Identity**

All three measures of identity were assessed using an adapted version Strachan & Brawley's 2009 validated healthy eater identity questionnaire. Consisting of nine questions, participants rated how well each statement described them on a 5-point likert scale, with a rating of 1 indicating strong disagreement and 5 indicating strong agreement. “I see myself to be a healthy/fruit/vegetable eater.” “I have numerous goals related to healthy eating/ eating fruit/ eating vegetables”, and “Being a healthy/fruit/vegetable eater is a central factor to my self-concept.” Responses were averaged with higher scores indicating greater identification with healthy/fruit/vegetable eater identities. See Appendix F.

3.3.10. **Cognitive Flexibility**

Cognitive flexibility was assessed using the Iowa Gambling Task. The task was run using the software Pebl (Muller, 2011). The IGT is scored by adding up the number of card choices that would result in smaller immediate rewards and larger delayed rewards (C & D) and subtracting the number of card choices that result in large immediate rewards and larger delayed losses (A & B). Only the last 40 card selections out of 100 trials were used to calculate IGT scores as research has shown these trials are the most representative of an individual’s cognitive flexibility (Monterosso, Ehrman, Napier, O’Brien, & Childress, 2001).
In this way, a higher IGT score indicates a greater amount of cognitive flexibility. See Appendix G.

3.4. **Data Analysis**

We used an *intent-to-treat* (ITT) analysis in which all available data, including data from participants who drop out, are included.

To ensure both groups started on equal footing, descriptive statistics for all outcome measures at baseline were calculated. Independent t-tests were run to determine whether differences in outcome measures existed between the two groups at baseline. Descriptive statistics were also calculated for all outcome variables at all subsequent time points.

The four questionnaires measuring fruit-eater identity, vegetable-eater identity, healthy-eater identity and the theory of planned behaviour collected at the screening visit 1 (week -2) were used as baseline measures for visit 2 (week 0).

3.4.1. **Was the Intervention Successful: Outcome Measures of F&V Consumption, Self-identity and Intentions**

The main outcome being investigated was change from baseline in 1) fruits and vegetables. Secondary analyses looked at changes in 2) fruits alone; 3) vegetables; 4) identity and; 5) intentions. We used a repeated-measures analysis of covariance (ANCOVA) with change from baseline as the outcome, and week, treatment, and week by treatment as main effects; and baseline value as a covariate. We assumed a first-order autoregressive correlation structure amongst repeated measures, which accounts for the fact that measures further apart in time will be less similar than those which are closer together in time; and adjusted the degrees of freedom of the F-tests using the Kenward-Rogers approximation. We also included a three-way interaction term of sex by week by treatment to assess whether the difference in the between-treatment change over time depended on sex. Analyses were conducted using SAS 9.3.
3.4.2. Exploring why the Intervention was Successful: Self-Identity and The Theory of Planned Behaviour

From the above analysis it was determined that the main effect the intervention had was on vegetable identity and consumption. Therefore, when exploring why the intervention was successful, the focus was exclusively on whether vegetable eater identity was able to uniquely predict intentions and consumption of vegetables over the course of the study.

To determine whether subjective norms, attitudes, and perceived behavioural control predicted intentions to eat vegetables and whether self-identity as a vegetable eater contributed uniquely to the prediction of intentions, a hierarchical linear regression was run using averaged data across all time points. All analyses were run in SPSS 22. Entered in block 1 were subjective norms, attitudes, and perceived behavioural control, collapsed across groups. In block 2, also collapsed across groups, self-identity.

To test whether the components of the TPB predicted vegetable consumption and whether self-identity as a vegetable eater contributed uniquely to the prediction consumption above and beyond the components of the TPB another hierarchical linear regression was run in SPSS 22 using averaged data across all time points. In block 1 all the components of the TPB, collapsed across groups, were entered. In block 2, also collapsed across groups, self-identity was entered.

3.4.3. Cognitive Flexibility

To determine whether cognitive flexibility moderated the relationship between intentions and behaviour a regression was run using the validated Process function developed by Hayes (2012) in SPSS version 22. Data were averaged across all time points.
Chapter 4- Results

4.1. Participants

A total of 227 participants filled out an online screening questionnaire (46 males, 181 females), out of which 80 eligible participants were randomly selected. Out of the 80 participants, 65 (19 males, 46 females) responded to follow-up emails and completed the first visit of the study. Before being randomized into the study one male and one female participant dropped out due to scheduling conflicts. Seventeen participants were excluded because they did not meet further screening criteria at the first visit. Of the seventeen that were excluded six lived at home and did not have control over their F&V consumption, one had a drastic change in dietary habits unrelated to the study, one was a graduate student that was mistakenly identified on the screening questionnaire and nine had a higher than recommended level of fruit and vegetable consumption. A schematic of the enrolment is given in Figure 5. A total of 47 participants were randomized into the study, 22 to the control and 25 to the intervention. Over the course of the study three participants dropped out. All three participants were male and in the experimental condition. One was lost to follow-up and the other two had appointments that fell within the examination period and conflicted with participation in the study.

In summary, a total of 47 participants (22 control, 25 experimental) were randomized into the study, of which 44 participants (22 control, 22 experimental) completed the study per protocol.
Figure 7. Recruitment Flow Chart
4.1.1. **Outcome Measures between Control and Experimental Group at Baseline**

Using t-tests, it was determined that no significant differences existed between the groups in terms of their demographic information: age, sex, year of study, BMI and nutrition knowledge, or outcome measures: fruit and vegetable consumption, healthy eater identity, vegetable eater identity, fruit eater identity, and intentions (Table 1).

Table 1. Demographic information, nutrition knowledge, F&V consumption, healthy/fruit/vegetable eater identity and intentions at baseline. Data are presented as means and standard deviations for all outcome variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n=22)</th>
<th>Experimental (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M/F)</td>
<td>5/17</td>
<td>8/17</td>
</tr>
<tr>
<td>Age (y)</td>
<td>20.18±1.29</td>
<td>20.26±1.28</td>
</tr>
<tr>
<td>Year of study (y)</td>
<td>2.76±1.04</td>
<td>2.87±0.91</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.47±2.69</td>
<td>22.38±2.96</td>
</tr>
<tr>
<td>Healthy Eater Identity</td>
<td>3.38±0.67</td>
<td>3.52±0.50</td>
</tr>
<tr>
<td>Fruit Eater Identity</td>
<td>3.30±0.62</td>
<td>3.18±0.59</td>
</tr>
<tr>
<td>Vegetable Eater Identity</td>
<td>3.31±0.65</td>
<td>3.16±0.63</td>
</tr>
<tr>
<td>Intentions</td>
<td>6.41±0.56</td>
<td>6.36±0.70</td>
</tr>
<tr>
<td>Fruit and Vegetables (servings)</td>
<td>4.85±1.86</td>
<td>4.51±1.62</td>
</tr>
<tr>
<td>Fruit (Servings)</td>
<td>1.91±1.21</td>
<td>1.99±1.13</td>
</tr>
<tr>
<td>Vegetable (Servings)</td>
<td>2.94±1.28</td>
<td>2.52±1.50</td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>17.64±3.53</td>
<td>16.77±3.42</td>
</tr>
<tr>
<td>Nutrition Knowledge</td>
<td>17.44±1.60</td>
<td>17.28±2.19</td>
</tr>
</tbody>
</table>
4.2. **Main Outcome: F&V Consumption Between Groups and Over Time**

The experimental group reported significantly higher intakes of F&V, consuming a mean average of 1.95±0.6 servings/day more than the control across the entire study (weeks 2, 4 & 6 combined) when compared to baseline values (week 0), *p=0.0008 (Figure 8).

![Change in fruit and vegetable consumption between groups and over time](image)

*Figure 8. Change in fruit and vegetable consumption between groups and over time, in 47 participants (22 Control, 25 Experimental) analysed using a repeated measures ANOVA. Data are presented as Means±SEM. The experimental group consumed significantly 1.95 servings more of fruits and vegetables than the control across all-time points, compared to baseline, ***p=0.0008*

4.2.1. **Fruit and Vegetable Intake Analysed Separately**

To further understand the differences that were seen in the total number of servings of F&V consumed between the control and experimental groups, fruits and vegetables were looked at individually and comparisons were made between the two groups. Over the course of the study the experimental group consumed significantly more of both fruits and vegetables than the control when compared to the baseline, consuming 0.90±0.40 servings/day more of fruit (*p=0.03) and 1.10±0.42 servings/day more of vegetables (*p=0.01).
4.2.2. **Experimental and Control Groups Analysed Separately**

When the overall trends in F&V consumption were examined for each group (intervention and control) individually, the mean increase from baseline for F&V intake for the control group was not significant (0.6±0.4 servings/d, p=0.15), while the experimental group significantly increased their mean F&V consumption from baseline across the entire study (2.52±0.4 servings/d, p<0.0001) (Table 2.).

When fruit and vegetable intake was examined separately for each group, significant increases in fruit, as well as vegetable intake were observed for the experimental group (1.43±0.3 servings/d, p<0.001 of fruit and 1.08±0.3 servings/d, p<0.001 of vegetables) while for those in the control, only the increase in fruit was significant (0.6±0.3 servings/d, p=0.0501) and vegetable intake did not change significantly (-0.02±0.3 servings/d, p=0.95) as shown in Figures 9a & 9b, and Table 2.
Figure 9a & b. Change in Fruit and Vegetable Consumption analysed separately. Change over 6 weeks in 47 participants (22 Control, 25 Intervention), analysed using a repeated measures ANOVA. Data are presented as Means±SEM. A: Fruit Consumption: Both groups significantly increased fruit consumption over the course of the study, * p=0.05 & *, ***, **** p<0.0001. B: Vegetable Consumption: The experimental group significantly increased their vegetable over the course of the study, ***p<0.001, while the control did not, p=0.95
### Table 2. Change in daily servings of fruit and vegetables from baseline a week 2, 4 & 6 during control and treatment periods and the difference between the two interventions. Data for Fruit and vegetable intake corrected for baseline and expressed as Mean±SE

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Week</th>
<th>Control</th>
<th>Treatment</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serv/d</td>
<td>SE</td>
<td>P</td>
<td>Serv/d</td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.95</td>
<td>0.36</td>
<td>0.0091</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.36</td>
<td>0.36</td>
<td>0.3145</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.46</td>
<td>0.36</td>
<td>0.2004</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.59</td>
<td>0.29</td>
<td>0.0500</td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.25</td>
<td>0.40</td>
<td>0.5279</td>
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<tr>
<td></td>
<td>4</td>
<td>0.13</td>
<td>0.40</td>
<td>0.7450</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>-0.44</td>
<td>0.40</td>
<td>0.2670</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>-0.02</td>
<td>0.30</td>
<td>0.9458</td>
</tr>
<tr>
<td>Fruit &amp; Veg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.20</td>
<td>0.49</td>
<td>0.0168</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.49</td>
<td>0.49</td>
<td>0.3239</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.02</td>
<td>0.49</td>
<td>0.9692</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.57</td>
<td>0.39</td>
<td>0.1532</td>
</tr>
<tr>
<td>Corrected for Baseline</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.24</td>
<td>0.47</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.53</td>
<td>0.47</td>
<td>0.2644</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.06</td>
<td>0.47</td>
<td>0.9013</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.61</td>
<td>0.37</td>
<td>0.1029</td>
</tr>
</tbody>
</table>

Abbreviations: SE = standard error; p = probability; WK = week; Serv/d = serving per day.
4.2.3. **F&V consumption at Individual Time Points analysed separately for experimental and control groups**

The overall picture was reflected in the outcome measures collected at week 2, 4 & 6, with significant increases in F&V consumption from baseline over weeks 2-6 for the experimental group ($p<0.0001$). Numerically the greatest increase in reported intake was seen at week 2 with slight reductions seen thereafter. This pattern was also observed for the control where the increase in F&V intake was greatest at week 2 (1.2±0.5 servings/d, $p=0.02$). However unlike the experimental group, F&V consumption declined dramatically for the control group at weeks 4 and 6. By week 6 the control group was no longer consuming an amount of F&V that was significantly different from baseline consumption levels, 0.6±0.4 servings/d, $p=0.15$.

The overall result being that the relative increase in F&V intake for the experimental group compared to control was greatest and most significant at week 6, (2.48±0.7 servings/d, $p=0.0006$) and therefore showed no signs of being reduced over time (Table 2).

4.2.4. **Sex Differences in Consumption**

Overall there was no significant interaction between F&V consumption and sex. As there were so few men ($n=15$) who took part in this study, this may be attributed to a lack of power. However, in general, men showed major increases in F&V intake at 2 weeks (4.0±0.8servings/d, $p<0.001$) which then fell to 2.48±1.02 servings/d, $p=0.023$ at 6 weeks. Women, on the other hand, were more consistent with consumption of 2.3±1.0 servings/d, $p<0.0001$) at 2 weeks and 2.5±0.6 servings/d ($p<0.0001$) at 6 weeks (Table 3).
Table 3. Change in daily servings of fruits and vegetables for males and females at week 2, 4 and 6 of males and females during control and treatment periods and the difference between the two interventions. Data are expressed as Mean±SE

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Control</th>
<th>Treatment</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sex</td>
<td>WK</td>
<td>Serv/d</td>
</tr>
<tr>
<td>Fruit &amp; Veg</td>
<td>Male</td>
<td>2</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>-0.74</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2</td>
<td>1.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Abbreviations: SE = standard error; p = probability; WK = week; Serv/d = serving per day.
4.2.5. **Self-Identity: Healthy Eater Identity, Vegetable Eater Identity and Fruit Eater Identity**

A separate repeated measures ANCOVA was run for each of the 3 measures of self-identity: Healthy-Eater identity as measured by the Healthy-Eater Identity questionnaire, Fruit Eater identity as measured by the Fruit-Eater Identity questionnaire and the Vegetable Eater identity as measured by the Vegetable Eater Identity questionnaire (Table 4).
Table 4. Change in Identity and Intentions at 2, 4 and 6 weeks and overall during control and treatment periods and the difference between the two interventions. Data are expressed as Mean±SE

<table>
<thead>
<tr>
<th>Identity</th>
<th>Control</th>
<th>Treatment</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week</td>
<td>Score</td>
<td>SE</td>
</tr>
<tr>
<td>Healthy Eater</td>
<td>2</td>
<td>0.38</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.54</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.70</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.54</td>
<td>0.09</td>
</tr>
<tr>
<td>Vegetable Eater</td>
<td>2</td>
<td>0.24</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.23</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.57</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.34</td>
<td>0.08</td>
</tr>
<tr>
<td>Fruit Eater</td>
<td>2</td>
<td>0.39</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.55</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.66</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.53</td>
<td>0.08</td>
</tr>
<tr>
<td>Intentions</td>
<td>2</td>
<td>0.18</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.02</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.17</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.12</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Abbreviations: SE = standard error; p = probability.
4.2.6. **Healthy Eater Identity**

No significant difference in healthy eater identity was found between the experimental and control groups across each week of the study ($p = 0.81$). However, both the experimental and the control group significantly increased their healthy eater identity over the course of the study by $0.51\pm0.09$ points, ($p<0.0001$), and $0.51\pm0.09$ points, ($p<0.0001$), respectively (Figure 10a).

4.2.7. **Fruit Eater Identity**

No significant difference in fruit eater identity was found between the experimental and control groups across each week of the study ($p = 0.67$). However, both the experimental and the control group significantly increased their fruit eater identity over the course of the study by $0.60\pm0.08$ points ($p<0.0001$), and $0.53\pm0.08$ points ($p<0.0001$), respectively (Figure 10b).

4.2.8. **Vegetable Eater Identity**

A significant difference in vegetable eater identity was found between the experimental and control groups across each week of the study ($p = 0.0014$). The experimental group identified to a significantly greater extent with vegetable eater identity than the control, scoring a mean average of $0.36\pm0.11$ points more than the control across the entire study compared to baseline ($p=0.0014$) (Figure 10c).
Figure 10. Self-identity: change over 2, 4 and 6 weeks in 47 participants (22 Control, 25 Experimental) assessed using mixed repeated measures ANOVA. Data are presented as Means±SEM. 

A: Healthy-Eater Identity: Both groups significantly increased their healthy eater identity at all time points compared to baseline, p< 0.0001. The difference between groups was not significant.

B: Fruit-Eater Identity: Both groups significantly increased their fruit eater identity at all time points compared to baseline, p< 0.0001. The difference between groups was not significant.

C: Vegetable-Eater Identity: Both groups significantly increased their vegetable eater identity at all time points compared to baseline, p< 0.0001. However, the difference between groups was also significant (**p<0.01), with the experimental group identifying more strongly as vegetable eaters than the control over the course of the study.
4.2.9. **Sex Differences in Identity Adoption**

Overall there was no significant interaction between identity and sex. There was no difference between the sexes in the adoption of healthy eater identity \((p = .67)\), fruit eater identity, \((p = .67)\) or vegetable eater identity \((p = .86)\) over the course of the study.

### 4.3. Intentions

For the final outcome measure of intentions, no significant interaction between group and time was found \((p = 0.11)\). However, after correcting for baseline by its inclusion in the model as a covariate, the interaction became significant \((p = 0.011)\). When correcting for baseline the experimental group scored a mean average of 0.23±0.09 points more than the control and baseline over the course of the study \((p = 0.011)\) (*Figure 11*).

*Figure 11*. Change in intentions over 6 weeks in 47 participants (22 Control, 25 Experimental) assessed using a mixed repeated measures ANOVA: Both groups significantly increased their intentions to eat a healthy diet over the course of the study. Data are presented as Means±SEM.
4.4. **Why was the intervention successful: Does self-identity predict the change in intentions and behaviour**

As the main driver of the differences seen in F&V consumption between the intervention and control groups was for vegetable consumption and vegetable eater identity it was concluded that the main effect of the self-as-doer task had was concerning the consumption of vegetables. Therefore, when determining why the intervention was effective only vegetable eater identity in relation to vegetable consumption was investigated and the hierarchical regression focused only on vegetable identity and vegetable consumption over the course of the study.

4.4.1. **Vegetable Eater Identity and the Theory of Planned Behaviour predicting Intentions**

When the components of the Theory of Planned Behaviour were analyzed on their own (Block 1), the model predicted over 70% of the variance in intentions to eat vegetables \( F(3, 40) = 31.46, p < 0.001 \). Although subjective norms were not found to significantly contribute to the prediction of intentions to eat F&V. A supplementary table describing the correlation coefficients can be found in Appendix H.

When vegetable eater identity was added to the model (Block 2) it predicted an additional 6% of the variance in intentions \( R^2 = 0.06, F(1,39) = 9.15, p = 0.004 \). The results of this analysis can be found in Table 5. Semi-partial correlations revealed that both attitudes and vegetable eater identity predicted the greatest unique variance in intentions.
### Table 5. Hierarchical regression of the Theory Planned Behaviour and vegetable eater identity predicting intentions

<table>
<thead>
<tr>
<th></th>
<th>Intentions</th>
<th></th>
<th></th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>b</td>
<td>SE b</td>
<td>β</td>
<td>p</td>
<td>sp²</td>
</tr>
<tr>
<td><strong>Block 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.91</td>
<td>0.63</td>
<td>0.63</td>
<td>p = .000</td>
<td>.01</td>
</tr>
<tr>
<td>(1.63, 4.18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>0.11</td>
<td>0.70</td>
<td>0.01</td>
<td>p = .88</td>
<td>.01</td>
</tr>
<tr>
<td>(-0.13, 0.15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>0.68</td>
<td>0.11</td>
<td>0.62</td>
<td>p = .000</td>
<td>.52</td>
</tr>
<tr>
<td>(0.45, 0.90)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioural Control</td>
<td>0.30</td>
<td>0.09</td>
<td>0.33</td>
<td>p = .003</td>
<td>.27</td>
</tr>
<tr>
<td>(0.11, 0.49)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.34</td>
<td>0.59</td>
<td>p = .000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.14, 4.54)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-0.51</td>
<td>0.07</td>
<td>-0.06</td>
<td>p = .45</td>
<td>-.06</td>
</tr>
<tr>
<td>(-0.19, 0.84)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>0.41</td>
<td>0.13</td>
<td>0.38</td>
<td>p = .004</td>
<td>.24</td>
</tr>
<tr>
<td>(-0.14, 0.68)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioural Control</td>
<td>0.25</td>
<td>0.09</td>
<td>0.27</td>
<td>p = .008</td>
<td>.22</td>
</tr>
<tr>
<td>(0.07, 0.42)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable Eater Identity</td>
<td>0.26</td>
<td>0.09</td>
<td>0.38</td>
<td>p = .004</td>
<td>.24</td>
</tr>
<tr>
<td>(0.09, 0.44)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: R² = .70 for block 1; Change in R² = .05, for block 2 (p < .01); R² = .75 for block 2. Abbreviations: b = unstandardized coefficient; SE b = standard error of b; β = beta, standardized coefficient, p = probability, sp² = semi-partial correlation coefficient
4.5. Vegetable Eater Identity and the Theory of Planned behaviour predicting Vegetable Consumption

Neither vegetable eater identity, nor the TPB significantly predicted vegetable consumption ($F(1,38) = 0.63, p = 0.43 \& F(4,39) = 2.07, p = 0.10$, respectively). The results of the analysis are summarized in Table 6 and correlation coefficients can be found Appendix J.
Table 6. Hierarchical linear regression for vegetable eater identity and the TPB predicting vegetable consumption

<table>
<thead>
<tr>
<th></th>
<th>Vegetable Consumption</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>SE b</td>
<td>β</td>
<td>p</td>
<td>sp²</td>
</tr>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.37</td>
<td>4.16</td>
<td>-1.17</td>
<td>.28</td>
<td></td>
</tr>
<tr>
<td>( -8.78, 8.04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-0.44</td>
<td>0.37</td>
<td>-1.17</td>
<td>.28</td>
<td>-0.17</td>
</tr>
<tr>
<td>( -1.19, 0.32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>0.22</td>
<td>0.82</td>
<td>0.06</td>
<td>.796</td>
<td>0.04</td>
</tr>
<tr>
<td>( -1.44, 1.88)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioural</td>
<td>1.25</td>
<td>0.56</td>
<td>0.43</td>
<td>.03</td>
<td>0.32</td>
</tr>
<tr>
<td>Control</td>
<td>( 0.11, 2.39)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentions</td>
<td>-0.35</td>
<td>.84</td>
<td>-0.11</td>
<td>.68</td>
<td>-0.06</td>
</tr>
<tr>
<td>( -2.05, 1.36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Block 2</td>
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<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.31</td>
<td>4.69</td>
<td>0.40</td>
<td>.18</td>
<td>-0.20</td>
</tr>
<tr>
<td>( -8.17, 10.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-0.54</td>
<td>0.40</td>
<td>-0.21</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>( -0.134, 0.26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>-0.01</td>
<td>0.88</td>
<td>-0.003</td>
<td>.99</td>
<td>-0.00</td>
</tr>
<tr>
<td>( -1.78, 1.76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioural</td>
<td>1.25</td>
<td>0.60</td>
<td>0.43</td>
<td>.03</td>
<td>0.32</td>
</tr>
<tr>
<td>Control</td>
<td>( 0.11, 2.40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentions</td>
<td>-0.67</td>
<td>0.94</td>
<td>-0.21</td>
<td>.48</td>
<td>-0.10</td>
</tr>
<tr>
<td>( -2.57, 1.23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable Eater Identity</td>
<td>0.45</td>
<td>0.57</td>
<td>0.21</td>
<td>.43</td>
<td>0.12</td>
</tr>
<tr>
<td>( -0.70, 1.60)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note R²=.18 for block 1 (p>.05); Change in R²=.01, for block 2 (p>.05) Abbreviations: TPB=Theory of Planned Behaviour b = unstandardized coefficient; SE b = standard error of b; β = beta, standardized coefficient, p = probability, sp² = semi-partial correlation coefficient
4.6. **Cognitive Flexibility moderating the Intention-Behaviour Gap**

To examine whether cognitive flexibility would act as a moderator between intention and behaviour, such that when cognitive flexibility is high a strong positive relationship between intention and behaviour would exist, and when cognitive flexibility is low a non-significant relationship would exist, a regression was run using the PROCESS function (Hayes, 2012). Data from time 0, 2, 4, and 6 were averaged to examine the moderating effects of cognitive flexibility on intentions and behaviour. No significant effect was found ($b = 0.01$, 95% CI [-0.30, 0.05], $t = 0.55$, $p > .05$).
Table 16. *Linear Model of Intentions Predicting Vegetable Consumption Moderated by Cognitive Flexibility*

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Average Vegetable Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.72</td>
</tr>
<tr>
<td>(Centred)</td>
<td>(-8.16, 6.73)</td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>-0.07</td>
</tr>
<tr>
<td>(Centred)</td>
<td>(-0.35, 0.20)</td>
</tr>
<tr>
<td>Average Intent (Centred)</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>(-0.58, 1.68)</td>
</tr>
<tr>
<td>Cognitive Flexibility x</td>
<td>0.01</td>
</tr>
<tr>
<td>Intent</td>
<td>(-0.03, 0.05)</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.13, p = 0.14 \]

...
Chapter 5- Discussion

The current study hypothesized that having a self-as-doer identity would result in the increased consumption of fruits and vegetables when the “doer” identity was specific to fruits and vegetables (i.e. fruit eater, vegetable eater). Furthermore, whether a self-as-doer identity could be created through identity building exercises was examined, as well as whether having a self-identity as a vegetable eater could predict intention and consumption of vegetables above and beyond the components of the Theory of Planned Behaviour. Finally, cognitive flexibility was examined for its role in moderating the intention-behaviour gap for vegetable consumption was examined.

The results of the present study support the main hypothesis that self-as-doer exercises will increase fruit and vegetable consumption, as individuals in the experimental group, who created specific F&V self-as-doer identities, reported consuming more F&V than the control group. However, the role of self-identity as the mechanism by which intentions and consumption were influenced was only partially supported. Vegetable eater identity was found to contribute uniquely to the prediction of intentions, but not vegetable consumption. Furthermore, cognitive flexibility was not found to moderate the intention behaviour gap, i.e., the intention to eat vegetables vs. their actual consumption. Although these results provide mixed evidence for the causal implications of the self-as-doer, the increased consumption of F&V, seen only in the self-as-doer group, offers initial evidence that having a self-as-doer identity can create behavioural change in terms of F&V consumption. A more detailed discussion of each of the key outcome variables follows below.

5.1. Fruit and Vegetable Consumption

Those who created self-as-doer identities were found to consume significantly more servings of F&V over the course of the study, when compared to the control.

When the number of servings of fruits and vegetables consumption were examined separately, it was found that while both groups significantly increased their overall fruit consumption, the change in vegetable consumption differed significantly between groups,
with the self-as-doer group consuming more vegetables over the course of the study and the control consuming less. Therefore, it can be speculated that vegetable consumption was responsible for the differences seen in total F&V consumption. The difference in vegetable consumption between the two groups supports previous research, which argues that F&V should be studied separately, as different factors may contribute to their consumption (Glasson, Chapman, & James, 2011). F&V require very different methods of culinary preparation, and have markedly different taste profiles (Trudeau et al., 1998). While fruits are typically sweet and can be eaten raw, vegetables are seldom sweet, frequently bitter and although they can be eaten raw in salads, usually require cooking. These challenges suggest that that vegetables may be harder to add into the diet than fruit. The discrepancy between F&V consumption goals and actual F&V consumption seen for the control group suggests that when individuals are motivated to increase their F&V consumption on their own, as was the case for all participants recruited for this study, they do what is easiest, i.e. increase their fruit consumption. In the current study having the explicit goal of being a “vegetable eater” may have added the extra motivation needed to tackle the challenges that come along with eating vegetables, resulting in the increase in consumption seen only for the self-as-doer group.

5.2. Self-identity

It was hypothesized that all three forms of identity (healthy eater, fruit eater, & vegetable eater) would increase only for the experimental group over the course of the study. However, self-identity as a healthy eater and fruit eater were found to increase for both groups over the course of the study. Only the change in vegetable eater identity was significantly different between the control and experimental groups, with the experimental group identifying more strongly as vegetable eaters. These results correspond with the consumption data in which vegetable consumption only increased for the experimental group, and fruit consumption increased for both groups, although to a greater extent for the experimental group.

Although the control group did not create self-as-doer identities, it is not surprising that they came to see themselves more strongly as healthy eaters, fruit eaters and vegetable eaters.
By participating in the study, individuals were made more aware of their eating habits and views surrounding consumption. It may be the case that the increases in self-identity seen for the control group were the result of a placebo effect, and that by simply participating in the study they felt they were making progress. Answering the self-as-doer identity questionnaires at visits may have served to reinforce this belief. It has also been argued that identity is shaped by the examples we have of our own behaviour (Bem, 1972; Fekadu & Kraft, 2001). Therefore, as the control group did in fact increase their fruit consumption, they may have become more inclined to see themselves as fruit eaters.

In terms of healthy eater identity, the increase in fruit consumption coupled with the general nature of healthy eater identity may have resulted in participants rating healthy eater identity as a reflection of their fruit consumption. Additionally, the human tendency to view ourselves in a positive light, known as self-enhancement bias (Brown, 1986), could have inflated scores for healthy eater identity. Still, one would expect that this tendency would affect both groups equally. However, it is possible that the creation of more concrete goals (i.e. the self-as-doer) resulted in the experimental group rating themselves more realistically than the control group, thus accounting for the lack of difference in healthy eater identity between the two groups. In studies investigating the efficacy of goal setting in goal achievement, those who set specific concrete goals are better able to accurately evaluate their progress towards those goals than those who do not (Guinote, 2007; Schunk, 2001; Schunk, 1990). These findings underscore the importance of using specific measures of identity (i.e. fruit eater, vegetable eater) rather than general measures (healthy-eater identity) when investigating their effects on dietary change.

5.3. Intentions

Although it was proposed that those who created self-as-doer self-identities would have greater intentions to eat F&V, the change in intentions compared to baseline was no different for the two groups. Therefore, despite the fact that individuals in the self-as-doer group did significantly increase their intentions to eat F&V, the change was not significantly different from that of the control. These findings contradict previous research investigating the
relationship between self-identity and intentions, which has demonstrated that when self-identity is high, intentions are also high (Åstrom & Rise, 2001; Rise et al., 2010).

A possible explanation as to why differences were not observed between the two groups is that participants from both groups identified with at least two of the three self-identities measured by the study. According to the Theory of Planned behaviour self-identity contributes to the formation of intentions, therefore it is not surprising intentions were high for both groups.

The second reason may be that participants hit a “ceiling” in their rating of intentions. Participants were recruited in part because they were interested in increasing their F&V intake, the result being that both groups reported strong intentions to eat F&V at baseline. However this high degree of original intent left little room for a further change in intentions to be significant, since this increase would likely be very small. Furthermore, the range for intentions for all groups across all time points was very narrow, only 6.36 to 6.83 out of a total score of 7 and the standard deviations were small, ranging from 0.36 to 0.7. This lack of variability may account for why differences were not seen between groups, and across time points.

When the analysis examining change in intentions was run again, correcting for baseline by its use as a covariate, the experimental group was found to have increased their intentions to eat F&V over the course of the study compared to the control. The lower level of intentions at the start of the study and allowed for larger differences to be observed over the course of the study, which resulted in more significance. These results show the importance of having a range of intentions for the influence of self-identity to be expressed. Future studies investigating the self-as-doer’s impact on intentions should recruit participants with varying levels of motivation and intentions to eat F&V.
5.4. Sex Differences in the Major Outcomes of Consumption, Identity and Intentions

No major differences were seen for male and female participants in terms of the consumption of F&V, adoption of a self-as-doer identity or intentions to eat F&V. However, male participants had the greatest increase in F&V consumption at week 2, whereas women consistently maintained their higher level of consumption throughout the study. The spike in F&V consumption at week 2 may be the result of men being more willing to add calories to their diets than women. In order for men to maintain this high level of consumption throughout the study it may be necessary to modify the intervention according to sex. As men responded most strongly to the first exercise, creating self-as-doer identities, perhaps they would benefit most from an intervention that involved continuously creating new identities. This spike of enthusiasm in men was also reflected in the drop out rate. Only men dropped out of the study, and only after Visit 3/Week 2.

5.5. Theory of Planned Behaviour

In order to explore why those in the experimental group increased their vegetable consumption while those in the control did not, the ability of the self-as-doer self-identity to predict intentions and behaviour was examined in the context of the Theory of Planned Behaviour. Previous research investigating self-identity’s role in the TPB has found that it is able to predict intentions and behaviour (Åstrosm & Rise, 2001; Rise, Sheeran, & Hukkelberg, 2010).

5.5.1. The Theory of Planned Behaviour predicting Intentions

The TPB, without the addition of self-as-doer self-identity, was able to predict intentions to eat F&V. However only two of the three components (attitudes and perceived behavioural control) were significant predictors of intent, while subjective norms were not. These results are expected to the extent that subjective norms have often been found to be a weak predictor of intentions (Godin & Kok, 1996; Sheppard et al., 1988). However why they did not predict intentions at all may be understood by looking at subjective norms’ relationship with the current study’s population. Subjective norms depend on the perceived attitudes of important/relevant friends/family/acquaintances toward behaviour. If they are favourable,
individuals are more likely to carry out that behaviour. Research has shown that for
individuals in university, important influencers consist of friend groups (Astin, 1992). As the
consumption of F&V is notoriously low for university students (Nelson & Story, 2009), it can
be assumed F&V consumption is not a priority for this group. Therefore, the opinions of our
participants’ peer group would not likely reflect the attitudes of this highly motivated group
and would result in subjective norms inability to predict intentions to eat F&V.

5.5.2. Vegetable Eater Identity and The Theory of Planned Behaviour
predicting Intentions

When vegetable eater identity was added to the model, it significantly contributed to the
prediction of intentions. Vegetable eater identity may have emerged as a unique predictor of
intentions due to the complex nature of vegetable consumption, in terms of planning and
preparation, which would require strong intentions. These results support the theory that self-
identity contributes to the formation of intentions.

5.5.3. Vegetable Eater Identity and The Theory of Planned Behaviour
predicting Behaviour

Neither the TPB nor the addition of vegetable eater identity was able to account for
vegetable consumption over the course of the study. As mentioned above, vegetable
consumption may involve factors like self-regulatory processes or self-control, and food
preparation skills, which are not accounted for by the TPB (Glasson et al., 2011). This
difference may in part explain why the TPB was not able to predict vegetable consumption.

These results contrast with previous studies, which have shown the ability of self-identity
to predict behaviour above and beyond the components of the TPB (Rise et al., 2010). Even
though self-identity as a vegetable eater identity was found to significantly contribute to the
prediction of intentions to eat vegetables, it was not found to contribute to the prediction of
their consumption. This disconnect may be attributed to the intention-behaviour gap. As
mentioned in the literature review, intentions do not always translate into behaviour, and self-
regulatory processes have been proposed to mediate this relationship (Sniehotta et al., 2005).
For vegetable consumption, self-regulatory processes would be important, as the preparation of vegetables can be complex. As mentioned above, unlike fruit, vegetables generally require planning and preparation before they can be consumed. This preparation involves self-regulatory processes to the extent that time must be set aside for their preparation, other easier and perhaps more appealing foods must be by-passed in favour of vegetables and finally the preparation of the vegetables themselves (e.g. chopping, peeling, soaking) must be carried out. As an increase in vegetable consumption was seen, it may be that self-identity as a vegetable eater provided the extra motivation needed to carry out the above behaviours. Future studies could investigate the influence of self-identity as a self as doer on these factors.

5.5.4. **Cognitive Flexibility**

One such self-regulatory process that was examined was cognitive flexibility. Previous research has found cognitive flexibility to moderate the intention behaviour gap for F&V consumption (Allom & Mullan, 2012). Therefore cognitive flexibility was measured to determine whether it could explain any observed differences between intention and behaviour. However, in the present study it was not found to moderate the intention-behaviour gap. These results are not uncommon in studies with high levels of behavioural intentions and little variance, as this combination can make moderator effects hard to detect (McClelland & Judd, 1993). Future studies with greater variability in intentions should investigate whether having cognitive flexibility moderates the relationship between intentions and behaviour for F&V consumption.

5.6. **Strengths**

The design of the self-as-doer intervention has many benefits. From an administrative perspective the materials, time and training needed to conduct the intervention are minimal. From a participant perspective, the self-as-doer task was found to be relatively easy. Given time, most participants did not have trouble generating six goals related to F&V consumption. Furthermore, most participants enjoyed completing the self-as-doer task, to the extent that some participants even spontaneously generated new F&V phrases as the study continued to address their evolving goals for F&V consumption. Only three participants
withdrawing from the study, and that none did so after the fourth week was evidence of participants’ engagement in the study. Furthermore, the current study demonstrated an increase in almost two servings of F&V where many studies, using similar assessment tools, have only seen an increase of half a serving (Kaiser et al., 2014).

Therefore, this kind of intervention, which requires minimal training, could easily be incorporated into clinical dietary interventions. Specifically, research that requires adherence to certain types of diets may benefit from the incorporation of the self-as-doer task to motivate dietary adherence.

5.7. Limits

The current study had limitations. Foremost was the self-report nature of the outcome measures (food diaries and cognitive measures), the results of which may be biased and limit generalizability of findings. As the explicit purpose of the study was to increase the consumption of F&V, this may have resulted in the over-reporting of F&V consumption (Buzzard, 1998). Additionally, participants may have omitted food items due to forgetfulness, or measured items incorrectly. Therefore the accuracy of the number of servings of F&V may be reduced. However, participants underwent intensive training in the use of food diaries at the start of the study with continued feedback and clarification was maintained throughout. These steps have been found to successfully minimize the degree of inaccuracy in food diaries and have been a limitation of past studies (Buzzard, 1998). However, it is still possible that those who are more strongly encouraged to consume more fruits and vegetables will oblige the investigators by reporting that they have in fact consumed more fruit and vegetables. It may even be their honest perception that they have indeed eaten more. A weighed food intake by the participants could have been used to confirm their perceptions. However, the method would be impossible for individuals living in residence because they eat most of their meals in the cafeteria, eliminating the majority of participants.

Alternately, the measurement of biochemical markers of F&V consumption could be used to compare and confirm the information provided by the food diaries. Blood levels of vitamin C have been used (Djuric et al., 2002), and measuring the increase in serum flavonoid
concentrations has also been proposed (Kaiser et al., 2014). However, there are no data providing a direct dose response relationship with fruit intake with sufficient resolution to pick up the changes reported here. Antioxidant activity of blood has also been used, but again may not be sufficiently sensitive (John et al., 2002). In the absence of good biomarkers, the diet history, as used here, though flawed, is universally the most generally used tool. A seven day record may have been better than a three day record (Tarasuk & Beaton, 1992) but the 3 day is used to avoid subject fatigue. Despite the failings of current biomarkers it would still have been useful to obtain anthropometric measurements and see if there were changes in body weight and BMI. However, the majority of the studies so far have not seen changes in body weight (Kaiser et al., 2014). Changes have been reported in blood pressure and vascular reactivity (John et al., 2002), but these measures would have added another layer of complexity to this pilot study where the aim was to test whether self-identity could be manipulated to increase F&V consumption.

The generalizability of the current study may also be limited by its selection of motivated university students. However, if relatively healthy motivated individuals can benefit from the self-as-doer intervention and increase their F&V consumption, then perhaps populations with added motivation, for instance those with chronic health concerns like diabetes or hypertension, would benefit just as much, if not more, from the self-as-doer intervention.
Chapter 6- Conclusions

6.1. General

The findings of the current study are largely in agreement with previous research demonstrating the role of self-identity and the self-as-doer in promoting health behaviour (Brouwer & Mosack, 2012, 2015; Houser-Marko & Sheldon, 2006). Although previous research has demonstrated the ability of a general self-as-doer identity to create general changes in health behaviour (Brouwer & Mosack, 2015), this is the first study to demonstrate the efficacy of a specific self-as-doer identity exercises to promote specific behaviour.

Prior to the study done by Brouwer & Mosack, (2015) research investigating whether self-identity could be manipulated to create lasting behavioural change was non-existent. The findings of the current study support past research and demonstrate a link between self-identity, specifically where one is the “doer” of behavioural goals, and behavioural change. These findings are also consistent with the identity theorist view that self-identity motivates behaviour that is consistent with identity (Biddle et al., 1985; Stryker & Burke, 2000). However, self-identity as a self-as-doer did not uniquely predict vegetable consumption above and beyond the components of the TPB. Despite the inability of self-identity to predict behaviour in this instance, evidence from the current study is promising, in that self-identity as a self-as-doer was found to predict some change in intentions, and the self-as-doer exercises caused significant changes in behaviour. However, at this point in time, the mechanism behind the change in behaviour is unclear and evidence from this study is too weak to recommend the inclusion of the self-as-doer self-identity in the TPB. It is possible that the self-as-doer task created a change in F&V intake by influencing some other factor involved in consumption that the current study was not been able to capture. What is clear is the need for further research into the mechanism by which the self-as-doer identity exercise creates behavioural change.

6.2. Future Research

The application of the self-as-doer and identity theory in larger intervention trials to promote the use of F&V is now justified. This approach may be particularly rewarding in
studies with risk factor outcomes such as body weight, blood pressure or blood lipids are the primary outcomes. Furthermore it would be of particular interest to test this approach in higher risk groups as the current study used only healthy volunteers and changes are often seen in risk factors only in those with elevated levels of cholesterol and blood pressure (Jenkins et al., 2003; Sacks et al., 2001).

Studies may have shown beneficial effects of fruits and vegetables when all food is provided, but have failed in the longer term when consumer choice has been the determinant of consumption (Kaiser et al., 2014). Our approach may therefore be relevant to all studies trying to effect change in people’s everyday lives.

Future research may also investigate ways to strengthen the self-as-doer beyond the initial intervention. For men, the high level of F&V consumption observed after the main self-as-doer intervention was not maintained throughout the study; therefore it may be necessary to develop follow-up interventions specifically for men that have greater impact. One way to strengthen the self-as-doer intervention may be the inclusion of additional established intervention techniques based in self-regulation and goal-orientation, such as motivational interviewing (Miller & Rollnick, 2012). Furthermore, studying the self-as-doer self-identity in relation to the above-mentioned concepts could help to elucidate the mechanism by which the self-as-doer creates behavioural change by determining whether they are similar.

Data on the women did not indicate any diminishment of the effect over 6 weeks of the intervention. However we have no data on durability of the effect once the intervention has ceased. Future research should investigate whether the effect last weeks, months, or even years after the initial peak of the intervention. Additionally, the necessary length of the initial period of instruction could be examined. The current study used four weeks of advice, whether more or less is needed is of interest.

As distinct trends emerged when total fruit and vegetable consumption was broken down into fruit consumption and vegetable consumption, future research could explore whether
breaking down the categories of “fruit” and “vegetables” to create even more specific self-as-doer identities, like “Kale Eater” could improve the predictive power of the model.

The ability of the self-as doer to cause changes in behaviour has important implications in relation to the mounting support for research and interventions that focus on self-identity. Up until this point many researchers have investigated the relationship between self-identity and various health behaviours (DeWall & Pond, 2011; Friese, Hofmann, & Wiers, 2011; Kwan, Hooper, Magnan, & Bryan, 2011), however very few have tried to manipulate this relationship. In this way, the present study contributes to an important and growing body of knowledge investigating the ways in which self-identity can be used in interventions to create specific health behaviour change.

6.3. Summary

6.3.1. Was the intervention successful

1. Those in the self-as-doer group increased their F&V consumption over the course of the study and in relation to the control, with the greatest difference being found in vegetable consumption.

2. Those in the self-as-doer group & control increased their healthy and fruit eater identities to the same extent over the course of the study. Differences were only found in vegetable eater identity where those in the self-as doer group increased their vegetable eater identity to a greater extent than those in the control.

3. Those in the self-as-doer group and experimental group increased their intentions to consume F&V to the same extent over the course of the study.

6.3.2. Why was the Intervention successful?

4. Vegetable eater identity significantly predicted intentions to eat vegetables above and beyond the components of the TPB

5. Vegetable eater identity did not contribute to the prediction of vegetable consumption, nor did the TPB.

6. Cognitive flexibility did not moderate the intention-behaviour gap.
Chapter 7 - References


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Povey, R., Conner, M., Sparks, P., James, R., & Shepherd, R. (2000). Application of the Theory of Planned Behaviour to two dietary behaviours: Roles of perceived control and self-


Appendix A- Screening & Restricted Eating Habits Questionnaire

Demographic Information
Age______

Gender______________
If not between the ages of 18-25 DNQ

Are currently an undergraduate student at the University of Guelph?
Yes______
No______
If “no” DNQ

Are you interested in improving your diet?
Yes______
No______
If “no” DNQ

Do you have a cellphone on which you can receive texts?
Yes______
No______

Would you be willing to receive a text from the research team during the study? No reply to the text is necessary.
Yes______
No______
If “no” to either question DNQ

Restricted Eating Questionnaire
By Perry et al., (2002)
Are you currently on a diet?
Yes______
No______

Do you worry you have lost control over how much you eat?
Yes______
No______

Have you recently lost more than 15 pounds in a three-month period?
Yes______
No______

Do you believe yourself to be fat when others say you are too thin?
Yes______
No______

Would you say food dominates your life?
Yes______
No______

Do you make yourself sick because you feel uncomfortably full?
Yes______
No______

If participant indicates they are on a diet and/or answers yes to more than two other questions they DNQ.
Appendix B- Self-as-Doer Task
by Brouwer (2012)

Now that you have read about healthy eating, we would like you to complete this task. For the survey below I would like you to think about 6 goals related to healthy eating. Please write them on the first line/or in the space after each number (1, 2, 3, 4). Leave the second line/space (1b, 2b, etc.) blank until further instructions.

1. _____________________ 1b. ______________
2. _____________________ 2b. ______________
3. _____________________ 3b. ______________
4. _____________________ 4b. ______________
5. _____________________ 5b. ______________
6. _____________________ 6b. ______________

Further Instructions:

Every personal goal contains both a verb and an object. For example, for the goal "to eat more fruits" the verb is eat and the object is fruits. For the goal "to consume less salt" the verb is consume less and the object is salt.

I would like you to think about the verb and object in each of the healthy eating goals you have and create a special phrase using the "er" suffix. Place this in the second blank above (1b, 2b, 3b, etc.). This phrase will refer to a person who does the goal.

For example, the goal "to eat more fruits" might be rephrased "fruit eater". The goal "to consume less salt" might be rephrased "less salt consumer".

Complete this task and then read the rest of these directions (example statements can be used).
Now that you have written down your goals and the special phrase please indicate how well the special phrase describes or fits you using the scale given below. Please put the number on the line/space in front of each number below corresponding to the above numbers.

*How well does the 'er' phrase describe you?*

<table>
<thead>
<tr>
<th>Does Not Describe Me Well At All</th>
<th>Does Not Describe Me Well</th>
<th>Neutral</th>
<th>Describes me Well</th>
<th>Describes Me Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1.__________

2.__________

3.__________

4.__________

5.__________

6.__________
## My Food Guide Servings Tracker

### FOOD INTAKE RECORD

<table>
<thead>
<tr>
<th>MEAL</th>
<th>VEGETABLES AND FRUIT</th>
<th>GRAIN PRODUCTS</th>
<th>MILK AND ALTERNATIVES</th>
<th>MEAT AND ALTERNATIVES</th>
<th>OILS AND FATS</th>
</tr>
</thead>
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<td>Dinner</td>
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<tr>
<td>Snacks</td>
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<tr>
<td>Total Number of Food</td>
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<tr>
<td>Guide Servings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NAME: ___________________________  DATE: ___________________________
Tip Sheet

Each day begins at 12:01am and ends at 11:59pm. Try and be as accurate and detailed as possible in terms of brands, preparation methods and amounts.

REMEMBER:

The top of your fist = 3oz of Meat

Your palm = ½ cup Veggies of Fruit

The volume of your thumb = 1 oz of Cheese or Spreads
Appendix D- The Nutrition Knowledge Questionnaire
by Dickson-Spillmann, (2011)

Please answer whether you think the following statements are true or false

1. Lentils contain only few useful nutrients; therefore their health benefit is not great. T/F
2. If you have eaten high-fat foods, you can reverse the effects by eating apples. T/F
3. If cream is whipped it contains less calories than in its liquid form. T/F
4. A healthy meal should consist of half meat, a quarter vegetables and a quarter side dishes. T/F
5. Fat contains fewer calories than the same amount of fiber. T/F
6. A salad dressing made with mayonnaise is as healthy as the same dressing made with mustard. T/F
7. Fat is always bad for your health; you should therefore avoid it as much as possible. T/F
8. Pasta with tomato sauce is healthier than pasta with mushroom and cream sauce. T/F
9. A balanced diet implies eating all foods in the same amounts. T/F
10. The health benefit of fruit and vegetables lies alone in the supply of vitamins and minerals. T/F
11. Bacon contains more calories than ham. T/F
12. Oily fish (salmon, mackerel) contain healthier fats than red meat. T/F
13. To eat healthily, you should eat less fat. Whether you also eat more fruit and vegetables does not matter. T/F
14. A scoop of chocolate ice cream is just as healthy as a scoop of lemon sorbet. T/F
15. The same amount of beef steak and chicken breast contains equal calories. T/F
16. The same amount of sugar and fat contains equally many calories. T/F
17. A sandwich with mozzarella contains as many calories as the same sandwich with Gruye’re cheese. T/F
18. For a healthy nutrition, dairy products should be consumed in the same amounts as fruit and vegetables. T/F
19. Skimmed milk contains fewer minerals than full-fat milk. T/F
20. Brown sugar is much healthier than white sugar. T
Appendix E - The Theory of Planned Behaviour Questionnaire

(Adapted from Brouwer, 2012)

The following survey asks questions regarding your attitudes towards eating fruits and vegetables.

Subjective Norms

*Below are series of statements about what other people might think about dieting. Please choose one response that best represents how you feel.*

1. People who are important to me think I:
   Please choose **only one** of the following:

   1. Should definitely not eat fruits and vegetables
   2. Should not eat fruits and vegetables
   3. Should probably not eat fruits and vegetables
   4. Are unsure if I should eat fruits and vegetables
   5. Should probably eat fruits and vegetables
   6. Should eat fruits and vegetables
   7. Should definitely eat fruits and vegetables

2. People who are important to me would:
   Please choose **only one** of the following:

   1. Definitely disapprove of my eating fruits and vegetables
   2. Disapprove of my eating fruits and vegetables
   3. Probably disapprove of my eating fruits and vegetables
   4. Neither approve or disapprove of my eating fruits and vegetables
   5. Probably approve of my eating fruits and vegetables
   6. Approve of my eating fruits and vegetables
   7. Definitely approve of my eating fruits and vegetables
3. People who are important to me want me to eat fruits and vegetables

Please choose the appropriate response for each item:

1. Strongly Agree
2. Disagree
3. Mildly Agree
4. Neither Agree or Disagree
5. Mildly Agree
6. Agree
7. Strongly Agree

4. I feel under social pressure to eat fruits and vegetables

Please choose the appropriate response for each item:

8. Strongly Agree
9. Disagree
10. Mildly Agree
11. Neither Agree or Disagree
12. Mildly Agree
13. Agree
14. Strongly Agree

Attitudes

Each of the following items contains two terms that can describe how you feel. Select the number between the two terms which you feel best captures your response to the following questions:

5. I feel eating fruits and vegetables is:

Please choose the appropriate response for each item:

1 2 3 4 5 6 7
Bad Good
Harmful        Beneficial
Unpleasant     Pleasant
Unenjoyable    Enjoyable
Unwise         Wise
Unnecessary    Necessary

Perceived Behavioural Control

6. Whether I eat fruits and vegetables is entirely up to me
Please choose the appropriate response for each item:

15. Strongly Agree
16. Disagree
17. Mildly Agree
18. Neither Agree or Disagree
19. Mildly Agree
20. Agree
21. Strongly Agree

7. How much personal control do you feel over eating fruits and vegetables in?
Please choose the appropriate response for each item:

1. Very little Control
2. Mostly not in Control
3. Somewhat NOT in Control
4. Neither in Control or Not in Control
5. Somewhat in Control
6. Mostly in Control
7. Completely in Control

8. How much do you feel that whether you eat fruits and vegetables is in your control?
Please choose the appropriate response for each item:

1. Not at all
2. Not Really
3. Somewhat NOT So
4. Neutral
5. Somewhat So
6. Mostly So
7. Very Much So

9. I believe I have the ability to eat fruits and vegetables.

Please choose the appropriate response for each item:

22. Strongly Agree
23. Disagree
24. Mildly Agree
25. Neither Agree or Disagree
26. Mildly Agree
27. Agree
28. Strongly Agree

10. To what extent do you see yourself as being capable of eating fruits and vegetables?

Please choose the appropriate response for each item:

8. Very Unlikely
9. Mostly not Likely
10. Somewhat NOT Likely
11. Neutral
12. Somewhat Likely
13. Mostly Likely
14. Very Likely
11. How confident are you that you will be able to eat Fruits and Vegetables?
Please choose the appropriate response for each item:

1. Very Unsure
2. Mostly Unsure
3. Somewhat Unsure
4. Neither Sure or Unsure
5. Somewhat Sure
6. Mostly Sure
7. Very Sure

12. If it were entirely up to me, I am confident that I would be able to eat fruits and vegetables.
Please choose the appropriate response for each item:

1. Strongly Agree
2. Disagree
3. Mildly Agree
4. Neither Agree or Disagree
5. Mildly Agree
6. Agree
7. Strongly Agree

Intentions

Please rate to what extent you agree with the following statements.

13. I intend to eat fruits and vegetables.
Please choose the appropriate response for each item:
1. Strongly Agree
2. Disagree
3. Mildly Agree
4. Neither Agree or Disagree
5. Mildly Agree
6. Agree
7. Strongly Agree

   Please choose the appropriate response for each item:

29. Strongly Agree
30. Disagree
31. Mildly Agree
32. Neither Agree or Disagree
33. Mildly Agree
34. Agree
35. Strongly Agree

15. I want to eat fruits and vegetables.
   Please choose the appropriate response for each item:

1. Strongly Agree
2. Disagree
3. Mildly Agree
4. Neither Agree or Disagree
5. Mildly Agree
6. Agree
7. Strongly Agree
Appendix F - Healthy/Fruit/Vegetable -Eater Identity Questionnaire

Adapted from Brouwer, (2015)

Please rate how much you agree with the following items

1. *I consider myself a healthy/fruit/vegetable-eater*

   1  2  3  4  5
   Strongly agree Strongly disagree

2. *When I describe myself to others I usually mention my healthy/fruit/vegetable-eating habits*

   1  2  3  4  5
   Strongly agree Strongly disagree

3. *I have numerous goals related to healthy-eating/ eating/fruits/vegetables*

   1  2  3  4  5
   Strongly agree Strongly disagree

4. *I need to eat healthy food/fruit/vegetables to feel good about myself*

   1  2  3  4  5
   Strongly agree Strongly disagree

5. *Others see me as someone who eats a healthy diet/fruits/vegetables*

   1  2  3  4  5
   Strongly agree Strongly disagree

6. *For me, being a healthy/fruit/vegetable-eater is something I work on everyday*
<table>
<thead>
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<tr>
<td></td>
<td>Strongly agree</td>
<td>Strongly disagree</td>
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</table>

7. *I would feel a real loss if I couldn’t eat healthy foods/fruits/vegetables*  

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<th></th>
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<th>4</th>
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<td></td>
<td>Strongly agree</td>
<td>Strongly disagree</td>
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</table>

8. *Eating healthy/fruits/vegetables is something I think about often*  

<table>
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<tr>
<td></td>
<td>Strongly agree</td>
<td>Strongly disagree</td>
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</tbody>
</table>
Appendix G- Iowa Gambling Task

You are about to take part in an experiment that involves gambling with money. You will start with a loan of $2000. On each trial, you will select a card from one of the four decks. After you select each card, you will be given a reward and possibly be required to pay a penalty. Your goal is to maximize the profit on your loan, and you may choose from any deck at any time to do so. Click the mouse to continue.

For each card you draw, you will get a reward. This reward depends on the deck you choose, and each deck has a fixed reward. You will also get a penalty, which will cost you money. Penalties are somewhat random—the penalty you will get is different for different cards in the deck. Sometimes the penalty will be zero, and sometimes it will be larger, at times even larger than the reward you get for choosing that deck. You should try to get as much money as possible by the end of the study. Press the mouse to continue.

At the bottom of the screen, there is a graph which shows you your current earnings. The more money you have the larger bar will be. Now you will begin the test. If you have any questions ask the researcher. Click the mouse to begin.
### Appendix H - Correlation Coefficients for the Theory of Planned Behaviour and Identity predicting Intentions

#### Table 1. Correlation Coefficients for the Theory of Planned Behaviour and Identity predicting Intentions

<table>
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<tr>
<th>Variables at Time 1</th>
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<td>2. Subjective Norms</td>
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<td>3. Attitudes</td>
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<tr>
<td>6. Vegetable Eater</td>
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* Significant at p=.05 level, ** significant at p=.01, *** p=.001
Appendix I- Correlation Coefficients for Healthy Eater Identity and the Theory of Planned Behaviour predicting Total fruit and Vegetable Consumption

Table 2. *Correlation Coefficients for Vegetable Eater Identity and the Theory of Planned Behaviour predicting Intentions*

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<td>3. Attitudes</td>
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<td>4. Perceived Behavioural Control</td>
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<td>5. Vegetable Eater Identity</td>
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* significant at p=.05 level, ** significant at p=.01, *** p=.001
Appendix J - Correlation Coefficients for the Theory of Planned Behaviour with Vegetable Eater Identity predicting Vegetable Consumption

Table 4. Correlation Coefficients for the Theory of Planned Behaviour with Vegetable Eater Identity predicting Vegetable Consumption

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<th>Variables at Time 1</th>
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<td>5. Intentions</td>
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<td>6. Vegetable Eater</td>
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* *significant at \( p=.05 \) level, ** *significant at \( p=.01 \), *** \( p=.001 \)