Fruit & vegetable intake among men in New Zealand: An evaluation and extension of a stage and continuous model of dietary behaviour

A thesis presented in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Psychology

at Massey University, Palmerston North,
New Zealand.

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2008

Abstract

Purpose. The purpose of the study is to develop a better understanding of the process of behaviour change and factors which contribute to an increased level of fruit and vegetable intake (F&V) among men in New Zealand. The study aims to determine the impact of psychosocial and contextual factors integrated into an extended stage model. As a more parsimonious continuous model maybe sufficient for understanding F&V intake, the study also plans to evaluate the impact of psychosocial and contextual factors on behaviour, and whether intentions is the mechanism by which the psychosocial factors influence behaviour.

Design. Data was collected using a self administered questionnaire in a mail survey from N = 518 men aged 18 years and over randomly selected from the electoral roll. Mean differences in factors across the stages of change were assessed with one way ANOVAs and Games Howell post hoc tests, and trend analyses assessed linear and non-linear components of trend. The independent impact of factors on intentions and behaviour was assessed with hierarchical multiple regression analyses.

Measures. Stage of change was assessed with a single item measure, F&V intake with a 7-item food frequency questionnaire, and food insecurity with items used in the 1997 National Nutrition Survey. Previously developed measures were used to assess the pros, cons, self efficacy, self identity, and susceptibility to disease. Scales were developed and adapted for F&V intake for control, descriptive and subjective norms.

Results. In total, 51% of men were in the action/maintenance stage and 32%, 10% and 7% in the precontemplation, contemplation, and preparation stages respectively. Mean F&V intake was 3.92 (SD = 2.08) servings a day and 30.4% were eating at least 5 servings. All factors differed significantly across the stages of change. The predictor variables collectively explained R^2 = 43% (42% adjusted) in intentions and 40% (38% adjusted) in behaviour. The impact of self efficacy and intentions on behaviour depended in part on household food insecurity status.

Discussion. Similar conclusions were reached using the stage and continuous model. To increase intentions of eating 5 or more servings of F&Vs a day in the future, interventions should modify perceived norms, self efficacy, pros and cons, and awareness of F&V guidelines. Interventions targeting those with high food insecurity may also be required to help translate their intentions into action.

Acknowledgements

First and foremost I would like to acknowledge and thank Dr Ross Flett for the major contribution he has had to this work. Your foresight, questioning, guidance and support are highly valued and greatly appreciated. I feel privileged to have had this opportunity to work with you again. I would also like to acknowledge and thank Dr Paul Hirini and Professor Kevin Ronan for their input and support.

The assistance received from Andy Towers in the practical implementation and design of the survey questionnaire is also much appreciated and gratefully acknowledged. I would also like to thank Natasha Tassell for her contribution to this research by examining the stages of change among Maori women in earlier work.

The receipt of a Massey University Doctoral Scholarship has also helped make this study possible and is gratefully acknowledged. Thank you also to the Distance Library Service who made studying at a distance much easier.

On a personal note, I would like to thank my family and friends for being there over the last 4 years with life's ups and downs. Thank you also Dad for seeing the red ribbons ahead of your time.

Finally but not least, I would like to thank the men who took part in the survey. Without your participation this study would not have been made possible.

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1. Introduction

At the turn of the 20th century infectious diseases were the leading cause of death in industrialised countries (Prochaska, 2000; Raczynski & DiClemente, 1999; Smith, Nealey & Hamann, 2000). With advances in medicine and public health (e.g., vaccines, antibiotics and sanitation) rates of these diseases have declined (Raczynski & DiClemente, 1999; Smith et al., 2000). Life expectancy at birth has subsequently improved and is now 78 years for males and 82 years for females in New Zealand (N.Z. [Statistics N.Z., 2008]). Since the 1980s there has also been a shift in the major causes of mortality with over 80% of deaths resulting from chronic diseases (Ministry of Health [MOH], 1999a). In 2003 for example, 28% of deaths were from cancer, 22% ischaemic heart disease, 10% cerebrovascular disease[1], and 3% from diabetes (N.Z. Health Information Service [NZHIS], 2006). Chronic diseases not only have high costs for individuals in terms of premature mortality and years of life lost, but are also associated with higher levels of disability, functional limitations, reduced productivity and lower self perceived health (Ayis, Gooberman-Hill & Ebrahim, 2003; Benyamini, Leventhal & Leventhal, 2000; Cott, Gignac & Badley, 1999; Eriksson, Unden & Elofsson, 2001; Ferraro & Yu, 1995; Hoffman, Rice & Sung, 1996; Johnson & Wolinsky, 1993; Manor, Matthews & Power, 2001; MOH & University of Auckland, 2003; Singh-Manoux, Martikainen, Ferrie, Zins, Marmot & Goldberg, 2006; Statistics N.Z., 2007a; World Health Organization [WHO], 2005). Chronic diseases are also expected to require management and care over an extended period of time and consequently place a large burden on the health care system which competes with other sectors for limited resources[2] [3](Buratta, Frova & Gargiulo, 2003; Hoffman et al., 1996; McHorney, 1999; MOH, 2004a). Moreover, despite frustration over current hospital waiting lists, the demand for health care services is expected to increase in the future, as the risk of chronic disease accumulates with age and populations such as N.Z.'s become increasingly older (de Groot, Verheijden, de

[1] Cerebrovascular disease encompasses various diseases which affect the arteries which supply the brain; this condition is commonly associated with stroke (NZHIS, 2006).
[2] In 1987, 46% of U.S. people reported chronic diseases and accounted for 76% of direct medical care costs (Hoffman et al., 1996).
[3] In 2004 health care expenditure totalled $12,681 million or 8.5% of N.Z.'s gross domestic product (MOH, 2007b).

Henauw, Schroll & van Straveren, 2004; Frizelle, 2002; Hoffman et al., 1996; Johnston, 2007; MOH, 2004a; Statistics N.Z., 2007a).

Priority population health objectives in the N.Z. Health Strategy therefore include reducing the incidence and impact of cardiovascular diseases, cancer and diabetes (MOH, 2000). The WHO (2002, 2005) has also stressed the need for global action to reduce the burden of chronic diseases which are expected to account for 60% (35 million) of deaths worldwide in 2005. Major chronic disease risk factors that are amenable to change include smoking, physical inactivity, and diet (Ferraro & Yu, 1995; Manor et al., 2001; MOH, 2004a). While smoking is a key modifiable cause of premature death, 2 in 5 deaths in N.Z. have been attributed to a lack of physical activity and poor diet (i.e., high blood pressure and cholesterol, excess body weight, and inadequate vegetable and fruit intake[4] [MOH, 2004a; MOH & University of Auckland, 2003]). Priority health objectives therefore also include reducing smoking and obesity, increasing physical activity, and improving nutrition (MOH, 2000).

Fruit & Vegetable Intake

Vegetables and fruit are an important aspect of what we eat. In total, 6% of deaths (7% males, 5% females) in N.Z. have been attributed to low fruit and vegetable (F&V) consumption (MOH & University of Auckland, 2003; Tobias et al., 2006). Similar rates have been reported for other developed countries (8% males, 7% females [Lock, Pomerleau, Causer, Altmann & McKee, 2005]). However, as summarised in Table 1.1 the proportion of deaths attributed to low F&V intake from ischaemic heart disease, ischaemic stroke and some cancers is higher. Further research indicates low F&V intake is associated with an increased risk of heart disease, stroke and some cancers (Bazzano, 2006; Dauchet, Amouyel & Dallongeville, 2005; Dauchet, Amouyel, Hercberg & Dallongeville, 2006; He, Nowson & MacGregor, 2005; Nanney, Haire-Joshu, Hessler & Brownson, 2004; Ness & Powles, 1997; Riboli & Norat, 2003; Van Duyn & Pivonka, 2000). Evidence also

[4] Approximately 5,000 (18%) of deaths in 1997 were attributed to smoking (11% females and 19% males aged 15 and over) and 11,000 deaths to nutrition-related factors (i.e., high blood cholesterol, high blood pressure, excess body weight and low fruit and vegetable intake. Of these 8000-9000 deaths reflect diet and 2000-3000 deaths reflect physical inactivity (MOH & University of Auckland, 2003; MOH, 1999a).

suggests low F&V intake is probably associated with an increased risk of cancers of the larynx, pancreas, breast and bladder, as well as arthritis, cataract formation, asthma and bronchitis (see Bazzano et al., 2006; La Vecchia, Decarli & Pagano, 1998; Nanney et al., 2004; Pattison, Symmons & Young, 2004; Riboli & Norat, 2003; Shikany & White, 2000; Van Duyn & Pivonka, 2000; World Cancer Research Fund/American Institute of Cancer Research [WCRF/AICR], 1997).

Table 1.1. *Attributable Mortality for Fruit & Vegetable Intake in New Zealand, 1997*

	Total		Males		Females	
	N	%	*n*	%	*n*	%
Ischaemic heart disease	1171	18.3	712	19.7	459	16.4
Ischaemic stroke	179	10.9	69	11.0	110	10.9
Lung cancer	131	9.4	81	9.2	50	9.6
Oesophageal cancer	25	13.2	17	13.7	8	12.3
Stomach cancer	39	13.5	24	14.0	15	12.7
Colorectal cancer	14	1.3	8	1.4	6	1.1
Total mortality	1560	5.9	911	6.7	648	5.0

[a] Attributable Fraction. From "Vegetable and fruit intake and mortality from chronic disease in New Zealand", by M. Tobias et al., 2006, *Australian and New Zealand Journal of Public Health, 30*(1), p. 28.

Eating plenty of F&Vs each day on the other hand may be beneficial for health. As summarised in Table 1.2, *each serving* of F&Vs consumed a day reduces the risk of ischaemic heart disease by up to 10%, and ischaemic stroke and some cancers by up to 6%. F&V intake is also inversely related to other chronic disease risk factors including diabetes and hypertension (high blood pressure [Bazzano, 2006; La Vecchia et al., 1998; Nanney et al., 2004; Pattison et al., 2004; Shikany & White, 2000; Van Duyn & Pivonka, 2000]). An adequate level of F&V consumption combined with physical activity may also reduce the risk of obesity (see Sullivan, Oakden, Young, Lau & Lawson, 2004)[5]. While F&V intake may directly and indirectly help protect against chronic diseases, higher levels of consumption have also been associated with better physical and self perceived health (Manderbacka, Lundberg & Martikainen, 1999; Manor et al., 2001; Myint et al., 2007). The health protective properties of F&Vs have been attributed to a range of nutrients including antioxidants (e.g., vitamins A, C and E), folate, magnesium and potassium, as well as their high level of

[5] Tohill and colleagues (2004) reviewed studies examining the relationship between F&V and body mass index (BMI) but the interaction with physical inactivity was not examined.

dietary fibre and low energy density (Ford & Mokdad, 2001; He et al., 2006; Ness & Powles, 1997; Roberts & Barnard, 2005; Shikany & White, 2000; Steinmetz & Potter, 1996; Terry, Terry & Wolk, 2001; Van Duyn & Pivonka, 2000; WHO, 2002).

Table 1.2. *Percentage Risk Reduction Associated with an 80 g per day Increase in Fruit & Vegetables for Selected Health Outcomes, by Age Group*

	Age group (years) %		
	15-69	70-79	80+
Ischaemic heart disease	10	7	5
Ischaemic stroke	6	5	3
Lung cancer	4	3	2
Gastric cancer	6	5	3
Oesophageal cancer	6	5	3
Colorectal cancer	1	1	-

[a] Equivalent to the size of one standard serving. See Table 1.3 for examples of serving sizes. Adapted from "The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet", by K. Lock, J. Pomerleau, L. Causer, D.R. Altman and M. McKee, 2005, *Bulletin of the World Health Organization, 83*, p. 104.

Guidelines for Fruit & Vegetables

The role F&Vs play in preventing disease and promoting health and wellbeing underscores the N.Z. food and nutrition guidelines (MOH, 2003a). The guidelines for healthy adults recommend eating a variety of nutritious foods including at least 5 servings of fresh, frozen or canned F&Vs a day; of which at least 3 servings should be vegetables and 2 servings fruit (see Appendix A). Outlined in Table 1.3 are examples of F&V servings and although whole F&Vs contain a higher level of dietary fibre (Nicklas, Weaver, Britten & Stitzel, 2005), one serving of juice or dried fruit also counts. Similar F&V guidelines are promoted nationally and internationally (e.g., 5+ A Day, 2007; Cancer Society of New Zealand, 2007; New Zealand Dietetic Association, 2007; U.K. Department of Health, 2007; WHO, 2003; WCRF/AICR, 2007). However, potatoes and other starchy vegetables have been excluded in some guidelines as they are higher in carbohydrates and provide less health benefits compared to non-starchy vegetables[6] (WHO, 2003; WCRF/AICR, 2007). Given 5 servings of F&Vs a day is currently the *minimum* recommended level of intake, several guidelines also suggest aiming for a higher level of consumption (e.g.,

[6] Starchy vegetables include yams and cassava which are staple food items similar to cereals and grains in other parts of the world.

Diabetes New Zealand, 2007; National Health & Medical Research Council, 2003; National Heart Foundation, 2007; Roberts, 1999; U.S. Department of Health and Human Services and U.S. Department of Agriculture [USDA], 2005). The National Heart Foundation (2007) for example recommends eating at least 8 servings of F&Vs a day to reduce the risk of cardiovascular disease. The U.S. dietary guidelines also recommend eating between 5 and 13 servings of a variety of F&Vs a day depending on energy needs[7] (U.S. Department of Health and Human Services and USDA, 2005).

Table 1.3. *Examples of a Fruit & Vegetable Serving*

Fruits	Vegetables
▪ 1 apple, pear, banana or orange (130 g) ▪ 2 small apricots or plums (100 g) ▪ ½ cup fresh fruit salad ▪ ½ cup stewed fruit (fresh , frozen or canned) (135 g) ▪ 1 cup fruit juice 250 ml or a serving of dried fruit (*only one counts*)	▪ 1 medium potato, kumara or similar sized root vegetable such as yam or taro (135 g) ▪ ½ cup cooked vegetable eg, puha, water cress, parengo or corn (50-80 g) ▪ ½ cup salad or mixed vegetables (60 g) ▪ 1 tomato (80 g)

Note. From *Food and Nutrition Guidelines for Healthy Adults: A Background Paper* (p. 97), by Ministry of Health, 2003, Wellington, New Zealand: Ministry of Health.

Fruit & Vegetable Consumption

The consumption of F&Vs among N.Z. adults has been examined in several diet and nutrition surveys. In 1977 a survey was undertaken by the National Heart Foundation (Birbeck, 1983), followed by the Life in New Zealand Survey (LINZ) for the Hillary Commission for Recreation and Sport in 1989 (Horwath, Parnell, Birbeck, Wilson, Russell & Herbison, 1991), and the National Nutrition Survey in 1997 (NNS97 [Russell, Parnell, Wilson et al., 1999]). Using a 24 hour recall to assess F&V intake, the NNS97 found the average level of consumption was 412 grams per day[8] (including juice and excluding potatoes [MOH & University of Auckland, 2003]). This corresponds to approximately 5.15 servings of F&Vs a day based on an average serving size of 80 grams. Mean consumption however often obscures the large proportion of people with a low level of F&V intake. While the NNS97 for example found mean F&V consumption was above the minimum recommended level, only

[7] Based on calorie levels ranging from 1,200 to 3,200 a day.
[8] 420 g males, 404 g females.

42% of those surveyed were eating at least 5 servings a day (MOH & University of Auckland, 2003). The NNS97 and the 2002/03 N.Z. Health Survey (NZHS) also assessed F&V intake with a brief 2-item measure. The results from these surveys are illustrated in Figure 1.1.

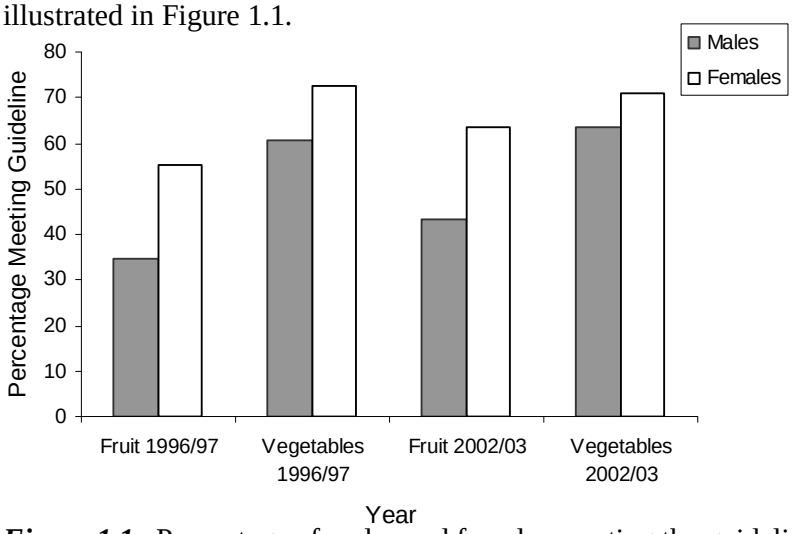

Figure 1.1. Percentage of males and females meeting the guidelines for fruit and vegetable intake, 1997 and 2002/03.

Note. From *A Comparison of Selected Findings from the 1996/97 and 2002/03 New Zealand Health Surveys* (p. 9-11), by the Ministry of Health, 2006, Wellington, New Zealand: Ministry of Health.

Figure 1.1 indicates a large proportion of N.Z. adults do not eat sufficient amounts of F&Vs a day. However, males are less likely to meet the guidelines for both vegetables and fruit compared to females. The percentage of adults eating at least 5 servings of F&Vs a day has also been examined. Based on the results of the 2002/03 NZHS, 54% of adults aged 15 years and over were eating 5 or more servings of F&Vs a day[9] (Tobias, Jackson, Yeh & Huang, 2007). Nevertheless, the proportion of males compared to females with an adequate level of F&V intake was also lower (44% vs. 62% respectively). In addition, a recent survey by the Cancer Society and SPARC (Sullivan et al., 2004) found less males than females were eating 2 servings of fruit *and* 3 servings of vegetables each day (41% vs. 59% respectively, *M* = 49%). As summarised in Table 1.4, general population surveys in Australia and the U.S. also suggest males tend to have an insufficient level of F&V intake compared to females when consumption is assessed with a brief food frequency questionnaire (FFQ).

[9] Excluding those diagnosed with cardiovascular disease or any type of cancer in the past.

Table 1.4. *Proportion Consuming 5 or more Servings of Fruit & Vegetables, 2 or more Servings of Fruit, and 3 or more Servings of Vegetables a day in New Zealand, Australia and the United States.*

					Fruit & vegetables 5 or more servings			Fruit 2 or more servings			Vegetables 3 or more servings		
Country	Survey	Response rate	Assessment method	Age	Total	M	F	Total	M	F	Total	M	F
N.Z.	2002/03 N.Z. Health Survey, Face to face interviews *N* = 12,929	72% main survey	Brief FFQ*a*	15+	54.0	44.3	61.9	53.9	43.3	63.6	67.3	63.3	71.1
N.Z.	1997 National Nutrition Survey Face to face interviews *N* = 4,636	74% 1996/97 Health Survey	Brief FFQ*a*	15+				45.2	34.5	55.2	66.9	60.8	72.6
Australia	2004/05 National Health Survey Face to face interviews *N* = 14,963	90%	Brief FFQ*b*	18+				54.0	47.6	60.1	60.3	55.9	64.7
U.S.	2005 Behavioral Risk Factor Surveillance System (BRFSS) Telephone survey *N* = 305,504	Median 51%	Brief FFQ*c*	18+				32.6	28.7	36.4	27.2	22.1	32.2
U.S.	2000 BRFSS Telephone survey *N* = 135,899	Cooperation Rate 74%*	Brief FFQ*c*	18+	24.6	20.0	29.0						

Country	Survey	Response rate	Assessment method	Age	Fruit & Vegetables 5 or more servings Total	M	F	Fruit 2 or more servings Total	M	F	Vegetables 3 or more servings Total	M	F
U.S.	1997 5+ a day follow-up survey Telephone survey *N* = 2,602	45%	Brief FFQ*d*	18+	26.8	20.4	32.5						

Note. The Australian guideline for vegetable intake is 5 servings a day (National Health & Medical Research Council, 2003). Information has only been provided here to facilitate comparison. * The cooperation rate is the number of completed interviews divided by the number of completed, refused, or terminated interviews. M=Male, F=Female

a Usual intake of fruit (fresh, frozen, canned or stewed; excluding juice and dried fruit) and vegetables (fresh, frozen, canned).

b Usual intake of fruit (fresh, frozen or tinned) and vegetables (fresh, frozen and tinned).

c Based on 6 items including fruit juice, fruit, green salad, potatoes (excluding fried potatoes), carrots and other vegetables.

d Based on 7 items including fruit juice, fruit, green salad, potatoes (excluding fried potatoes), and other vegetables.

Data in rows 1 and 2 are from "Do healthy and unhealthy behaviours cluster in New Zealand?", by M. Tobias, G. Jackson, L. Yeh and K. Huang, 2007, *Australian and New Zealand Journal of Public Health, 31*(2), p. 157. Copyright 2007 by the Public Health Association of Australia and *A comparison of selected findings from the 1996/97 and 2002/03 New Zealand Health Surveys* (p. 9-11), by the Ministry of Health, 2006, Wellington: Ministry of Health. Data in row 3 are from *4364.0 2004-05 National Health Survey: Summary of Results* (p. 38-41), by Australian Bureau of Statistics, 2006, Canberra: Australian Bureau of Statistics. Data in row 4 are from "Fruit and vegetable consumption among adults – United States, 2005", by H.M. Blanck et al, 2007, *Weekly, 56*(10), p. 213-217. Data in row 5 are from "Trends in fruit and vegetable consumption among adults in the United States: Behavioral Risk Factor Surveillance System, 1994-2000", by M.K. Serdula, C. Gillespie, L. Kettel-Khan, R.Farris, J. Seymour and C. Denny, 2004, *American Journal of Public Health, 94*(6), p. 1016. Data in row 6 are from "Changes in vegetable and fruit consumption and awareness among US adults: Results of the 1991 and 1997 5 A Day for Better Health Program surveys", by G.J. Stables et al, 2002, *Journal of the American Dietetic Association, 102*, p. 813.

In summary, research indicates F&V consumption has a positive impact on health. Higher levels of F&V intake have been associated with a lower risk of chronic disease including ischaemic heart disease, ischaemic stroke, and some cancers. In addition, a higher level of F&V consumption has been related to a reduced risk of other chronic disease risk factors including diabetes and hypertension. Ultimately however, eating plenty of F&Vs each day may help improve life expectancy. Despite the range of health benefits associated with F&Vs, a large proportion of N.Z. adults do not eat sufficient amounts each day. However, even small increases in F&V consumption may have a beneficial impact on health. Estimates suggest 200 male deaths and 134 female deaths could be avoided each year in N.Z. with a 40 gram (about half a serving) a day increase in F&V intake in the population, over and above expected trends (MOH & University of Auckland, 2003).

The focus of the current study is on F&V consumption among males. That is, those with the lowest level of F&V intake on average, and those who may benefit the most from increased consumption. The study aims to develop a better understanding of the process of behaviour change and those factors that contribute to a higher level of F&V intake. Prominent theories used to understand and predict health behaviour are therefore reviewed. The transtheoretical model (TTM) is a widely used stage model of health behaviour which claims successful behaviour change involves progressing through a series of stages of change over time. According to the TTM, different factors aid progression between different stages of change. Consequently, stage matched interventions are expected to be more effective in facilitating behaviour change than standardised intervention programmes. Despite the popularity of the TTM, empirical support for the model is relatively weak. A number of limitations and areas of confusion are identified which the study seeks to clarify. The review of health behaviour theories nevertheless highlights a number of psychosocial factors which may be useful to integrate into a single model. Contextual factors are also identified which may contribute to a more comprehensive understanding of behaviour. The impact of these factors is examined across the stages of change for F&V intake. As a more parsimonious continuous model may be sufficient for understanding F&V intake, the psychosocial and contextual factors are also examined in relation to behaviour. Based on these findings, a number of research objectives and hypotheses are formulated and will be examined further.

2. Theories of Health Behaviour

Fruit and vegetable (F&V) consumption is one factor which may be potentially modified to reduce the risk of chronic disease and improve physical health and wellbeing. The study therefore aims to develop a better understanding of the process of behaviour change and those factors which may facilitate an increased level of F&V intake. In this chapter prominent theories which have been used to understand and predict a range of health-related behaviours are examined. The transtheoretical model (Prochaska & DiClemente, 1983, 1992) is a widely used stage model that has generated optimism and enthusiasm about behaviour change. Other models of health behaviour may however offer insights and contribute to a more comprehensive understanding of F&V intake. Other theories reviewed in this section therefore include the health belief model (Janz & Becker, 1984), social cognitive theory (Bandura, 1986), theory of reasoned action (Ajzen & Fishbein, 1980), and theory of planned behaviour (Ajzen, 1991). As opposed to the traditional approach of deciding which theory out performs the others, the current study plans to integrate various theoretical constructs into a single model. The integration of psychosocial factors from different theoretical models is currently being advocated in health behaviour research to facilitate a more comprehensive understanding of behaviour, improve the explanatory power of models and to potentially develop more robust interventions (Armitage & Conner, 2001; Prochaska et al., 1994; Rimer, 2002; Rutter & Quine, 2002; Weinstein, 1993). Those factors which may be usefully integrated into a single model are reviewed at the end of the chapter. The relationship of these factors with F&V intake will be examined in more detail in Chapter 3.

Transtheoretical Model

The transtheoretical model (TTM) was developed following a comparative analysis of principles and processes of change in leading systems of psychotherapy and by examining how people quit smoking with and without the aid of professional treatment (Prochaska & DiClemente, 1983, 1992; Prochaska, DiClemente & Norcross, 1992a; Prochaska, Redding & Evers, 2002). As a stage model, the TTM conceptualises behaviour change as taking place over time and involving a series of

discrete stages of change. According to the TTM there are 5 stages of change as summarised in Table 2.1. The stages of change include precontemplation, contemplation, preparation, action, and maintenance. The stages reflect an order or sequence which one is expected to move through in order to achieve successful behaviour change. While forward stage progression is expected to occur from one stage of change to the next, other paths to action are possible (Weinstein, Rothman & Sutton, 1998). An individual may relapse to an earlier stage of change and recycle through the stages before action is taken (DiClemente, 1993; Greene, Rossi, Rossi, Velicer, Fava & Prochaska, 1999; Prochaska et al., 1992a). Although some have argued (e.g., Bandura, 2000) progression through the stages should be invariant and non-reversible, this appears to be more appropriate for stages of biological development than individual behaviour change (see Weinstein, Rothman et al., 1998).

Table 2.1. *Stages of Change*

Stage	Definition
Precontemplation	No intention of changing or altering one's behaviour within the next 6 months
Contemplation	Thinking about changing one's behaviour within the next 6 months
Preparation	Committed to and intend changing one's behaviour within the next month
Action	Engaged in the behaviour for less than 6 months
Maintenance	Engaged in the behaviour for more than 6 months

As summarised in Table 2.1, those in the precontemplation stage have no intention of changing or altering their behaviour within the next 6 months (Prochaska & DiClemente, 1992; Prochaska et al., 1992a; Prochaska & Velicer, 1997). The time frame used to define the precontemplation stage reflects the period in which it is assumed plans to make specific behavioural changes are usually made (Velicer, Rossi, Prochaska & DiClemente, 1996). In the contemplation and preparation stages, people are thinking about changing their behaviour and are therefore viewed as less resistant to change. In the contemplation stage people are thinking about changing their behaviour within the next 6 months, and in the precontemplation stage within the next month (Prochaska & DiClemente, 1983, 1992; Prochaska et al., 1992a; Prochaska & Velicer, 1997). Small steps toward the behavioural goal may have already been taken

in the preparation stage but they are not sufficient to be classified in the action stage (Prochaska et al., 1992a ; Sigman-Grant, 1996; Suris, del Carmen Trapp, DiClemente & Cousins, 1998). The preaction stages (i.e., precontemplation, contemplation and preparation) are therefore based on intentions of performing the behaviour in the future.

The action and maintenance stages of change reflect short- and long-term performance of the behaviour respectively. In the action stage people have been actively engaged and making overt behavioural changes for *less* than 6 months (Prochaska, 2000; Prochaska et al., 2002; Prochaska & Velicer, 1997). In the maintenance stage the gains accomplished in the action stage have been sustained and integrated into the lifestyle of the individual (DiClemente & Velasquez, 2002; Levesque, Prochaska, Prochaska, Dewart, Hamby & Weeks, 2001; Prochaska et al., 1992a). The maintenance stage is therefore defined as having performed the behaviour for 6 months *or more.* The time frames used to define the postaction (i.e., action and maintenance) stages are derived from smoking cessation research where it takes approximately 6 months of sustained action to progress into the maintenance stage (Horwath, 1999; Prochaska & DiClemente, 1983). Povey and colleagues (1999) nevertheless found 75% of those in the action stage for F&V intake had been performing the behaviour for 6 months or less, and 70% in the maintenance stage had been doing so for 6 months or more[10]. The most stable stages which people may remain in for long periods of time are precontemplation and maintenance (Velicer et al., 1996). Conversely, the contemplation, preparation and action stages are assumed to be more dynamic and with only a small proportion of the population expected to take meaningful action at any one given time, fewer people are expected to be found in these stages (Greene et al., 1999; Nigg et al., 1999).

Progression through the stages of change is influenced by a number of factors. Similar factors are assumed to be important among those in the same stage of change (Weinstein, Rothman et al., 1998; Weinstein & Sandman, 2002). However, different factors are expected to be important in different stages of change (Weinstein & Sandman, 2002). For example, factors which help facilitate change in the initial

[10] In the preparation stage 77% were also thinking about changing their behaviour within the next month.

stages of change are expected to differ from those involved in the maintenance of behaviour. Therefore, few factors if any are expected to be important in all stages (Weinstein & Sandman, 2002). Consequently, stage matched interventions are expected to be more effective in facilitating behaviour change than standardised intervention programmes. In other words, interventions targeted to each stage based on the characteristics which people share should result in more positive outcomes (see Kreuter & Skinner, 2000). The TTM therefore requires one intervention to be matched to each stage.

Decisional balance, self efficacy and the processes of change are expected to help facilitate movement through the stages of change. Decisional balance is based on Janis and Mann's (1977) decision making theory and refers to the relative weighing of the pros and cons associated with behavioural performance (Prochaska et al., 2002, 2000; Prochaska & Velicer, 1997; Rossi et al., 2001). The pros include the positive aspects of changing including the anticipated gains, advantages and benefits (Greene et al., 1999; Rossi et al., 2001). The cons on the other hand include the anticipated losses, disadvantages and barriers (Greene et al., 1999; Rossi et al., 2001). For positive health behaviours the cons are expected to outweigh the pros in the precontemplation stage, while the pros exceed the cons in the latter stages of change (Prochaska, 1994; Prochaska et al., 1994; Prochaska & Velicer, 1997). The pros and cons are therefore expected to cross-over before action is taken.

Self efficacy is derived from Bandura's (1986) social cognitive theory and adapted in the TTM to include temptation for negative health behaviours. Self efficacy refers to one's perception or judgement of their ability in performing a specific behaviour (Bandura, 1986; Kraft, Sutton & Reynolds, 1999). In the TTM, self efficacy is considered to be a key factor which facilitates progression into the action and maintenance stages of change (Greene et al., 1999; Prochaska & DiClemente, 1992). The TTM also incorporates ten processes of change which represent overt and covert activities used by professionals and individuals to modify their behaviour (Greene et al., 1999; Horwath, 1999; Prochaska & DiClemente, 1983; Prochaska et al., 1992a). The processes of change reflect two higher order factors: cognitive-affective (experiential) and behavioural processes (Norman, Velicer, Fava & Prochaska, 1998; Prochaska & Velicer, 1997). The cognitive-affective processes are expected to help

facilitate progression through the earlier stages of change, while the behavioural processes are assumed to be more important in the latter stages of change (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez & Rossi, 1991; Prochaska & DiClemente, 1983, 1992; Prochaska et al., 1992a; Prochaska, Velicer, Guadagnoli & Rossi, 1991).

A number of reviews of the TTM have been undertaken (e.g., Bunton, Baldwin, Flynn & Whitelaw, 2000; Carey, Purnine, Maisto & Carey, 1999; Horwath, 1999; Littell and Girvin 2002; Ni Mhurchu, Margetts & Speller, 1997; Prochaska & DiClemente, 1982, 1992; Prochaska et al., 2002; Sigman-Grant, 1996; Sutton. 2000, 2001). Although the TTM was originally developed to understand addictive health behaviours, the model has since been applied to a wide range of health behaviours (see Bunton et al., 2000; Kristal, Glanz, Currry & Patterson, 1999). The TTM therefore appears to have face validity among researchers and health professionals in the field. Dietary studies which have examined the distribution of people in each stage of change have been reviewed by Horwath (1999) and more recently by Spencer and colleagues (2007). Table 2.2 summarises stage distributions in general population surveys examining dietary behaviours. Brief algorithms which include questions relating to behaviour and intentions have typically been used to assign people to one of the mutually exclusive and discrete stages of change for dietary behaviours. The behaviours examined in Table 2.2 include the consumption of a healthy, low fat and high fibre diet, as well as cereal, milk product and F&V intake. Despite the fact many dietary behaviours are interrelated (e.g., F&Vs may be sources of fibre and substituted for high fat foods [Kumanyika et al., 2000]), they tend to be individually assessed due to their complexity and findings indicating people are often in different stages of change for different behaviours (Horwath, 1999; Ni Mhurchu et al., 1997). That is, one could be in the maintenance stage for F&V intake and precontemplation stage for consuming a low fat diet.

Table 2.2. *Stage of Change Distributions for Dietary Behaviours.*

Reference	Year	Location	Sample	Method	Response rate %	Behaviour	Measure		Stage % PC	C	P	A	M
Ling	1999	Singapore	716 51% female	Mail and telephone survey of Chinese households.	71	Cereal foods	Stage based on intake assessed with a brief FFQ and clarified in a telephone interview. Action criterion of 5.75 servings for men and 4.75 for women. .		43	7	8	*42	
Laforge et al.	1994	U.S.	405 63% female	Random telephone survey in Providence, RI.	84	F&V intake	Stage based on eating 5+ servings of F&Vs a day, and intentions.		38	29	19	2	13
Van Duyn et al.	1998	U.S.	2,811 58% female	Random telephone survey including an over sample of 755 African Americans & Hispanics.	43	F&V intake	Stage based on self rated intake (from very high to very low), duration of behaviour and intentions. Method based on Prochaska & DiClemente (1982, 1983, 1992).		22	3	13	35	27
Ling & Horwath	2000, 1999	Singapore	716 51% female	Mail and telephone survey of Chinese households.	71	F&V intake	Stage based on intake assessed with a brief FFQ and clarified in a telephone interview. Action criterion of 3.75 servings of F&Vs a day.	 Male Female	29 33 26	33 35 31	29 26 32	*9 *6 *11	
Lechner et al.	1998	Netherlands	402 50% female	Telephone survey of Dutch general public.	60	Fruit Vegetables	Stage based on self rated intake as sufficient or high, and intentions. Method based on Curry et al., (1992), Glanz et al., (1994), Greene et al., (1994), Campbell et al., (1994).	Fruit Veg	18 8	5 1	6 2	*71 *89	
							Alternative classification method based on intake meeting Dutch dietary guidelines (150g vegetables and 2 pieces of fruit) assessed with a FFQ, and intentions.	Fruit Veg	35 59	5 2	8 2	*52 *37	
Ma et al.	2003	U.S.	1,545 61% females 90% white 50% students	Telephone interview and mail survey of adults 18-24 years in 10 states.	55	Fruit Vegetables	Stage based on eating 2 servings of fruit (3 servings of vegetables) and intentions. Method based on Campbell et al. (1994, 1999), Glanz et al. (1994, 1998), Sorenson et al. (1996), Brug et al. (1997), Cullen et al. (1998).	Fruit Veg	14 23	13 21	16 27	10 3	46 26

Reference	Year	Location	Sample	Method	Response rate %	Behaviour	Measure		Stage % PC	C	P	A	M
Sullivan et al.	2004	N.Z.	8,163 61% female	Mail survey of adults.	61%	Fruit Vegetables	Stage based on 2 servings of fruit (3 servings of vegetables) and intentions.	Fruit Veg	14 13	11 8	7 5	8 5	59 68
de Graaf et al.	1997	Europe	12,541	Face to face interviews in 15 member states of the European Union.		Healthy eating	Stage based on eating a healthy diet, intentions and plans to change. Method based on Curry et al. (1992), Glanz et al. (1994), Greene et al. (1994), Brug et al. (1996ab), Sporny & Contento, (1995).	†	52	2	1	7	31
Auld et al.	1998	U.S.	2,066	Mail survey of adults in 11 states and D.C.	52	High fibre diet	Stage based on awareness of diet-disease relationship, intentions and behaviour. Unambiguously classified 2006 of 3198 participants.		7	10	44	*38	
Steptoe et al.	1996	England	366 57% female	Mail survey of 2 areas in South London (one affluent, one less wealthy).	46	Low fat diet	Stage based on behaviour and intentions. Method based on Curry et al., (1992).	 Male Female	35 43 29	13 13 13	4 6 3	6 5 6	42 33 50
Auld et al.	1998	U.S.	2,004	Mail survey of adults in 11 states and D.C.	52	Low fat diet	Stage based on awareness of diet-disease relationship, intentions and behaviour. Unambiguously classified 2004 of 3198 participants.	 Male Female	8 9 7	13 16 10	35 40 32	*45 *35 *51	
Laforge et al.	1999	U.S.	508 63% female	Random telephone survey.	73	Low fat diet	Stage based on "Do you consistently avoid eating high fat foods?" and intentions.		29	6	10	4	51
Laforge et al.	1999	Australia	2,439 58% female	Face to face interviews of South Australian households	50-60	Low fat diet	Stage based on "Do you consistently avoid eating high fat foods?" and intentions.		22	4	3	7	64
Gulliver & Horwath	2001a	N.Z.	965 females	Mail and telephone survey of women.	80	Milk products	Stage based on intake of 2 servings of milk products assessed with a brief history style interview and intentions.		26	3	4	4	63

PC= Precontemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance. F&V = Fruit and vegetables. Veg = Vegetables. .

* Includes Action and Maintenance Stage. † Remainder of participants were classified in a relapse stage.

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Table 2.2 indicates stage distributions vary for different dietary behaviours. Ling and Horwath (2000) for example found a greater proportion of respondents in the postaction stages for cereal consumption (42%) than F&V intake (9%). Nevertheless, Table 2.2 also indicates stage distributions vary for the same target behaviour. For example, Van Duyn and colleagues (1998) found a larger proportion of U.S. adults in the postaction stages for F&V intake compared to Laforge and colleagues (1994 [62% vs. 15% respectively]). While the period of time in which the surveys were undertaken and response rates vary, the main factor contributing to the different findings appears to be the stage classification method used. The method used by Van Duyn and colleagues (1998) asked participants to rate their F&V intake from very high to very low. Vague questions nevertheless rely much more on individual interpretation of the question (Dillman, 2000). People may differ widely in what they perceive to be a low or high level of F&V consumption. Consequently, studies which have assessed the stages of change based on the direction of F&V intake tend to find a larger proportion of people in the action and maintenance stages (e.g., Brug, Glanz & Kok, 1997; Kloek, van Lenthe, van Nierop & Mackenbach, 2004; Lechner et al., 1998; Trudeau, Kristal, Li & Patterson, 1998; Van Duyn et al., 1998).

A specific action criterion of 5 servings of F&Vs a day was used by Laforge and colleagues (1994) to assign participants into the stages of change. Studies which have used specific action criteria tend to find fewer people classified in the postaction stages for F&V intake (Armitage, Povey & Arden, 2003; De Vet, De Nooijer, De Vries & Brug, 2005b; Laforge et al., 1994; Ma, Betts, Horacek, Georgiou, White & Nitzke, 2002; Ma et al., 2003). As summarised in Table 2.3, those classified in the postaction stages based on a specific action criterion also tend to have a higher level of F&V intake on average. The use of a clearly specified action criterion which is agreed upon by researchers and professionals in the field and associated with a reduced risk of disease has therefore been recommended in the literature (Howarth, 1999; Prochaska, 2000; Prochaska et al., 2002; Prochaska & Velicer, 1997). Consequently, the TTM may be more suitable for examining food based (e.g., F&V intake) rather than nutrition goals (e.g., high fibre diet), as the latter are often unclear and many people lack the ability to rate their diet in terms of nutrient intake (Greene, Rossi, Reed, Willey & Prochaska, 1994; Horwath, 1999; Ling & Horwath, 2000). As

a result, the study plans to examine the stages of change with respect to eating 5 or more servings of F&Vs each day.

Table 2.3. *Mean Servings of Fruit & Vegetables in each Stage of Change.*

		Stage of change				
Reference	Type of Measure	PC	C	P	A	M
Fruit & Vegetables						
Van Duyn et al., (1998)	Direction of intake	3.1	2.4	2.7	3.7	5.1
Campbell et al., (1998)	Specific target behaviour	3.5	3.3	3.5	*6.5	
Fruit						
Van Duyn et al., (1998)	Direction of intake	0.8	0.5	0.6	1.0	1.5
Brug et al., (1997)	Direction of intake	1.0	1.6	1.6	4.0	2.9
Kloek et al., (2004)	Direction of intake	0.3	0.4	0.5	1.7	1.4
Ma et al., (2002, 2003)	Specific target behaviour	1.1	1.5	1.8	3.0	4.0
Vegetables						
Van Duyn et al., (1998)	Direction of intake	1.7	1.5	1.4	1.8	2.5
Brug. et al., (1997)	Direction of intake	0.9	1.0	1.0	1.3	1.1
Ma et al., (2002, 2003)	Specific target behaviour	1.9	2.4	2.5	3.1	4.0

PC = Precontemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance. * Includes Maintenance

Progression through the stages of change has also been examined in several studies (e.g., Armitage, Sheeran, Conner & Arden, 2004; Courneya, Plotnikoff, Hotz & Birkett, 2001; De Nooijer, van Assema, De Vet & Brug, 2005; De Vet et al., 2005a; Greene & Rossi, 1998; Kristal et al., 1999; Lam, Chan, Chan, Leung, Ho & Chan, 2006; Norman et al., 1998; Prochaska et al., 1991). De Vet and colleagues (2005a) for example assessed the stages of change for fruit intake over a period of four months. Based on six assessments, 37% of participants remained in the same stage, 14% progressed, 10% regressed, and 4% regressed before progressing (De Vet et al., 2005a). Prochaska and colleagues (1991) found similar stage profiles for smokers who were trying to quit on their own when assessed every six months over a period of two years[11]. Littell & Girvin (2002) have however noted the lack of research documenting progression through the entire sequence of stages. Findings nevertheless indicate the majority of people tend to remain in their baseline stage (e.g., Armitage et

[11] Among those trying to quit smoking on their own, Prochaska and colleagues (1991) found 36% remained stable in the same stage when, 16% progressed from one stage to the next, 12% regressed, and 13% regressed before progressing.

al., 2004; Courneya et al., 2001; De Vet et al., 2005a; Kristal et al., 1999). In addition, a greater proportion of people tend to advance through the stages than regress. The precontemplation and maintenance stages are also the most stable (Armitage et al., 2004; Courneya et al., 2001; De Nooijer et al., 2005; De Vet et al., 2005a; Lam et al., 2006). For example, between consecutive assessments for fruit intake, 74-83% and 86-90% in the precontemplation and maintenance stages respectively were in the same stage, while only 36-55% in the preparation stage were (De Vet et al., 2005a). Another study of dietary fat intake (Greene & Rossi, 1998) found those in the preparation stage were more likely to progress to the action and maintenance stages than those in the precontemplation or contemplation stages (Greene & Rossi, 1998).

Cross sectional and prospective studies have been used to examine differences in the pros, cons, and self efficacy across the stages of change. The pattern of pros and cons was examined by Prochaska and colleagues (1994) for 12 health behaviours[12]. For each of the behaviours, the cons were higher than the pros in the precontemplation stage, and the pros outweighed the cons in the action stage for 11 behaviours[13]. As a result, the pattern of pros and cons tended to cross over between the contemplation and preparation stages before action was taken. On average, the pros increased at least twice as much as the cons decreased (Prochaska, 1994)[14]. The results of prospective studies also indicate the pros, cons, and having more of a positive attitude towards the behaviour predict progression and regression in different stages of change (e.g., Courneya et al., 2001; De Vet, et al., 2005b; Velicer, Norman, Fava & Prochaska, 1999).

For self efficacy, evidence indicates those in the precontemplation stage have the lowest level of confidence in performing the behaviour on average, while those in the action and maintenance stages have the most confidence (e.g., Armitage & Arden, 2002; Armitage et al., 2004; Gulliver, 1998; Lippke & Plotnikoff, 2006; Malotte et al., 2000; Ounpuu, Woolcott & Rossi, 1999; Prochaska & DiClemente, 1992; Prochaska

[12] Smoking cessation, quitting cocaine, weight control, high fat diets, adolescent delinquent behaviours, safer sex, condom use, sunscreen use, radon gas exposure, exercise acquisition, mammography screening and physicians' preventive practices with smokers (Prochaska et al., 1994).
[13] Except cocaine.
[14] The average amount of increase in the pros from precontemplation to action was approximately 1 *SD*, while the cons decreased by 0.5 *SD* (Prochaska, 1994).

et al., 1991; Rhodes & Hergenrather, 2003). In a prospective study of fruit intake (De Vet et al., 2005b), self efficacy was also found to predict forward stage progression from the precontemplation and contemplation stages. Although less research has examined temptation for negative health behaviours, the available evidence suggests those in the action and maintenance stages are the least tempted on average (e.g., Prochaska et al., 1991; Rossi et al., 2001). Temptation has also been shown to predict progression in the contemplation and preparation stages in a prospective study of smoking cessation (Velicer et al., 1999).

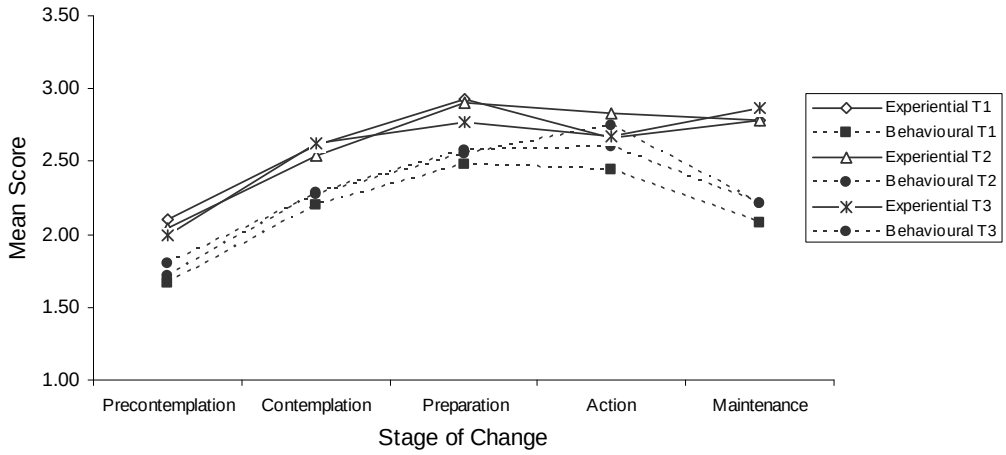

Figure 2.1. Process use at three time points across the stages for fruit intake.

T = time period. Adapted from *Testing the Transtheoretical Model of Behavior Change: Validity and Applicability for Fruit Intake* (p.54), by E.W.M.L. De Vet, 2005, Unpublished doctoral dissertation, University of Maastricht, the Netherlands.

The processes of change have been examined in a meta-analysis by Rosen (2000) for a range of health behaviours. The processes of change were used the least in the precontemplation stage. Although the use of the cognitive-affective processes were found to vary slightly for different behaviours, their use increased on average across the stages of change before declining in the action and maintenance stages. Similarly, use of the behavioural processes peaked in the action stage before declining in the maintenance stage. The pattern of cognitive-affective (experiential) and behavioural processes of change reported by De Vet (2005) for fruit intake over 3 time periods are illustrated in Figure 2.1. De Vet and colleagues (2005c) also found the cognitive-affective processes predicted progression from the precontemplation stage and transition into the action stage, while the behavioural processes predicted progression from the precontemplation and contemplation stages and transition into the action

stage. Both cognitive-affective and behavioural processes of change therefore appear to facilitate progression through the preaction stages.

Finally, experimental studies examining the impact of stage matched and mismatched interventions provide the ultimate test of the TTM (Sutton, 2000; Weinstein, Rothman, et al., 1998). Finding stage matched interventions (i.e., one intervention for each stage) are more effective than mismatched interventions in moving people to the next stage would provide strong support for the hypothesis that behaviour change follows a stage process (Sutton, 2001; Weinstein, Rothman, et al., 1998). For example, a greater proportion of those in precontemplation stage should progress to the contemplation stage if they receive an intervention matched to their stage rather than one designed for contemplators (Sutton, 2001). There is however a paucity of research examining the efficacy of stage matched interventions (Sutton, 2000; Weinstein, Rothman, et al., 1998; Whitehead, 1997) and the available research has produced mixed results (Bridle et al., 2005; Marcus et al., 1998; van Sluijs, van Poppel & van Mechelen, 2004).

A review of randomised controlled trials (Bridle et al., 2005) for example found only 5 out of 20 trials favoured TTM interventions, 5 reported mixed effects, and in 10 trials there were no statistically significant differences when compared to alternative non-stage-based interventions. The review also found the efficacy of TTM interventions did not differ in relation to the outcome examined (i.e., behaviour or stage movement)[15], comparison group (i.e., alternative intervention or control group)[16], or behaviour (e.g., smoking, physical activity, or dietary change). The superior value of TTM interventions has therefore not been clearly demonstrated to date. Reviews of the model (e.g., Adams & White, 2005; Ashworth, 1997; Whitehead, 1997; Whitelaw, Baldwin, Bunton & Flynn, 2000) suggest a number of factors may explain the lack of strong evidence supporting TTM interventions including 1) the validity of stage of change measures, 2) model specification, 3) the design of TTM interventions, and 4) whether or not the stages are discrete.

[15] Of those studies examining stage movement as the outcome variable, 6 out of 15 trials favoured TTM interventions. Compared to non-stage-based interventions, 3 favoured TTM interventions, 1 was inconclusive and 4 showed no difference. When compared to no intervention controls, 3 favoured TTM interventions, 4 were inconclusive and 3 showed no difference.

[16] Compared to no intervention or usual care, 6 out of 22 trials favoured TTM interventions, 6 reported mixed effects, and 10 reported no statistically significant differences.

Accurate methods are required to classify people into the stages of change. Reviews of the TTM have repeatedly noted the lack of attention paid to the psychometric properties of stage measures (e.g., Adams & White, 2003, 2005; Armitage & Conner, 2000; Bridle et al., 2005; Brug, Conner, Harre, Kremers, McKellar & Whitelaw, 2005; Bunton et al., 2000; Riemsma et al., 2003). A review of randomised controlled trials for example found only one third of studies reported some detail about the validity of stage measures used (Bridle et al., 2005). The use of unvalidated measures to classify people into stages may result in the delivery of inappropriate interventions and consequently TTM interventions being judged ineffective. As noted above, the use of a specific action criterion appears to improve the validity of stage measures. When stage classification is based on this method those in the postaction stages tend to have a higher level of F&V consumption on average. As summarised in Table 2.4, a large proportion of those in the pre- and post-action stages also tend to be correctly classified in relation to cut-off values when stage is assessed with a specific action criterion. The study therefore plans to assess the validity of the stage of change measure used in relation to F&V intake.

Table 2.4. *Percentage Correctly Classified in the Preaction and Postaction Stages of Change for Fruit & Vegetable Intake based on Action Criterion*

Reference	Target Behaviour	Objective Assessment	Action criterion	Stage %	
				Preaction	Postaction
De Vet et al (2005a)	Fruit	14 item FFQ	2 servings	73	78
Ma et al (2003)	Fruit†	12 item FFQ	2 servings	67	84
Ma et al (2003)	Vegetables†	14 item FFQ	3 servings	66	69
Ling & Horwath (2000)	F&Vs	24 hour recalls	3.75 servings	89	76

Note. Preaction = Precontemplation, Contemplation and Preparation Stages. Postaction = Action and Maintenance Stages. † Based on staging method A used by Ma, Betts, Horacek, Georgiou & White (2003). FFQ = Food frequency questionnaire. F&Vs = Fruit and vegetables. While the method used by Ling and Horwath (2000) appears to have classified the greatest proportion of participants overall correctly, the method used depends on a trained interviewer to clarify F&V intake during a telephone interview and is therefore less suitable for inclusion in a self-administered questionnaire.

Findings in Table 2.4. nevertheless indicate some participants may be misclassified. Those in the post-action stages who fail to meet the action criterion have been referred to as “pseudo-maintainers” (Rossi, 1993). The reclassification of pseudo-maintainers into an earlier stage of change based on their intentions of performing the behaviour in the future has improved the validity of some measures. Green and colleagues

(1994) for example reclassified those who were eating *more* than 30% of total energy from fat into the preparation stage. Other studies have reclassified pseudo-maintainers into one of the preaction stages based on their intentions (Greene & Rossi, 1998; Lechner et al., 1998; see also Table 2.2). The advantage of reclassification for pseudo-maintainers is the opportunity of receiving an intervention to help facilitate behaviour change. However, the TTM assumes interventions should be matched to stages based on the characteristics people share. It is unclear from the above studies whether pseudo-maintainers shared similar characteristics with those in the preaction stages and would benefit from interventions matched to these stages.

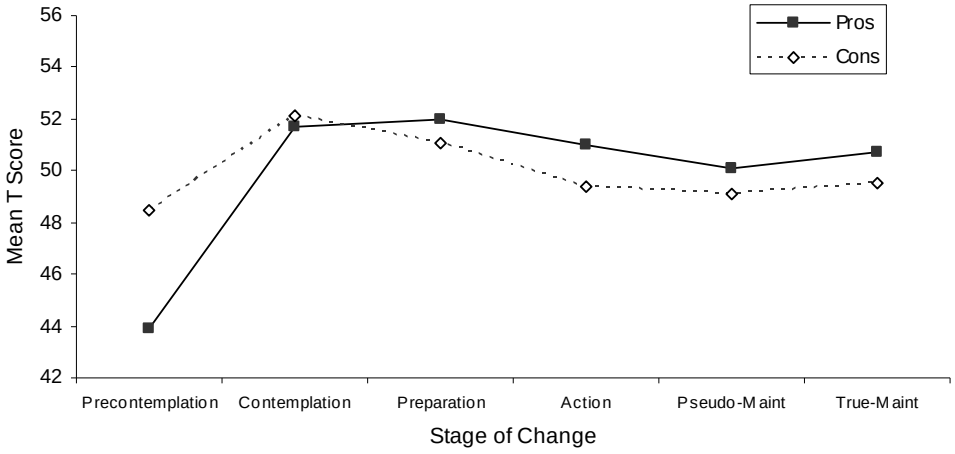

Figure 2.2. Pros and cons across the stages of change for fruit intake.

Maint = Maintenance. Adapted from "Assessing stages of change for fruit and vegetable intake in young adults: a combination of traditional staging algorithms and food-frequency questionnaires", by J. Ma, N.M. Betts, T. Horacek, C. Georgiou and A. White, 2003, *Health Education Research*, *18*(2), (p. 230-231). Copyright 2003 by Oxford University Press.

The characteristics of pseudo-maintainers have been compared to true-maintainers (i.e., those meeting the action criterion) and those in the preaction stages in several studies. Ounupuu and colleagues (2000) compared the use of processes of change (e.g., counter-conditioning, self-control, and consciousness raising) among pseudo-maintainers, true-maintainers and true-precontemplators with respect to dietary fat intake. Ounupuu et al. (2000) concluded pseudo-maintainers were more similar to true-maintainers than precontemplators. Similarly, Ma et al. (2003) assessed the perceived pros, cons and self efficacy among those who had a sufficient and inadequate level of vegetable and fruit intake in each stage. Illustrated in Figure 2.2 are the mean pros and cons found in each stage for fruit intake. Based on the magnitude of mean differences, pseudo-maintainers appeared to be more similar to

true-maintainers than those in the preaction stages. The pattern of pros and cons for vegetable intake was similar. These findings suggest the reclassification of pseudo-maintainers into an earlier stage may be unnecessary. The study therefore plans to assess the proportion of participants misclassified in the pre- and post-action stages and to determine whether those who do not meet the action criterion in the postaction stages should be reclassified into an earlier stage of change.

In order to design effective TTM interventions one needs to know what factors move people from one stage of change to the next. The second point mentioned above relates to the lack of specificity in the TTM as to which factors discriminate between adjacent stages of change. The model gives a general idea as to how factors should differ across the stages of change (e.g., the pros will increase and cons decrease across the stages of change and cross over before action is taken) but does not clearly indicate which factors move people from precontemplation to contemplation, or from precontemplation to action for example. In order to develop effective interventions a clear understanding of the factors which discriminate between adjacent stages is required (Bridle et al., 2005; Horwath, 1999; Kraft et al., 1999; Weinstein, Rothman, et al., 1998). In other words as Sutton (2001) has pointed out, "we need a causal model for each stage transition" (p. 181). The study therefore plans to contribute to a better understanding of those factors which discriminate between adjacent stages of change for F&V intake. The magnitude of differences will also be examined to identify those factors which are most important in different stages. Other factors not included in the TTM may nevertheless help facilitate progression through the stages of change and therefore also beneficial to include in intervention programmes (Adams & White, 2005; Brug et al., 2005; West, 2005). As a result, the study plans to incorporate and examine the impact of other theoretical variables across the stages of change.

Finally, in contrast to the assumptions of the TTM, it is possible the process of behaviour change does not involve a series of discrete stages of change. Several authors (Sutton, 2000; Weinstein, Rothman et al., 1998) have discussed how any number of stages or categories could be created by arbitrarily dividing a continuum. These would however represent "pseudo" rather than genuine stages. A pseudo-stage model is indicated if there are consistent increases (or decreases) in factors across the

stages in a linear pattern (Sutton, 2000; Weinstein, Rothman et al., 1998). If linear patterns are found on most variables then those factors which help facilitate behaviour change would largely be the same regardless of one's stage. In addition, pseudo-stage models do not assume successful behaviour change is achieved by progressing through the stages, from one stage of change to the next. Nevertheless, small naturally occurring shifts along a continuum are expected to be more common in pseudo-stage models, as opposed to larger ones (Weinstein, Rothman, et al., 1998). A number of critiques of the TTM have therefore questioned whether the stages, or subsets of them, reflect pseudo-stages based on intentions and the duration of behavioural performance (e.g., Bandura, 2000; Etter & Sutton, 2002; Littell & Girvin, 2002; Shepherd, 2002; West, 2005). It is possible for example the preaction stages reflect an underlying continuum of intentions based on arbitrary time periods. If the TTM reflects a pseudo-stage model then interventions which are not stage based may be just as effective in facilitating behaviour change as those which are. In which case, the advantage of using a stage model for understanding health-related behaviours may be limited in comparison to more parsimonious continuum models (see Weinstein, Rothman et al., 1998). The current study therefore plans to examine the relationship of factors across the stages of change for F&V intake and determine whether they are best described by a linear or non-linear trend.

If the TTM is a pseudo-stage model, then a more parsimonious continuous model may have a number of practical advantages for understanding F&V intake. Firstly, continuous models combine factors into a single prediction equation and are therefore simpler and easier to examine. Secondly, the sample size required to detect relationships among variables assessed on a continuum is less than that needed to detect significant mean differences between groups (see Cohen, 1992). Consequently, based on the same sample size, a continuous model would be able to detect smaller relationships which exist than a stage model. In addition, the sample size required to perform multivariate analyses which take into account the relationship among predictor variables is also less for the prediction of continuous variables than group membership (Hair, Anderson, Tatham & Black, 1998; Tabachnick & Fidell, 1997; Wright, 1995). Consequently, a continuous model may be more practical for understanding behaviour given the lower demand on resources such as sample size, time and funding. The study therefore plans to examine the relative utility of a

continuous model of F&V intake. Several continuous models are reviewed below including the health belief model (Janz & Becker, 1984), social cognitive theory (Bandura, 1986), theory of reasoned action (Ajzen & Fishbein, 1980), and theory of planned behaviour (Ajzen, 1991). The strength of the relationship among factors has been interpreted using Cohen's (1992) guidelines in which .10, .30 and .50 reflect small, moderate and large effects respectively. The review also aims to identify factors which may be useful to integrate into a single model.

Health Belief Model

The health belief model (HBM [Janz & Becker, 1984]) was developed in the 1950s to understand the widespread failure of people to undertake preventive disease behaviours (e.g., immunisation) and screening for early detection of asymptomatic disease (Janz & Becker, 1984; Janz, Champion & Strecher, 2002). As illustrated in Figure 2.3, the HBM claims behaviour is influenced by several health beliefs. These factors include specific health threats, which are based on subjective perceptions of susceptibility to disease and the severity of disease (Janz & Becker, 1984; Janz et al., 2002). Perceived benefits and barriers associated with a particular behaviour also influence the course of action taken (Janz & Becker, 1984; Janz et al., 2002). The perceived benefits include beliefs about the efficacy of various actions to reduce the risk of disease, and non-health related benefits (e.g., pleasing others [Clark & Becker, 1998; Janz et al., 2002]). The perceived barriers include tangible and psychological costs such as the negative side effects, expense, inconvenience, and unpleasantness (e.g., difficult and upsetting [Janz & Becker, 1984; Janz et al., 2002]). Cues to action was added to the model as a trigger to the decision making process and include internal or external cues such as symptoms of disease or media publications (Janz & Becker, 1984; Kohler, Grimley & Reynolds, 1999). Sociodemographic and background variables in the HBM are believed to indirectly impact on behaviour through individual beliefs (Janz et al., 2002).

Several reviews and meta-analyses of the model have been undertaken (e.g., Harrison, Mullen & Green, 1992; Janz & Becker, 1984; Janz et al., 2002; Sheeran & Taylor, 1999). The HBM has primarily been used to examine circumscribed health behaviours and those which are easy to perform such as condom use, disease

screening, and adherence to medical regimens (Brownell & Cohen, 1995a; Janz & Becker, 1984; Janz et al., 2002). For those behaviours which are more difficult and require long term changes, self efficacy from social cognitive theory has also been examined alongside HBM components (Janz et al., 2002). In the HBM, the perceived benefits and barriers, which are akin to the pros and cons in the TTM, tend to be the strongest predictors of behaviour. Evidence suggests perceived susceptibility to disease is also important for preventative health behaviours (see Harrison et al., 1992). On the other hand, the perceived severity of disease tends to be the least predictive dimension of the model (Harrison et al., 1992; Janz et al., 2002). This may be explained in part by the limited variability in perceived severity for some diseases. Most people for example would be expected to rate the risk of cancer as severe (Harrison et al., 1992). As there is a paucity of research examining cues to action, it is more difficult to discern the impact of this factor. Nevertheless, cues to action have been found to have a small impact on dietary behaviour (Contento & Murphy, 1990). Overall, the HBM components tend to have a small-moderate impact on behaviour (Harrison et al., 1992; Sheeran & Taylor, 1999).

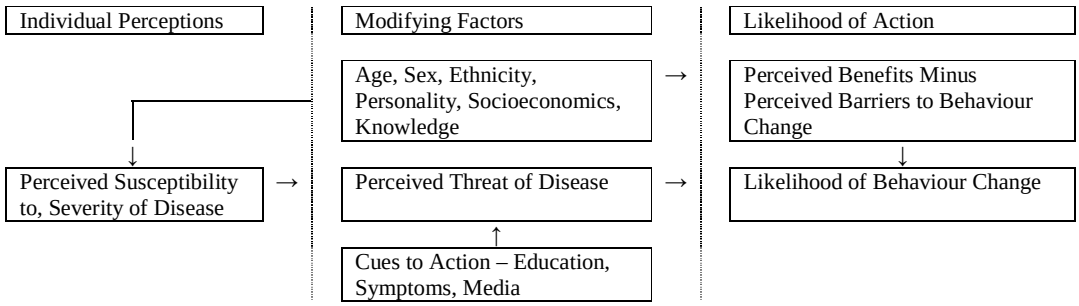

Figure 2.3. Health belief model.

Note. From "The Health Belief Model", by N.K. Janz, V.L. Champion and V.J. Strecher in *Health Behavior and Health Education* (3rd ed., p. 45), by K. Glanz, B.K. Rimer and F.M. Lewis (Eds.), 2002. San Francisco, CA: Jossey-Bass. Copyright 2002 by John Wiley & Sons, Inc.

The impact of HBM components on behaviour may nevertheless be underestimated. The model has been criticised for not clearly defining and operationalising model components (see Armitage & Conner, 2000; Janz et al., 2002; Rutter & Quine, 2002). Measurement of the HBM components has therefore been inconsistent and the psychometric properties of measures are often not adequately assessed. More attention has been paid to scale development however in the area of cancer screening

(e.g., Champion, 1984; see Janz et al., 2002). The HBM has nevertheless been criticised for not clearly specifying the relationship among variables and how they combine to predict behaviour (Armitage & Conner, 2000; Janz et al., 2002; Rutter & Quine, 2002). Despite this, evidence suggests perceived susceptibility to disease may help contribute to a better explanation of F&V intake. With respect to dietary behaviours, Contento and Murphy (1990) found risk perceptions were also among the strongest discriminating factors between those who were eating a healthy diet from those who were not. Perceived susceptibility to disease may therefore be useful to integrate into a single model.

Social Cognitive Theory

Social cognitive theory (SCT [Bandura, 1986]) was developed in the 1970s and synthesises cognitive, emotional and behaviouristic understandings of behaviour change (Baranowski, Perry & Parcel, 2002). Underscoring SCT is the principal of reciprocal determinism; that is the person, behaviour and environment all interact so change in one component affects the others (Bandura, 1986). According to the model, self efficacy is the main determinant of behaviour given its influence on goal setting, as well as people's investment and endurance in behaviour change (Bandura, 1986, 2000; Baranowski et al., 2002; Schwarzer, 2001). Self efficacy refers to one's confidence in their ability to successfully perform a particular behaviour (Bandura, 1986). "It is concerned not with the skills one has but with judgements of what one can do with whatever skills one possesses" (Bandura, 1986, p. 391). Self efficacy is influenced by previous performance accomplishments, observational learning of others (i.e., modelling), verbal persuasion, and emotional and physiological reactions to the behaviour (e.g., stress and tension [Bandura, 1998; Baranowski et al., 2002]). Other key determinants of behaviour include outcome expectations or the perceived positive and negative consequences of the behaviour, outcomes expectancies or the value placed on particular outcomes (e.g., valuing health and wellbeing), self-control or one's ability to control their own behaviour (e.g., setting individual behavioural goals and self monitoring), as well as knowledge of associated health risks (Banudra, 2004; Baranowski et al., 2002).

Several reviews and meta-analyses of the SCT have been undertaken (Bandura, 1986, 1997, 2000, 2004; Baranowski et al., 2002; Holden, 1991; Stajkovic & Luthans, 1998). Much of the research has however focused on the role of self efficacy. Self efficacy tends to have a moderate impact on intentions and behaviour (Armitage & Conner, 2000; Holden, 1991; Schwarzer, 1992; Stajkovic & Luthans, 1998). The impact of health values on the other hand tends to be small (e.g., Abella & Heslin, 1984; Contento & Murphy, 1990). Baranowski and colleague's (2003) review of the model provides further evidence to suggest outcome expectancies influence intentions, while modelling and intentions/goal setting are related to behaviour. The assessment of SCT constructs has nevertheless been subject to criticism and the utility of the model in predicting behaviour may be enhanced by increased specificity and measurement refinement (Baranowski et al., 2002; Wallston & Wallston, 1984). While self efficacy is included in the TTM, and outcome expectations are akin to the pros and cons, the SCT nevertheless suggests the influence of other people, knowledge and environmental determinants may be important to consider in an integrated model.

Theory of Reasoned Action/Theory of Planned Behaviour

The theory of reasoned action (TRA [Ajzen & Fishbein, 1980]) was developed in the late 1960s in an attempt to understand the relationship between cognitive variables (e.g., beliefs and attitudes) and behaviour (Rimer, 2002). According to the model, the proximal determinant of behaviour is intentions (Ajzen, 2002; Ajzen & Fishbein, 1977). Intentions in turn are influenced by attitudes and subjective norms (Ajzen & Fishbein, 1977). Attitude refers to an evaluation of the positive and negative outcomes associated with performing the behaviour (Ajzen, 1991; Armitage & Conner, 2001; Rivis & Sheeran, 2003). Subjective norms on the other hand refer to the social pressure from others to perform (or not perform) the behaviour (Ajzen, 1991). As summarised in Figure 2.4, the theory of planned behaviour (TPB) extends the TRA by including perceived behavioural control (PBC). PBC was added to the model to understand action when complete control over the behaviour was lacking (Ajzen, 1991, 2002). PBC combines beliefs about the behaviour being under voluntary control, as well as how easy or difficult it is to perform the behaviour (Ajzen, 1991, 2002). PBC is therefore conceptually similar to self efficacy in the

SCT. As indicated in Figure 2.4, PBC may directly influence behaviour or indirectly through intentions (Ajzen, 2002). Consequently, behavioural performance may be restricted among people with high intentions if they lack a sufficient level of control.

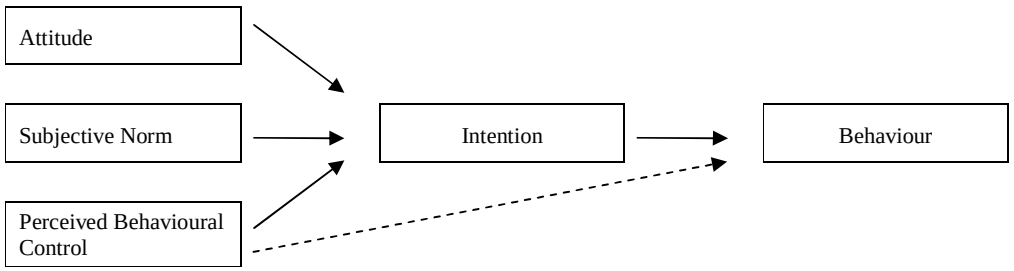

Figure 2.4. Theory of planned behaviour.

Note. Adapted from "The theory of planned behavior", by I. Ajzen, 1991, *Organizational Behavior and Human Decision Processes, 50*, p. 182. Copyright 1991 by Academic Press.

A number of reviews and meta-analyses of the TRA/TPB have been undertaken (Ajzen, 1991, 2002; Albarracin, Johnson, Fishbein & Muellerleile, 2001; Armitage & Conner, 2001; Cooke & Sheeran, 2004; Montano & Kasprzyk, 2002; Sheeran & Taylor, 1999). Overall, attitudes, subjective norms, and PBC tend to have a moderate-large impact on intentions (Albaraccin et al., 2001; Armitage & Conner, 2001; Rivis & Sheeran, 2003; Sheeran & Taylor, 1999). In addition, attitudes and subjective norms tend to collectively account for 30-35% of the variance in intentions (Ajzen & Fishbein, 1973; Albaraccin et al., 2001; Sheeran & Taylor, 1999). PBC tends to explain an additional 5% of the variance in intentions over and above attitudes and subjective norms (Armitage & Conner, 2001; Cooke & Sheeran, 2004; Rivis & Sheeran, 2003; Sheeran, Conner & Norman, 2001). While PBC has been assessed with self efficacy and/or perceived control items, factor analyses indicate these factors are empirically distinct and evidence also suggests they are not associated with intentions and behaviour in the same manner (Armitage & Conner, 1999a, 2001; Manstead & van Eekelen, 1998; Povey, Conner, Sparks, James & Shepherd, 2000a; Sparks, Guthrie & Shepherd, 1997; Terry & O'Leary, 1995; White, Terry & Hogg, 1994). Findings indicate self efficacy has a larger impact on intentions and behaviour than perceived control. Perceived control may nevertheless be useful to include as a separate component alongside self efficacy in an integrated model. In addition, while attitudes are conceptually similar to decisional balance in

the TTM, the TRA/TPB also suggests the impact of other people is important to consider.

In the TPB, the impact of intentions on behaviour tends to be moderate-large (Ajzen & Fishbein, 1973; Albaraccin et al., 2001; Armitage & Conner, 2001). For example, Armitage and Conner (2001) found intentions accounted for 22% of the variance in behaviour in a meta-analysis of a range of health behaviours. This study also found intentions were more predictive of behaviour than conceptually similar measures of desires (33% vs. 22% respectively). Evidence also suggests PBC independently predicts behaviour when intentions are controlled for (Armitage & Conner, 2001). Although intentions and PBC tend to collectively explain a larger proportion of variance in self reported than observed behaviour (31% vs. 20% respectively [Armitage & Conner, 2001]). While the TPB also assumes PBC moderates the impact of intentions in predicting behaviour, there is a paucity of research examining this relationship (see Ajzen, 1991). The study therefore plans to examine the interaction between intentions and self efficacy in predicting F&V intake. Findings to date however suggest intentions and PBC largely combine to influence behaviour (see Ajzen, 1991; Armitage & Conner, 2001). It is nevertheless possible other factors interact with intentions and self efficacy to impact on behaviour.

Several other variables have been examined within the framework of the TPB which may be useful to include in an integrated model including descriptive norms and self identity. A broader conceptualisation of normative influences was recommended in the literature following reviews of the TPB which indicated subjective norms were the least predictive dimension of the model (see Armitage & Conner, 2001; Astrom & Rise, 2001; Rivis & Sheeran, 2003). Descriptive norms refer to the perceived behaviour of others (e.g., whether or not important others eat a healthy diet). A meta-analysis found descriptive norms had a moderate impact on positive health behaviours (Rivis & Sheeran, 2003)[17]. While descriptive and subjective norms also tend to be moderately correlated, descriptive norms have been independently related to intentions when other TPB variables have been controlled for (Rivis & Sheeran, 2003). The impact of self identity has also been examined. Self identity reflects a

[17] Descriptive norms were found to have a larger impact on health risk behaviours.

more subtle normative influence based on the roles and labels people use to describe themselves in their everyday interactions with others and their positions in the social structure (Bisogni, Connors, Devine & Sobal, 2002; Callero, 1985; Sparks & Guthrie, 1998; Terry, Hogg & White, 1999). Previous research for example has examined one's identity as a health conscious person or healthy consumer (e.g., Armitage & Conner, 1999ab; Sparks & Shepherd, 1992; Sparks, Shepherd, Wieringa & Zimmermans, 1995). For a range of health behaviours self identity has been shown to have a moderate impact on intentions (Conner & Armitage, 1998). An additional 5% of the variance in intentions also tends to be explained by self identity and descriptive norms when TPB variables are controlled for (Astrom & Rise, 2001; Rivis & Sheeran, 2003; Sparks & Sheppard, 1992; Terry et al., 1999).

The variance accounted for by factors over and above the TPB's existing components has largely been the focus of previous research given Ajzen's (1991) claim:

> The theory of planned behavior, is in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behaviour after the theory's current variables have been taken into account. (p. 199).

Research has therefore tended to examine the impact of additional factors in predicting intentions once attitudes, subjective norms, and PBC have been controlled for. Similarly, the impact of factors on behaviour has been examined once intentions and PBC have been taken into account. Previous research has therefore been mainly concerned with the predictive value of the model.

Less research has focused on developing a better understanding of the causal pathways by which factors impact on behaviour. In the TPB, the impact of psychosocial factors on behaviour is expected to be largely indirect and mediated by intentions (Ajzen, 1991; Ajzen & Fishbein, 1980). There are however few tests of this assumption. While it is possible factors indirectly impact on behaviour through intentions, they may also have a direct impact on behaviour, impact on behaviour through other factors, or only influence intentions. Evidence nevertheless suggests the impact of subjective norms is through intentions, but the impact of attitudes is less consistent with some studies finding direct effects and others finding only indirect effects (e.g., Bagozzi, 1981; Bentler & Speckart, 1979; Fredricks & Dossett, 1982).

An examination of possible mediating effects would help develop a better understanding of the mechanism by which factors influence behaviour, refine models and aid the design of interventions (see Baranowski, Anderson & Carmack, 1998; Bauman, Sallis, Dzewaltowski & Owen, 2002; Kristal, Glanz, Tilley & Li, 2000; Rimer, 2002; Sutton, 1998). The current study therefore aims to contribute to a better understanding of behaviour by examining whether the psychosocial factors directly or indirectly impact on behaviour through intentions.

In summary, prominent frameworks which have been used to understand and predict health-related behaviours have been reviewed. These theories have generated a large amount of research and have been applied to a wide range of health behaviours, including dietary behaviours. Although the TTM is a more complex model, if behaviour change does follow a stage process then interventions matched to one's stage of change should be more effective in facilitating change than standardised intervention programs. The study therefore plans to examine an integrated stage model. If however, the TTM reflects an underlying continuum of intentions and/or behaviour then a more parsimonious linear model may be sufficient for understanding behaviour and in designing interventions aimed at increasing F&V intake. Among the continuous models examined the TPB appears to account for the largest proportion of variance in behaviour. The utility of the TPB in predicting behaviour has been attributed to the higher level of attention paid to measurement issues and the specificity of relationships (see Ajzen, 2002; Ajzen & Fishbein, 1977; Rimer, 2002; Wallston & Wallston, 1984). The study therefore plans to also examine the utility of an extended continuous model based on the TPB.

A number of factors which may be usefully integrated into a single model to develop a better understanding of behaviour have been identified. An integration of theoretical factors from alternate models of behaviour should however be thoughtful, parsimonious, and give consideration to the conceptual overlaps among variables (Montano & Kasprzyk, 2002; Rimer, 2002; Weinstein, 1993). The review suggests the key theoretical variables contained in the TTM are also important in other models. While decisional balance in the TTM refers to the relative weighing of the pros and cons associated with behaviour, the benefits and barriers are also examined explicitly in the HBM. In the TRA/TPB the benefits and barriers underlie attitudes and in SCT

they are embodied in outcome expectations (Rimer, 2002). The major contribution of SCT to understanding behaviour is the concept of self efficacy. Self efficacy has been included in the TTM and adapted to include temptation for negative health behaviours. Self efficacy has also been examined explicitly alongside HBM components and included implicitly in perceived barriers (Janz & Becker, 1984; Rimer, 2002). Self efficacy is also conceptually similar to PBC in the TPB (Ajzen, 1999; Rimer, 2002; Sheeran & Taylor, 1999). Although the conceptualisation of these factors varies in different models, their meaning and the methods used to assess them are essentially indistinguishable from one theory to another (Weinstein, 1993).

Other psychosocial factors important in several models include perceived control and normative beliefs. In the TPB, perceived control underlies the concept of PBC (along with self efficacy) and self-control is a key component in SCT. The influence of other people on individual behaviour is a central factor in the TRA/TPB and SCT. Subjective norms or the approval (or disapproval) from others in performing a behaviour is a key component of the TRA/TPB. Reviews of the TRA/TPB have however recommended a broader conceptualisation of normative beliefs and as a result descriptive norms and self identity have also been examined (see Armitage & Conner, 2001; Astrom & Rise, 2001; Rivis & Sheeran, 2003). Descriptive norms refer to the behaviour of others while self identity reflects personal norms. In SCT, observational learning or the modelling of behaviour by others and verbal persuasion are also considered important. Finally, perceived susceptibility to disease is a key component of the HBM which may also contribute to a better understanding of F&V intake. The study therefore plans to examine a number of psychosocial factors including the perceived pros and cons, self efficacy, control, subjective and descriptive norms, self identity and susceptibility to disease.

Given psychosocial factors are more amenable to change they have been the main focus of the health behaviour theories reviewed. A primary focus on individual factors may however decontextualise behaviour and contribute to blaming people for eating an unhealthy diet (see Linney, 1990; McKinlay, 1995). Other factors more external to the individual may also be important and impact on behaviour either directly or indirectly through psychosocial factors. Orleans (2000) has recommended expanding current health behaviour theories to take into account social environmental

variables. The study therefore plans to examine the impact of sociodemographic factors including age, education, and income, as well as food insecurity, and awareness of F&V guidelines. Food insecurity refers to the limited or uncertain availability of nutritious, safe and personally acceptable foods that can be acquired in socially acceptable ways (Anderson, 1990). As F&V guidelines are largely promoted by public health and media campaigns, awareness of F&V guidelines have also been included as a contextual factor in the current study. An examination of these factors may contribute to a better understanding of factors influencing individual beliefs, help identify those who may benefit from targeted interventions, and avenues for environmental interventions which may be used to complement and support individual approaches (Brownson, Haire-Joshu & Luke, 2006; Kumanyika, 2001; Swinburn, Egger & Raza, 1999). The study therefore plans to use a multiple level approach which integrates individual level psychosocial factors and contextual factors. In the following chapter the psychosocial and contextual factors are examined in more detail with respect to the stages of change for F&V intake. The relationship of these factors with behaviour will also be reviewed. The impact of psychosocial factors on intentions will also be examined given the impact of these factors on behaviour is expected to be indirect and mediated by intentions.

3. Psychosocial & Contextual Factors

Improving nutrition is a priority population health objective in the New Zealand (N.Z.) Health Strategy (Ministry of Health [MOH], 2000). Fruit and vegetable (F&V) intake was identified as one important aspect of what we eat in Chapter 1. Low F&V intake is associated with an increased risk of mortality and chronic disease including heart disease, stroke and some cancers (Bazzano, 2006; Dauchet, Amouyel & Dallongeville, 2005; Dauchet, Amouyel, Hercberg & Dalllongeville, 2006; He, Nowson & MacGregor, 2005; MOH & University of Auckland, 2003; Nanney, Haire-Joshu, Hessler & Brownson, 2004; Ness & Powles, 1997; Riboli & Norat, 2003; Tobias et al., 2006; Van Duyn & Pivonka, 2000). A high level of F&V consumption on the other hand is related to a reduced risk of chronic disease and other chronic disease risk factors including diabetes and hypertension (Bazzano, 2006; La Vecchia, Decarli & Pagano, 1998; Nanney et al., 2004; Shikany & White, 2000; Van Duyn & Pivonka, 2000). An adequate level of F&V intake combined with physical activity may also help reduce the risk of obesity (see Sullivan, Oakden, Young, Lau & Lawson, 2004). The N.Z. food and nutrition guidelines therefore recommend the consumption of at least 5 servings of F&Vs each day (MOH, 2003a). Despite the range of health benefits conferred by eating plenty of F&Vs, a large proportion of N.Z. adults do not consume a sufficient amount of F&Vs each day (e.g., MOH, 2003b, 2006; Russell, Parnell, Wilson et al., 1999; Tobias, Jackson, Yeh & Huang, 2007). Males are nevertheless less likely to meet the guidelines for F&V intake than females.

The study aims to develop a better understanding of the process of behaviour change and those factors which may help facilitate a higher level of F&V intake. Prominent theories of health behaviour were therefore reviewed in Chapter 2. The transtheoretical model (TTM) is a popular model and widely used by health professionals and researchers in the field. The other health behaviour theories nevertheless offered insights into factors which may be useful to integrate into a single model of health behaviour. As opposed to the traditional approach of deciding which theory outperforms the others, the integration of psychosocial factors from different theoretical models is currently being advocated in health behaviour research

to facilitate a more comprehensive understanding of behaviour, improve the explanatory power of models and to potentially develop more robust interventions (Armitage & Conner, 2001; Prochaska et al., 1994; Rimer, 2002; Rutter & Quine, 2002; Weinstein, 1993). The other health behaviour theories reviewed included the health belief model (HBM), social cognitive theory (SCT), theory of reasoned action (TRA), and its extension, the theory of planned behaviour (TPB). After taking into account the conceptual overlaps among variables, a number of psychosocial factors were identified including perceived pros and cons associated with behaviour, self efficacy, control, subjective and descriptive norms, self identity, and susceptibility to disease. Other contextual factors may nevertheless contribute to a more comprehensive understanding of behaviour and help identify other possible avenues for intervention. The study therefore plans to use a multiple level approach which incorporates psychosocial and contextual factors including age, education, income, food insecurity and awareness of F&V guidelines. In this chapter the psychosocial and contextual factors will be examined in relation to F&V intake specifically and the stages of change.

Stage of change is the core construct in the TTM. There are five stages of change which include precontemplation, contemplation, preparation, action and maintenance. In the preaction stages (i.e., precontemplation, contemplation and preparation) people vary in their intentions of performing the behaviour in the future, while those in the postaction stages (i.e., action and maintenance) differ in the duration of behavioural performance. The TTM assumes successful behaviour change is achieved by progressing through the stages of change, from one stage to the next (Weinstein, Rothman & Sutton, 1998). A clear understanding of those factors which are important at different stage transitions is therefore required to develop effective stage matched interventions (Bridle et al., 2005; Horwath, 1999; Kraft, Sutton & Reynolds, 1999; Weinstein, Rothman et al., 1998). Consequently, people in adjacent stages of change are compared (i.e., precontemplation-contemplation, contemplation-preparation, preparation-action, and action-maintenance [Weinstein & Sandman, 2002]). In this chapter the impact of psychosocial and contextual factors at different stage transitions will be examined. To identify those factors which are important the *magnitude of standardised mean differences* is also considered and interpreted using

Cohen's (1992) guidelines which suggest .20, .50 and .80 reflect small, medium and large effect sizes respectively.

Stage models also assume different factors are important in different stages of change (Weinstein, Rothman et al., 1998). Consequently, stage matched interventions (i.e., one intervention matched to each stage) are expected to be more effective in facilitating behaviour change than standardised intervention programmes. If different factors are important in different stages of change then non-linear patterns should largely be found. In other words, mean scores on factors are *not* expected to consistently increase (or decrease) across the stages of change in a linear pattern (Sutton, 2000; Weinstein, Rothman et al., 1998). In contrast to stage model assumptions, linear patterns suggest a factor may help facilitate behaviour change in all stages of change. Sutton (2000) has therefore recommended testing for linear trend and departures from linear trend. The overall pattern of scores on psychosocial and contextual factors across the stages of change is therefore considered.

If linear patterns are found on most factors then the stages may reflect "pseudo" rather than genuine stages based on an underlying continuum (Sutton, 2000; Weinstein, Rothman et al., 1998). If the stages of change reflect an underlying continuum then a more parsimonious continuous model may be sufficient for understanding F&V intake. In contrast to stage models, continuous models conceptualise behaviour change as involving small naturally occurring shifts along a continuum (Weinstien, Rothman et al., 1998). The TPB has been identified as one continuous model which may be useful to extend for F&V intake. In the TPB, intentions are assumed to be the proximal determinant of behaviour. In addition, the impact of psychosocial factors on behaviour is largely expected to be indirect and mediated by intentions. Although, beliefs about the behaviour being under one's own control and the perceived difficulty of behavioural performance are expected to directly influence behaviour (Ajzen, 1991, 2002). The impact of the psychosocial and contextual factors is therefore examined in relation to F&V intake, as well as the impact of the psychosocial factors on intentions. The *strength of the relationship* between factors has been interpreted using Cohen's (1992) guidelines which suggest correlations of .10, .30, and .50 represent small, moderate and large effect sizes respectively.

Contextual Factors

This section examines the contextual factors in relation to F&V intake and the stages of change. The contextual factors examined include age, education, income, food insecurity, and awareness of F&V guidelines.

Age

Older people have witnessed dramatic changes in the supply of food over the last 50 years. Restaurants first appeared in N.Z. in the 1960s, followed by fast food restaurants in the 1970s (Bailey & Earle, 1999). There has also been a shift away from home grown F&Vs over the last 20 to 30 years as a wide variety and amount of commercially grown produce is now available year round (Bailey & Earle, 1999). Despite these changes, F&V consumption has been positively related to age (e.g., Australian Bureau of Statistics, 2006; Blanck et al., 2007; Guenther, Dodd, Reedy & Krebs-Smith, 2006; Hoare et al., 2004; Magarey, McKean & Daniels, 2006; MOH, 2004b; Russell, Parnell, Wilson et al., 1999). The 1997 National Nutrition Survey (NNS97) and 2002/03 N.Z. Health Survey (NZHS) for example found older people were more likely to meet the guidelines for F&V intake (MOH, 2004b; Russell, Parnell, Wilson et al., 1999).

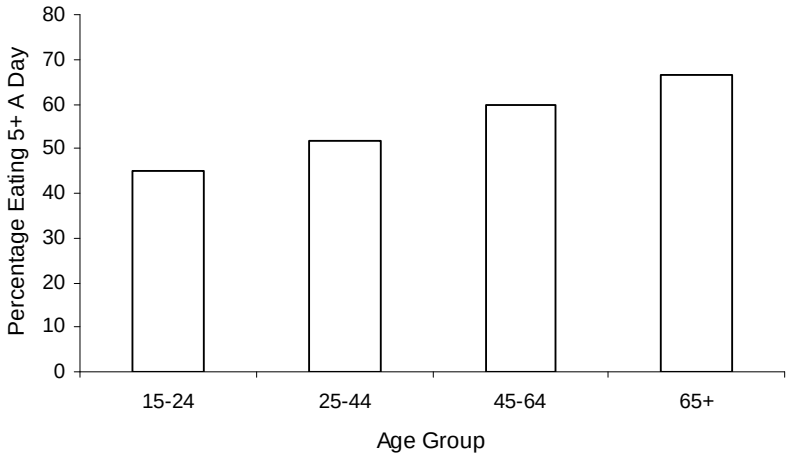

Figure 3.1. Proportion of adults consuming 5 or more servings of fruit and vegetables a day in New Zealand.

Note. Adapted from "Do healthy and unhealthy behaviours cluster in New Zealand?", by M. Tobias, G. Jackson, L-C. Yeh and K. Huang, 2007, *Australian and New Zealand Journal of Public Health, 31*(2), p.157. Copyright 2007 by the Public Health Association of Australia.

As illustrated in Figure 3.1, about two thirds of adults over the age of 65 were eating a healthy diet comprised of 5 or more servings of F&Vs a day in the 2002/03 NZHS, compared to less than half of those aged between 15 and 24 (Tobias et al., 2007). Although the average level of F&V intake also increases with age, some studies have found slight decreases in consumption in the oldest age groups (Guenther et al., 2006; Henderson, Gregory & Swan, 2002; Johannson, Thelle, Solvoll, Bjorneboe & Drevon, 1999; Stables et al., 2002; Trudeau, Kristal, Li & Patterson, 1998; Wardle, Parmenter & Waller, 2000). Younger adults nevertheless have a higher risk of low F&V intake.

Age has also been examined in relation to the stages of change for F&V intake (Campbell et al., 1998; De Vet, De Nooijer, De Vries & Brug, 2005a; Kloek, van Lenthe, van Nierop & Mackenbach, 2004; Laforge, Greene & Prochaska, 1994; Perkins-Porras, Cappuccio, Rink, Hilton, McKay & Steptoe, 2005; Resnicow, McCarty & Baranowski, 2003; Van Duyn et al., 1998). Those in the contemplation, preparation and action stages tend to be younger than in the precontemplation and maintenance stages. Mean differences in age between the precontemplation and contemplation stages, and action and maintenance stages tend to be small-moderate (e.g., De Vet et al., 2005a; Perkins-Porras et al., 2005; Resnicow et al., 2003). The results of a Dutch survey (De Vet et al., 2005a) examining fruit intake are illustrated in Figure 3.2 for example.

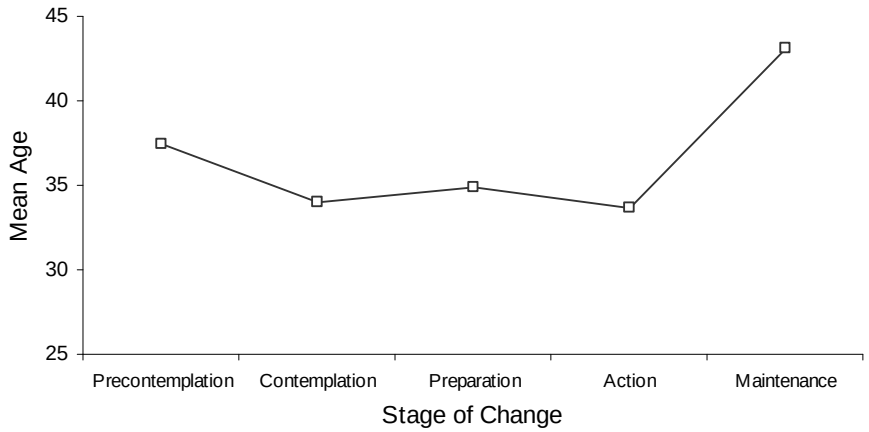

Figure 3.2. Age across the stages of change for fruit intake.

Note. Adapted from "Stages of Change for Fruit Intake: A Longitudinal Examination of Stability, Stage Transitions and Transition Profiles", by E. De Vet, J. De Nooijer, N.K. De Vries and J. Brug, 2005, *Psychology and Health, 20,* p.418.

Age therefore appears to differ across the stages of change for F&V intake and primarily differentiate between the precontemplation and contemplation stages, and those in the latter stages of change. Consequently, the overall pattern on age appears to be non-linear, in line with stage model assumptions.

Education

One proxy indicator of socioeconomic status is education. Those who are more educated tend to have a higher level of F&V intake (Krebs-Smith & Kantor, 2001; Johansson et al., 1999; Metcalf, Scragg & Davis, 2006; Stables et al., 2002; Trudeau et al., 1998; Wardle et al., 2000). Similar results were reported in a meta-analysis of European studies (Irala-Estevez, Groth, Johansson, Oltersdorf, Prattala & Martinez-Gonzalez, 2000). U.S. surveys also indicate those with a higher level of education are more likely to eat at least 5 servings of F&Vs a day (e.g., Blanck et al., 2007; Li, Serdula, Bland, Mokdad, Bowman & Nelson, 2000; Serdula, Coates, Byers, Simoes, Mokdad & Subar, 1995; Serdula, Gillespie, Kettel-Khan, Farris, Seymour & Denny, 2004; Stables et al., 2002). In the 2000 Behavioral Risk Factor Surveillance System (BRFSS) for example nearly 29% of college graduates had an adequate level of F&V intake compared to 20% of those with less than a high school education (Serdula et al., 2004). Low education therefore increases the risk of low F&V intake.

Across the stages of change, education has also been examined in relation to F&V intake (e.g., De Vet et al., 2005a; Campbell et al., 1998; Kloek et al., 2004; Laforge et al., 1994; Perkins-Porras et al., 2005; Resnicow et al., 2003; Van Duyn et al., 1998). Summarised in Table 3.1 are stage distributions based on education level. Findings indicate those who are less educated are more likely to be in the precontemplation stage, while those with a higher level of education are more likely to be in the maintenance stage. Education therefore appears to differ across the stages of change and differentiate between the precontemplation and contemplation stages, and those in the latter stages of change. While differences in education between adjacent stages may only be small, education appears to increase across the stages of change.

Table 3.1. *Stage of Change Distributions for Fruit & Vegetable Intake by Educational Level (row percentage)*

Target			Education		Stage of change %				
behaviour	Reference	Sample	level	*n*	PC	C	P	A	M
Fruit	DeVet et al., (2005a)	Dutch internet panel	Low	121	39	19	10	7	25
			Medium	350	31	24	14	8	23
			High	264	32	19	17	5	27
			Total	735	33	21	14	7	25
F&V	Resnicow et al., (2003)	African American adults	<High School	395	7	4	64	6	19
		from 14 churches in the	>High School	509	10	3	61	3	23
		Eat for Life Trial	Total	904	9	3	62	4	21
F&V	Campbell et al., (1998)	African American adults	<8th grade	466	30	4	59	7 *	
		from 50 churches in North	<High School	592	22	3	66	9 *	
		Carolina participating in a	High School	1,194	21	3	69	6 *	
		5+ A Day study	>High School	1,294	24	3	63	10 *	
			Total	3,546	24	3	65	8 *	
F&V	Van Duyn et al., (1998)	Random telephone baseline	<12 years	363	24	2	11	48	15
		5+ A Day survey in 1991	12 years	973	19	3	13	39	26
			>12 years	1,469	17	3	14	31	35
			Total	2,797	19	3	13	37	28

PC = Precontemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance. * Includes Action and Maintenance. Data in rows 1, 2, and 4 are adapted from column percentages.

Income

Income influences the amount of money which can be spent on food including F&Vs. As illustrated in Figure 3.3, a basic healthy diet for a male in N.Z. is estimated to cost $50 per week and $48 for a female (Department of Human Nutrition, University of Otago, 2007; MOH, 2006). The cost of moderate and liberal diets are also illustrated in Figure 3.3. The price of healthy and alternative food choices have also been compared. Few differences in the cost of milk, bread and cereals were found in one N.Z. study when a healthy food basket was compared to regular food choices (Ni Mhurchu & Ogra, 2007). Healthier choices for meat, butter/margarine and cheese were however 27%, 44%, and 19% higher respectively (Ni Mhurchu & Ogra, 2007). An Australian study found the substitution of current food choices with healthier options also resulted in an overall increase in cost (McAllister, Baghurst & Record, 1994). Furthermore, food pricing favours higher, rather than lower saturated fat options, and energy dense foods high in grains, sugars and fats (Drewnowski & Darmon, 2005; Drewnowski & Specter, 2004; Rush, Puniani, Snowling & Paterson, 2007; Wilson & Mansoor, 2005). Potato chips, chocolates and biscuits for example cost less and provide more energy than F&Vs (Drewnowski & Specter, 2004; Rush et al., 2007). Overall food expenditure may therefore increase among those planning to eat a healthier diet.

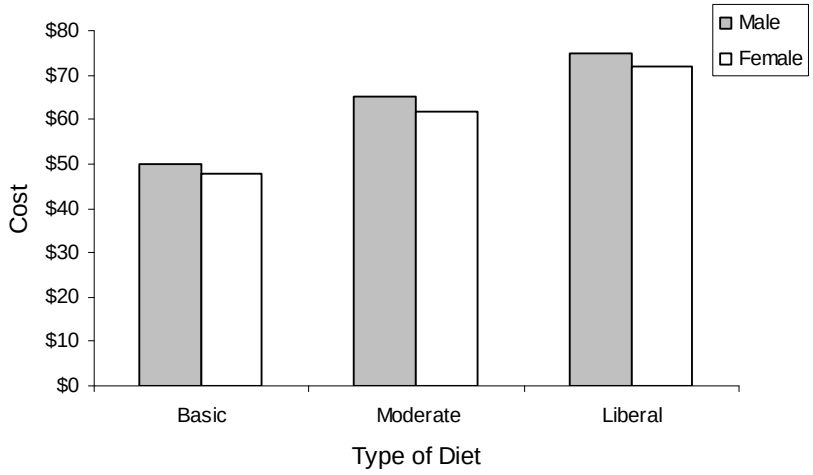

Figure 3.3. Cost of a healthy diet a week for males and females in New Zealand, 2007.

Note. Adapted from *Information Package for Users of the Estimated Food Costs*, by Department of Human Nutrition, University of Otago, 2007, Dunedin, New Zealand: Otago University.

Food expenditure was examined in the 2002/03 N.Z. Household Economic Survey (MOH, 2006; Statistics N.Z., 2004). Low income households spend a greater proportion of their income on food. Households with incomes under $15,900 for example spend at least 23% of their income on food[18], while the average household spends 12%[19] (MOH, 2006; Statistics N.Z., 2004). Low income households nevertheless spend less money on food in total, including F&Vs and eating out (Drewnowski & Specter, 2004; Kilpatrick & Tarasuk, 2003; Ricciuto, Tarasuk & Yatchew, 2006; Santich, 1992; Shepherd, Paisley, Sparks, Anderson, Eley & Lean, 1996; Turrell, Blakely, Patterson & Oldenburg, 2004). While income also influences the *quantity* of F&Vs purchased, it appears to have less impact on staple food items such as meat, milk and bread (Ricciuto et al., 2006). The *quality* likely differs however as expenditure also increases in relation to income, especially for meat (Ricciuto et al., 2006).

F&V consumption was also higher in a N.Z. workforce study among high income compared to low income groups, in line with earlier studies (Deshmukh-Taskar, Nicklas, Yang & Berenson, 2007; Johansson et al., 1999; Kamphuis, Giskes, de Bruijn, Wendel-Vos, Brug & van Lenthe, 2006; Krebs-Smith & Kantor, 2001; Metcalf et al., 2006; Shepherd et al., 1996). An Australian survey also found low income households were more likely *not* to have eaten F&Vs the previous day, while high income households eat a greater variety of F&Vs and would like to increase their consumption (Giskes, Turrell, Patterson & Newman, 2002)[20]. Those with higher incomes are also more likely to meet the guidelines for F&V intake (e.g., Blanck et al., 2007; Casagrande, Wang, Anderson & Gary, 2007). Low income therefore appears to be a risk factor for an inadequate level of F&V consumption.

[18] Based on an average weekly expenditure of $70 on food including meals away from home (Statistics N.Z., 2004).
[19] Based on an average weekly expenditure of $143 per week and an average income of $60,433 per annum (Statistics N.Z., 2004).
[20] These findings do not necessarily apply to adolescents.

Table 3.2. *Stage of Change Distributions for Fruit & Vegetable Intake by Income Level (row percentage)*

Target behaviour	Reference	Sample	Household income	*n*	Stage of change %				
					PC	C	P	A	M
F&V	Resnicow et al., (2003)	African American adults from 14 churches participating in the Eat for Life Trial	<40,000	499	8	3	65	5	19
			>40,000	405	9	4	59	4	24
			Total	904	9	3	62	4	21
F&V	Campbell et al., (1998)	Members of 50 black churches in 10 rural counties in North Carolina participating in a 5+ A Day study	<20,000†	2,157	25	3	64	7 *	
			>20,000	1,400	22	3	66	9 *	
			Total	3,557	24	3	65	8 *	
F&V	Van Duyn et al., (1998)	Random telephone 5+ A Day 1991 baseline survey	<130% PIR	506	18	4	15	45	18
			130-300% PIR	973	18	3	14	37	28
			>300% PIR	1,098	20	3	12	34	31
			Total	2,797	22	3	13	35	27

PC = Precontemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance. * Includes Action and Maintenance. † Median income. PIR = Poverty Income Ratio (based on % poverty, adjusts for income and household size). Data in row 1 and 3 are adapted from column percentages.

Income has been examined across the stages of change for F&V intake (e.g., Campbell et al., 1998; Perkins-Porras et al., 2005; Resnicow et al., 2003; Van Duyn et al., 1998). Stage distributions based on income are summarised in Table 3.2. Findings indicate those with higher incomes are more likely to be in the postaction stages for F&V intake. The 5+ A Day baseline survey also suggests the poverty-income-ratio primarily differs in the maintenance stage. Income appears to differ little however across the preaction stages. Across the stages of change a non-linear pattern on income is therefore expected, with those in the maintenance stage earning more on average.

Food Insecurity

Food insecurity may be one mechanism by which income has an impact on F&V intake. Food insecurity refers to the limited or uncertain availability of nutritious, safe and personally acceptable foods that can be acquired in socially acceptable ways (Anderson, 1990). Food insecurity ranges in degree from food security (access to nutritious and safe foods at all times), to worry and uncertainty over the household food supply, to reduced variety and quality of foods eaten, to food insufficiency. Food insufficiency reflects not having enough food to eat as it has run out and not being able to afford to buy more (Dubois, Farmer, Girard & Porcherie, 2006; Quine & Morrell, 2005; Rose & Oliveira, 1997). Food insecurity can result in hunger at its highest level and usually impacts on adults first, then children (Anderson, 1990; Bhattacharya, Currie & Haider, 2004; Coates, Frongillo, Rogers, Webb, Wilde & Houser, 2006; Dubois et al., 2006; Edwards, Weber & Bernell, 2007; Kendall, Olson & Frongillo, 1996; Nord, Andrews & Carlson, 2004).

As summarised in Table 3.3, household food insecurity was examined in the NNS97. Only a small proportion of households rely on other people or organisations to provide food when they do not have enough to eat. The variety of food eaten was nevertheless limited by money in about 1 in 4 households. In total, 14% had also run out of food due to a lack of money. In the 2001 Australian National Health Survey, 5% of households (5% males, 6% females) had run out of food and could not afford to buy more in the last 12 months (Australian Bureau of Statistics, 2003). Compared to Australia, food insufficiency may therefore be higher in N.Z.. Food insecurity has

been examined using similar measures in the U.S. and Canada. In 2006, 11% of U.S. households were food insecure, of which about a third (4%) had very low food security[21] (Nord, Andrews, Carlson, 2007). The 2004 Canadian Community Health Survey (Health Canada, 2007) found 9% of households were food insecure (3% adults severe). Based on the response to similar survey items[22], food insecurity may also be higher in N.Z. than the U.S.

Table 3.3. *Household Food Insecurity in the 1997 National Nutrition Survey (sometimes or often)*

Food insecurity item	Females %	Males %	Total %
Can afford to eat properly[a]	85	87	86
Food runs out	16	11	14
Eat less	14	12	13
Variety of foods limited	29	25	27
Rely on others	9	6	7
Use of food grants/banks	6	2	4
Stressed about lack of money for food	15	9	12
Stressed when no food for social occasions	15	9	13

[a] Always. From *NZ Food: NZ People: Key Results of the 1997 National Nutrition Survey* (p. 122), by D.G. Russell, W.R. Parnell, N.C. Wilson et al., 1999, Wellington, New Zealand: Ministry of Health.

The risk of food insecurity and insufficiency is higher among those with lower incomes including women, households containing children and of larger size, headed by a single parent, living in rented accommodation, and located in more deprived areas (Edwards et al., 2007; Laraia, Siega-Riz & Evenson, 2004; Nord et al., 2004, 2007; Parnell, Scragg, Wilson, Schaaf & Fitzgerald, 2003; Radimer, Allsopp, Harvey, Firman & Watson, 1997; Rose & Oliveira, 1997; Russell, Parnell, Wilson, et al., 1999; Vozoris & Tarasuk, 2003). For example, 21% of males and 27% of females living in the most deprived areas of N.Z. were sometimes unable to afford to eat properly in the NNS97 compared to 5-6% in the least deprived areas (Russell, Parnell, Wilson et al., 1999). Similarly, 1 in 5 households containing children were sometimes unable to afford to eat properly in 2002 (Parnell et al., 2003). Younger adults also

[21] This is the terminology now used in the US to refer to those who are food insecure with hunger.
[22] In the U.S., 15% were worried food would run out before (I/we) got money to buy more, 12% food bought didn't last and (I/we didn't have money to get more, 11% couldn't afford to eat balanced meals (Nord et al., 2007).

have a higher risk of food insecurity and insufficiency (Parnell, Reid, Wilson, McKenzie & Russell, 2001; Russell, Parnell, Wilson et al., 1999; Temple, 2006), and food insecurity is more common in socioeconomically disadvantaged ethnic groups including Maori and Pacific Islanders (Nord et al., 2004, 2007; Parnell et al., 2001; Rush et al., 2007; Te Hotu Manawa Maori, 2007).

Although food insecurity and insufficiency do not appear to influence the consumption of total fat as a percentage of energy, or the consumption of meat, bread and take-aways (Dixon, Winkleby & Radimer, 2001; Gulliford, Mahabir & Rocke, 2003; Gulliford, Mahabir, Nunes & Rocke, 2005; Kendall et al., 1996; Radimer, et al., 1997), the quality of food choices may differ. Older adults who are food insufficient nevertheless have a lower level of total energy intake (Dixon et al., 2001; Rose & Oliveira, 1997). Food insecurity and insufficiency are also associated with low F&V consumption (Dixon, et al., 2001; Gulliford et al., 2003, Kendall et al., 1996; Quine & Morrell, 2005; Radimer et al., 1997). Although the consumption of potatoes does not differ in relation to food insecurity and insufficiency status (Dixon et al., 2001; Kendall et al., 1996), total F&V intake is lower on average among those experiencing higher levels of food insecurity.

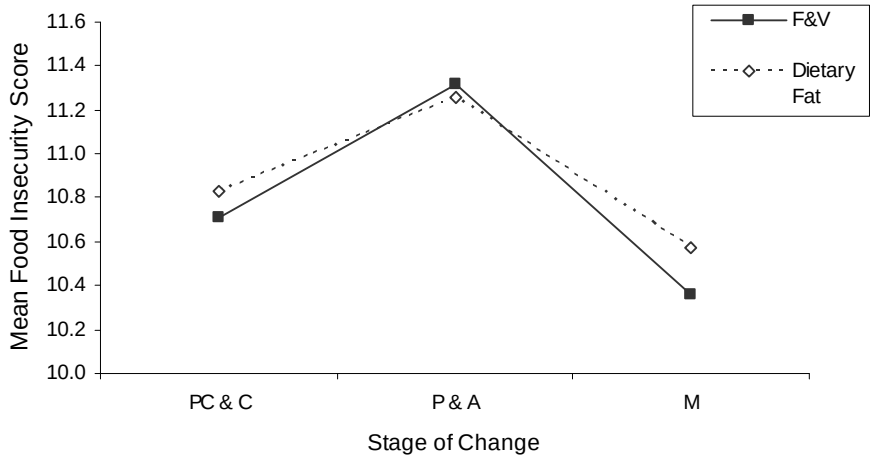

Figure 3.4. Food insecurity in stages of change for fruit and vegetable, and dietary fat intake among Maori women.

PC = Precontemplation C = Contemplation, P = Preparation, A = Action, M = Maintenance. F&V = Fruit and vegetable. Adapted from "Stages of Change for Fruit and Vegetable Intake and Dietary Fat Modification in Maori Women: Some relationships with body attitudes and eating behaviours", by N. Tassell and R. Flet, 2005, *New Zealand Journal of Psychology, 34*(1), p. 31-32.

Despite these findings, there is a paucity of research examining food insecurity or insufficiency across the stages of change for dietary behaviours. A recent N.Z. study did however examine F&V and dietary fat intake in a convenience sample of Maori women (Tassell & Flett, 2005). As illustrated in Figure 3.4, food insecurity increased between the combined precontemplation/contemplation and preparation/action stages then declined in the maintenance stage. Mean differences in food insecurity between these stages were moderate-small. Food insecurity nevertheless accounted for a larger proportion of total variance due to differences in group means across the stages of change for F&V consumption (4%) than dietary fat intake (2%). Food insecurity therefore appears to differ across the stages of change in a non-linear pattern and be important in the preparation and action stages.

Awareness of Fruit & Vegetable Guidelines

While the recommendation to eat plenty of F&Vs is not new, the message to eat 5 or more servings of F&Vs a day has been more intensely promoted since the launch of the 5+ A Day in the U.S. in 1991 (National Cancer Institute, 2007). The campaign involved media news and advertising,[23] point of sale promotions, community level interventions, and a research component (Havas et al., 1994; National Cancer Institute, 2007; Stables et al., 2002). In 1994 the 5+ A Day programme was launched in N.Z. by United Fresh and now runs in about 28 countries worldwide (5+ A Day, 2007). The consumption of at least 5 servings of F&Vs a day has also been promoted in recent N.Z. campaigns and is one of the key messages in the Ministry of Health's Healthy Eating – Healthy Action Plan (MOH, 2004a, 2007a).[24] There has subsequently been an increase in the number of people aware of the guidelines for F&V intake. Those aware 5 or more servings of F&Vs should be eaten each day in the U.S. increased from 8% in 1991 to 19% in 1997 (Krebs-Smith, Heimendinger, Patterson, Subar, Kessler & Pivonka, 1995; Stables et al., 2002). As illustrated in Figure 3.5, awareness of F&V guidelines in the U.K. increased from 43% in 2000 to 71% in 2006 (Food Standards Agency, 2007).

[23] The National Cancer Institute spent $1 million a year on media and communications in support of the programme. Contributed resources added an estimated $35million. Total fast food advertising in the U.S. on the other hand totalled $3.1 billion – of which $1.03 billion alone was spent by McDonalds (National Cancer Institute, 2007).

[24] Programs include for example Mission on, Feeding our Futures, Fruit and Schools (see MOH, 2007).

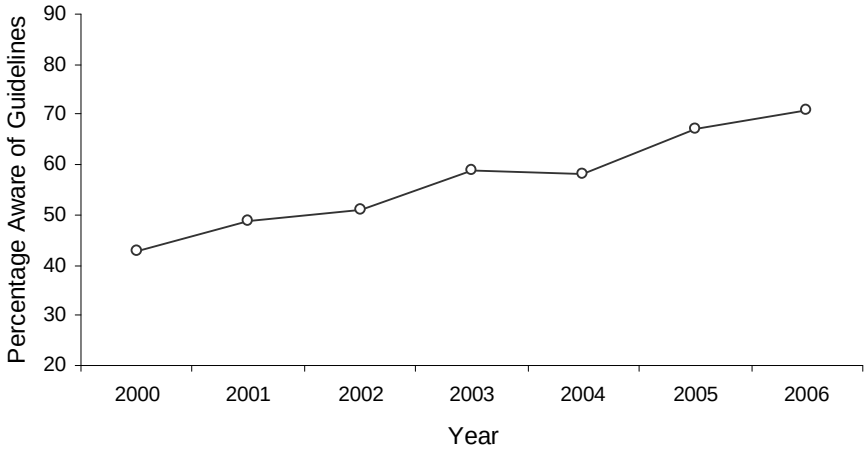

Figure 3.5. Proportion of U.K. adults aware of the guidelines for fruit and vegetable intake, 2000 to 2006.

Note. Adapted from *Consumer Attitudes to Food Standards Wave 7: UK Report*, by Food Standards Agency, 2007, London: Food Standards Agency, p. 35.

Awareness of the 5+ A Day program has been examined in N.Z.. A survey conducted in 1999 and 2000 found 74% of supermarket shoppers were aware of the 5+ A Day programme, and 71% identified the 5 a day message from the 5+ A Day logo (5+ A Day, 1999; Ashfield-Watt, Stewart & Sheffer, 2004). In another non-random sample of N.Z. adults, 64% were aware of the 5+ A Day programme/message, and 32% of the Food and Nutrition Guidelines (Green & Boyle, 2001). Previous research suggests the proportion of people aware of the 5+ A Day program is similar to those aware of the 5+ A Day message (Plesko, Cotugna & Aljadir, 2000; Stables et al., 2002). A large proportion of N.Z. adults may therefore be aware of the guidelines for F&V intake.

Not everyone is aware of the guidelines however. Males have a lower level of awareness compared to females (Baker & Wardle, 2003; Food Standards Agency, 2007; Krebs-Smith et al., 1995; Parmenter, Waller & Wardle, 2000; Stables et al., 2002). In the U.K. for example, 81% of women and 62% of men believed they should be eating 5 or more servings of F&Vs each day (Food Standards Agency, 2007). An Australian survey (Dixon, Borland, Segan, Stafford & Sindall, 1998) similarly found the mean number of F&V servings women believed they should be eating was significantly higher than that of men[25]. Women also have a higher level of dietary

[25] M = 2.20 vs. 1.92 for fruit and 3.30 vs. 2.62 for vegetables for women and men respectively.

knowledge than men (Baker & Wardle, 2003; Parmenter et al., 2000; Turrell, 1998; Worsley, Worsley & McConnon, 1991). This may reflect the greater responsibility women have for food purchasing, preparation and cooking, as well as concerns about their weight (Food Standards Agency, 2007; Steptoe & Wardle, 1999; Worsley, Blasche, Ball & Crawford, 2003). Nevertheless, those who are more educated and earn more also have a higher level of dietary knowledge and awareness of F&V guidelines (Dixon et al., 1998; Krebs-Smith et al., 1995; Parmenter et al., 2000; Stables et al., 2002). Dietary knowledge may therefore be one mechanism by which sociodemographic factors influence F&V intake.

Research has also investigated the relationship between awareness of F&V guidelines and consumption. While an early meta-analysis found the relationship between dietary knowledge and dietary behaviour was weak (Axelson, Federline & Brinberg, 1986), awareness of F&V guidelines has consistently been related to intake (Baker & Wardle, 2003; Food Standards Agency, 2007; Krebs-Smith et al., 1995; Stables et al., 2002; Steptoe, Perkins-Porras, McKay, Rink, Hilton & Cappuccio, 2003; Van Duyn et al., 2001; Watters, Satia & Galanko, 2007). F&V consumption is about 25% higher among those aware of F&V guidelines compared to those who are not (Steptoe et al., 2003; Watters et al., 2007; Van Duyn et al., 2001). Awareness of F&V guidelines also independently predicts self reported and biomarkers of F&V intake when other sociodemographic and background variables (e.g., education, socioeconomic status, and habit), and psychosocial factors (e.g., attitudes, self efficacy and diet-disease knowledge) have been controlled for (Baker & Wardle, 2003; Krebs-Smith et al., 1995; Steptoe et al., 2003; Van Duyn et al., 2001). Being unaware of the guidelines for F&V intake is therefore associated with a higher risk of low F&V consumption.

Across the stages of change, dietary knowledge has been examined for fat, fibre and F&V intake (e.g., Auld et al., 1998; Campbell et al., 1998; Kloek et al., 2004; Resnicow et al., 2003; Van Duyn et al., 1998, 2001). While those in the precontemplation stage are less aware of the guidelines for F&V intake on average, awareness increases across the stages of change so those in the action and maintenance stages have the highest awareness (Campbell et al., 1998; Kloek et al., 2004; Van Duyn et al., 1998). A Dutch study (Kloek et al., 2004) for example found the odds of being in a higher stage of change for vegetables and fruit was 1.5-1.6

times higher among those aware of the guidelines compared to those who were not. While differences between stages may only be moderate-small, awareness of F&V guidelines appears to increase across the stages of change.

In summary, the contextual factors examined in this section included age, education, income, food insecurity, and awareness of F&V guidelines. F&V consumption was positively associated with age, education, income and awareness of F&V guidelines, and negatively related to food insecurity. That is, older people, those who have a higher level of education and income, and are more aware of the guidelines for F&V intake, tend to have a higher level of F&V consumption. Conversely, those who are more food insecure tend to eat less F&Vs on average. Across the stages of change, education and awareness of F&V guidelines appear to increase on average in a linear pattern. On the other hand, age, income and food insecurity appear to differ across the stages of change in a non-linear pattern, in line with stage model assumptions. Those in the contemplation, preparation and action stages are on average younger, while those in the preparation and action stages appear to be more food insecure. Those in the maintenance stage also appear to earn more on average. Differences in the contextual factors between adjacent stages of change tend to be moderate-small. The impact of the psychosocial factors across the stages of change is examined in the following section. The relationship between the psychosocial factors and behaviour, as well as intentions is also examined.

Psychosocial Factors

Psychosocial factors which may contribute to a better understanding of F&V intake include the perceived benefits and barriers associated with behaviour, self efficacy, control, subjective and descriptive norms, self identity, and susceptibility to disease. These factors were identified following a review of health behaviour theories in Chapter 2, which included the transtheoretical model (TTM), health belief model (HBM), social cognitive theory (SCT), theory of reasoned action (TRA), and theory of planned behaviour (TPB). In this section the psychosocial factors will be examined across the stages of change for F&V intake. The impact of the psychosocial factors on F&V intake will also be examined. In the TPB, intentions are however assumed to be the proximal determinant of behaviour.

> Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour (Ajzen, 1991, p.181).

In line with a meta-analysis examining a range of health behaviours (Armitage & Conner, 2001), intentions tend to have a moderate-large impact on dietary behaviour and independently predict F&V intake when other psychosocial factors are controlled for (e.g., Bogers, Brug, van Assema & Dagnelie, 2004; Brug, Lechner & De Vries, 1995; Chatzisarantis, Hagger, Smith & Phoenix, 2004; Lechner, Brug & De Vries, 1997; Povey, Conner, Sparks, James & Shepherd, 2000a). The impact of intentions on F&V intake is however larger when behaviour is self rated (e.g., high/low) than objectively assessed with a food frequency questionnaire[26] (see Bogers et al., 2004; Brug, De Vet, De Nooijer & Verplanken, 2006; Chatzisarantis et al., 2004; Lechner et al., 1997; Povey et al., 2000a). In the TPB intentions are assumed to be the mechanism by which the psychosocial factors largely impact on behaviour. That is, the psychosocial factors are expected to influence behaviour indirectly through

[26] The total proportion of variance accounted for by intentions and other psychosocial factors in self reported F&V intake ranges form 33-49% as opposed to 10-39% for intake assessed with a food frequency questionnaire. These findings are also in line with those of Armitage and Conner (2001) in which intentions and perceived behavioural control were found to account for 27% of the variance in behaviour on average (31% self reported vs. 20% observed).

intentions. The relationship between the psychosocial factors and intentions is therefore also reviewed in this section.

Pros and Cons

The perceived positive and negative outcomes associated with behaviour were important in all health behaviour models reviewed. For dietary behaviours and F&V intake in particular, positive outcomes include taste, convenience, adding variety to meals, weight control, self image, nutrition and health benefits, as well as encouragement and support from others (Balch, Loughrey, Weinberg, Lurie & Eisner, 1997; Dittus, Hillers & Beerman, 1995; Henry, Reicks, Smith, Reimer, Atwell & Thomas, 2003; James, 2004; Krummel, Humphries & Tessaro, 2002; Pollard, Kirk & Cade, 2002; Satia, Kristal, Curry & Trudeau, 2001; Steptoe, Wijetunge, Doherty & Wardle, 1996). However, the more immediate consequences of behaviour and internal rewards (or punishment), such as feeling good and losing weight, appear to be more important in facilitating behaviour change than external rewards such as pleasing others and the long term health benefits (Balch et al., 1997; Satia et al., 2002; Trudeau et al., 1998). On the other hand, the negative outcomes associated with behaviour include taste preferences, having to give up other foods, inconvenience, cost, concerns about pesticides and chemical substances, family preferences, and a lack of support from others (Balch et al., 1997; Henry et al., 2003; James, 2004; Krummel et al., 2002; Pollard et al., 2002; Story, Newmark-Sztainer & French, 2002).

Research examining the positive and negative outcomes associated with dietary behaviours has largely been based on the TPB. In the TPB, attitudes have been examined towards consuming a healthy and low fat diet (Astrom & Rise, 2001; Conner, Norman & Bell, 2002; Povey et al., 2000ab), red meat, chocolate, hot potato chips, and F&Vs (Bogers et al., 2004; Chatzisarantis et al., 2004; Cox, Anderson, Lean & Mela, 1998; Povey et al., 2000a; Sparks, Conner, James, Shepherd & Povey, 2001; Sparks, Guthrie & Shepherd, 1997; Sparks & Shepherd, 1992). Attitudes assessed on semantic differential scales (e.g., eating a healthy diet would be good-bad) tend to have a large and independent impact on intentions. A U.K. survey (Povey et al., 2000a) for example found attitudes accounted for 58% of the variance in intentions for a low fat diet and 30% in intentions for F&V intake. In line with the

results of previous research (e.g., Armitage & Conner, 1999a; Astrom & Rise, 2001; Bogers et al., 2004; Brug et al., 2006; Cox et al., 1998; Povey et al., 2000b; Sparks & Guthrie, 1998; Sparks et al., 1997; Sparks & Shepherd, 1992), the study also found attitudes independently predicted intentions when other TPB variables were taken into account (i.e., subjective norms, perceived control, and self efficacy). Attitudes do not appear to independently predict F&V intake however when intentions and other TPB variables are controlled for (e.g., Bogers et al., 2004; Brug et al., 1995; Chatzisarantis et al., 2004).

Within the framework of the HBM and TTM, the association between the perceived benefits and barriers with F&V consumption (e.g., Brug et al., 2006; Ling & Horwath, 2001; Steptoe et al., 2003; Van Duyn et al., 2001), dietary fat intake, and making positive dietary changes has been examined (Contento & Murphy, 1990; Kristal, Bowen, Curry, Shattuck & Henry, 1990; Schafer, Keith & Schafer, 1995; Steptoe, Doherty, Kerry, Rink & Hilton, 2000). The impact of the pros and cons on behaviour is small. Although some studies indicate the pros and cons are independently related to behaviour (e.g., Contento & Murphy, 1990; Schafer et al., 1995; Steptoe et al., 2000, 2003), the unique variance accounted for by these factors is also small and not consistent (e.g., some have found the pros are related to behaviour but not the cons or vice versa). The impact of intentions has also not been taken into account. The benefits and barriers may therefore indirectly influence behaviour through intentions. The study plans to contribute to the literature by examining the influence of the pros and cons and the pathway by which they impact on behaviour.

Given decisional balance is a key theoretical construct in the TTM, the pros and cons have been examined across the stages of change for a number of dietary behaviours. For F&V intake in particular, the pros increase between the precontemplation and preparation stages, before decreasing slightly in the postaction stages (e.g., De Vet et al., 2005b; Greene, Fey-Yensan, Padula, Rossi, Rossi & Clark, 2004; Henry, Reimer, Smith & Reicks, 2006; Horacek et al., 2002; Ling & Horwath, 2001; Ma, Betts, Horacek, Georgiou, White & Nitzke, 2002; Ma, Betts, Horacek, Georgiou & White, 2003). For example, Figure 3.6 illustrates the pattern of pros and cons for vegetable and fruit intake found in a U.S. survey of young adults (Ma et al., 2003). Between the precontemplation and contemplation stages, moderate increases in the pros have been

found. Although, small increases in the pros were found in one study of low income African American mothers (Henry et al., 2006). Nevertheless, a Dutch longitudinal survey (De Vet et al., 2005b) found the pros predicted forward stage progression in the precontemplation stage for fruit intake. An intervention which used brief leaflets designed to increase awareness about the benefits of eating a low fat diet also predicted progression from the precontemplation stage (Armitage, Sheeran, Conner & Arden, 2004). Between the contemplation and preparation stages for F&V intake, small increases in the pros have also been found, as well as small decreases in the postaction stages. The cons tend to gradually decrease between the contemplation and maintenance stages (e.g., De Vet et al., 2005b; Ling & Horwath, 2001; Ma et al., 2002, 2003; Rapley & Coulson, 2005). Between the precontemplation and contemplation stages however the pattern of cons is less consistent, with some studies reporting decreases (e.g., Rapley & Coulson, 2005), no differences (e.g., De Vet et al., 2005b; Greene et al., 2004; Ling & Howarth, 2001) or small increases (e.g., Ma et al., 2002, 2003).

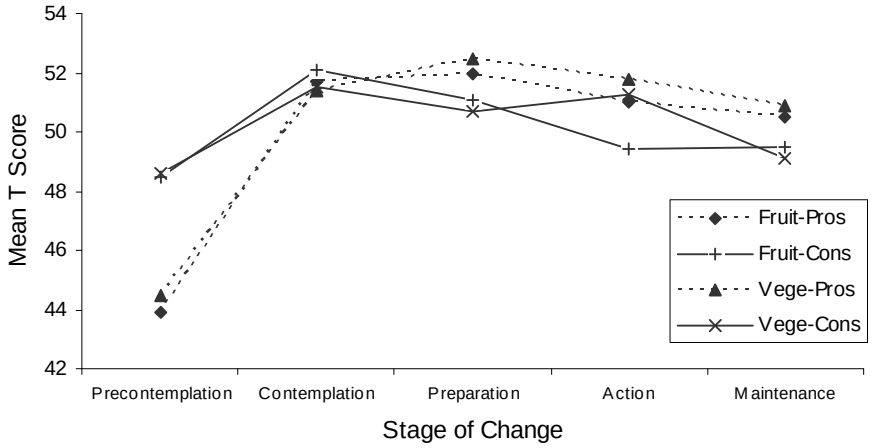

Figure 3.6. Pros and cons across stages of change for fruit and vegetable intake.

Note. Adapted from "Assessing stages of change for fruit and vegetable intake in young adults: a combination of traditional staging algorithms and food-frequency questionnaires", by J. Ma, N.M. Betts, T. Horacek, C. Georgiou and A. White, 2003, *Health Education Research*, *18*(2), 224-236, p. 230. Copyright 2003 by Oxford University Press.

The nature of the relationship between the pros and cons across the stages of change is unclear with previous studies finding both linear and non-linear patterns (e.g., Horacek et al., 2002; Ling, 1999; Ma et al., 2002; Rapley & Coulson, 2005). Non-linear patterns indicate a factor is important in different stages of change in line with stage model assumptions. Linear patterns however suggest a factor is important in all

stages of change. Although few studies have specifically tested the nature of the relationship, Stroebl and colleagues (V. Stroebl, personal communication, 14 August, 2007; Stroebl & Ellgring, 2005) found a non-linear quadratic component of trend accounted for some of the variance in the pros. A larger proportion of variance in both the pros and cons was nevertheless accounted for by the linear component of trend. The current study therefore plans to help clarify the relationship between the pros and cons across the stages of change by testing the nature of the trend. The total proportion of variance accounted for by the pros across the stages due to differences in group means is however consistently larger than the cons (e.g., Greene et al., 2004; Gulliver & Horwath, 2001b; Ling & Horwath, 2001; Rossi et al., 2001; Tassell & Flett, 2005).

Self Efficacy

The major contribution of SCT in understanding behaviour change is the concept of self efficacy. Self efficacy refers to one's perception or judgement of their ability in successfully performing a specific behaviour (Bandura, 1986; Kraft et al., 1999). Self efficacy has subsequently been examined in the other theoretical models reviewed. Although perceived behavioural control in the TPB has been assessed with measures of self efficacy and/or control (Courneya, 1995; Rimer, 2002; Sheeran & Taylor, 1999), these items have been found to reflect different factors in factor analyses and differentially impact on intentions and behaviour (Armitage & Conner, 1999a; Manstead & van Eekelen, 1998; Povey et al., 2000a; Sparks et al., 1997; Terry & O'Leary, 1995; White, Terry & Hogg, 1994). Self efficacy and control are therefore examined as separate components in the current study.

The impact of self efficacy on intentions and behaviour has been examined for F&V intake (e.g., Bogers et al., 2004; Brug et al., 1995, 2006; Chung & Hoerr, 2005; Cox et al., 1998; Povey et al., 2000a; Steptoe et al., 2003), and the consumption of a low fat diet (e.g., Armitage & Conner, 1999ab; Povey et al., 2000a; Steptoe et al., 2000). Self efficacy has a moderate-large impact on intentions for dietary behaviours, and moderate impact on behaviour. A U.K. survey (Povey et al., 2000a) for example found self efficacy accounted for 46% of the variance in intentions and 24% in behaviour for F&V intake. Self efficacy also independently impacts on intentions and

behaviour when other TPB variables (including intentions) are controlled for (e.g., Brug et al., 1995; Povey et al., 2000a). The TPB also claims the impact of intentions on behaviour depends in part on perceived behavioural control (Ajzen, 1991). Although there is a paucity of research examining the interaction among these factors, Povey and colleagues (2000b) found intentions and perceived behavioural control (assessed with a mixed item measure) largely combined to influence behaviour for a healthy diet. The current study nevertheless plans to contribute to the literature by examining whether self efficacy moderates the impact of intentions in predicting F&V intake.

Confidence in being able to eat F&Vs in specific situations has been examined across the stages of change. In the TTM self efficacy is considered a key factor that facilitates progression into the action and maintenance stages (Greene, Rossi, Rossi, Velicer, Fava & Prochaska, 1999; Prochaska & DiClemente, 1992). Self efficacy moderately increases between the preparation and action stages, and action and maintenance stages for F&V intake (Armitage, Povey & Arden, 2003; Henry et al., 2006; Horacek et al., 2002; Ling & Horwath, 1999; Ma et al., 2003; Maddock, Marshall, Nigg & Barnett, 2003; Tassell & Flett, 2005). Self efficacy also predicts progression from the action stage for a low fat diet (Armitage et al., 2004). Across the preaction stages small-moderate increases in self efficacy have also been found (e.g., Armitage et al., 2003; Greene et al., 2004; Henry et al., 2006; Horacek et al., 2002; Ling & Horwath, 1999; Ma et al., 2003; Maddock et al., 2003; Tassell & Flett, 2005). Self efficacy also predicted forward stage progression for fruit intake in the precontemplation and contemplation stages, and progression from the contemplation stage for a low fat diet (Armitage et al., 2004; De Vet et al., 2005b). Those in the precontemplation stage have the lowest levels of self efficacy on average, while those in the maintenance stage have the highest levels. Linear trends have therefore explained the relationship between self efficacy and the stages of change (Armitage et al., 2003; V. Stroebl, personal communication, 14 August 2007). A moderate-large proportion of total variance due to differences in group means has also been accounted for by self efficacy across the stages of change for F&V intake (e.g., Greene et al., 2004; Ling & Horwath, 1999; Maddock et al., 2003; Tassell & Flett, 2005). Self efficacy therefore appears to be important in all stages of change.

Control

Perceived control has its roots in social learning theory (Rotter, 1966), in which behavioural performance is expected among those who attribute outcomes to themselves rather than external circumstances. Beliefs about control vary in degree from the general – almost worldviews, to the domain specific (e.g., health locus of control), to those associated with specific behaviours such as exercise and eating a healthy diet (Luszczynska & Schwarzer, 2005; Skinner, 1996; Strickland, 1989). However, when specific behaviours are being examined, specific control beliefs are expected to be more predictive of behaviour due to their corresponding level of specificity (see Norman & Bennett, 1996; Strickland, 1989; Wallston, 1992). A review of studies assessing control beliefs in relation to dietary behaviours and weight loss suggests specific and internal control beliefs are associated with more positive outcomes (AbuSabha & Achterberg, 1997).

Also informative are TPB studies which have used control items (as opposed to self efficacy or a mixture of both items) to assess perceived behavioural control. For example, two meta-analyses (Armitage & Conner, 2001; Trafimow, Sheeran, Conner & Finlay, 2002) examining a range of health behaviours indicate perceived control has a moderate impact on intentions and small-moderate impact on behaviour. Perceived control has also been examined for several dietary behaviours including F&V intake (Chatzisarantis et al., 2004; Povey, et al., 2000a), and the consumption of a low fat diet, red meat, hot potato chips, and dieting (Armitage & Conner, 1999ab; Hagger & Chatzisarantis, 2005; Povey et al., 2000a; Sparks et al., 1997). For dietary behaviours, perceived control (e.g., degree of control over eating a low fat diet) has a small impact on intentions and behaviour. Perceived control also independently predicts intentions associated with dietary behaviours when other TPB variables are controlled for (e.g., Armitage & Conner, 1999ab; Povey et al., 2000a). Perceived control does not appear to independently impact on behaviour however when intentions, self efficacy and other TPB variables are taken into account.

Across the stages of change, perceived control over behaviour (e.g., eating a low fat diet is entirely up to me) has been examined with respect to a low fat diet (Armitage & Arden, 2002). Perceived control decreased between the precontemplation and

contemplation stages then increased across the remaining stages of change. In line with the results of another study examining exercise behaviour (Courneya, Plotnikoff, Hotz & Birkett, 2001), small differences in perceived control were found between adjacent stages of change. In addition, the overall pattern of perceived control reflected a linear trend (Armitage & Arden, 2002). Health locus of control (e.g., degree of control in preventing health problems) was examined in a survey of deprived neighbourhoods in the Netherlands for vegetable and fruit intake (Kloek et al., 2004), and was important in all stages of change, with those in higher stages having more control on average. Beliefs about control therefore appear to be important in all stages of change.

Subjective Norms

The influence of other people on individual behaviour is examined in the TRA/TPB and SCT. In the TRA/TPB subjective norms are expected to have an impact on intentions and reflect the perceived social pressure from others to perform a particular behaviour (Ajzen, 1991; Armitage & Conner, 2001; Clark & Becker, 1998; Kohler, Grimley & Reynolds, 1999; Rivis & Sheeran, 2002; Rutter & Quine, 2002). For dietary behaviours, spouses/partners, other family members and friends appear to be important influences (Berg, Jonsson & Conner, 2000; Paisley, Lloyd, Sparks & Mela, 1995; Rah, Hasler, Painter & Chapman-Novakofski, 2004; Zey & McIntosh, 1992). Subjective norms have been examined in relation to F&V intake (e.g., Bogers et al., 2004; Brug et al., 2006; Chatzisarantis et al., 2004; Cox et al., 1998; Lytle et al., 2003; Paisley et al., 1995; Povey et al., 2000a; Sparks & Shepherd, 1992), and the consumption of red meat, milk, bread, making positive dietary changes, and a healthy and low fat diet (Armitage & Conner, 1999ab; Astrom & Rise, 2001; Berg et al., 2000; Conner et al., 2002; Contento & Murphy, 1990; Luszcynska et al., 2004; Povey et al., 2000a; Sparks et al., 1997; Sparks et al., 1997; Towler & Shepherd, 1992; Zey & McIntosh, 1992). For F&V intake, subjective norms have a moderate and independent impact on intentions when other TPB variables are controlled for. Povey and colleagues (2000a) for example found those who had more people around them who approved of their F&V consumption had stronger intentions of eating 5 portions of F&Vs a day in the future when attitudes, perceived control, self efficacy, and

perceived need were taken into account. Subjective norms do not tend to impact on behaviour however when intentions and other TPB variables are controlled for.

Across the stages of change, the approval or disapproval from others has been examined for dietary fat and F&V intake (Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003, 2004; Sporny & Contento, 1995). Small-moderate increases in social pressure have been found across the stages of change so those in the action and maintenance stages have the most pressure on average. Illustrated in Figure 3.7 for example is the pattern of subjective norms found by Armitage and colleagues (2003) for F&V intake. Trend analyses also indicate subjective norms are linearly related to the stages of change for dietary behaviours (e.g., Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003; Sporny & Contento, 1995). Similar patterns have been found for social support. A 5+ A Day study of African American church members found small increases in support from family and friends across the stages of change (Campbell et al., 1998). Encouragement from family members and friends also increases the odds of being in the postaction rather than preaction stages for F&V intake (Van Duyn et al., 2001). The influence of other people therefore appears to be important in all stages of change.

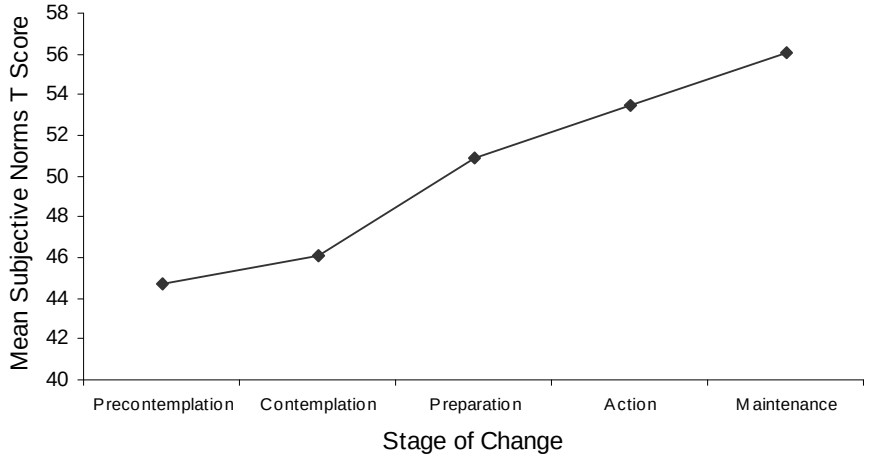

Figure 3.7. Subjective norms across stages of change for fruit and vegetable intake.

Note. Adapted from "Evidence for discontinuity patterns across the stages of change: a role for attitudinal ambivalence", by C.J. Armitage, R. Povey and M.A. Arden, 2003, *Psychology and Health, 18*(3), p. 380. Mean scores in precontemplation (*M* = -.68, *SD* = .88), contemplation (*M* = -.56, *SD* = 1.05), preparation (*M* = -.03, *SD* = .76), action (*M* = .25, *SD* = .81), and maintenance (*M* = .52, *SD* = 1.08) have been converted into T scores (*M* = 50, *SD* = 10) based on the full sample mean of -.12 (*SD* = 1.06).

Descriptive Norms

Descriptive norms have been examined within the framework of the TPB following a review of the model which recommended a broader conceptualisation of normative influences (see Armitage & Conner, 2001; Astrom & Rise, 2001; Rivis & Sheeran, 2003). Descriptive norms refer to the perceived behaviour of other people (e.g., the extent to which other people eat a healthy diet) and have been examined in relation to dieting, the consumption of a healthy diet, high fibre bread, milk (Berg et al., 2000; (Hagger & Chatzisarantis, 2005; Luszczynska et al., 2004; Povey et al., 2000b) and fruit intake (Dennison & Shepherd, 1995). Descriptive norms have a moderate impact on intentions. Although descriptive and subjective norms are moderately-highly correlated (e.g., Berg et al., 2000; Povey et al., 2000b), the behaviour of friends has been independently related to intentions for fruit intake when subjective norms and other TPB variables have been controlled for among adolescents (Dennison & Shepherd, 1995). The relationship between descriptive norms and dietary behaviour is however less consistent. While the behaviour of others has been positively related to dieting, the consumption of high fibre bread, milk and a healthy diet among young adults and adolescents (Berg et al., 2000; Hagger & Chatzisarnatis, 2005; Luszczynska et al., 2004), the consumption of a healthy diet was not related to descriptive norms among adults (Povey et al., 2000b). While it is possible the impact of other people's behaviour differs in relation to age, there is nevertheless a lack of research examining the relationship between descriptive norms and F&V intake. The study therefore plans to address this gap in the literature.

For dietary fat intake, the consumption of a healthy diet by important others has been examined across the stages of change (Brug, Hospers & Kok, 1997; Sporny & Contento, 1995). The modelling of healthy behaviours by others tends to increase across the stages of change in a linear pattern. In other words, those in the action and maintenance stages have more people around them who consume a healthy diet. Across the stages of change for vegetable and fruit intake, a similar pattern was found when one's own behaviour was compared to that of similar others (Brug, Glanz & Kok, 1997). Small-moderate differences in normative beliefs tend to be found between adjacent stages of change. Van Duyn and colleagues (2001) also found the odds of being in the postaction rather than preaction stages for F&V intake were

higher among those who had family and friends who consumed more F&Vs. When encouragement from others and other psychosocial variables were included in the same model however the impact was no longer significant. Nevertheless, the study did not examine differences in descriptive norms among the preaction stages. The current study therefore plans to contribute to the literature by examining descriptive norms across the stages of change for F&V intake.

Self Identity

Within the framework of the TPB, self identity has been examined as a more subtle normative influence. Self identity is derived from identity theory in which the self is inextricably linked to the wider social structure and is "conceived as a collection of identities that reflects the roles that a person occupies in the social structure" (Terry, Hogg & White, 1999, p. 226). Previous research for example has examined the extent to which people consider themselves a green consumer (e.g., organic vegetables) or health conscious person (Armitage & Arden, 2002; Armitage & Conner, 1999ab; Povey, Wellens & Conner, 2001; Sparks & Shepherd, 1992; Sparks, Shepherd, Wieringa & Zimmermans, 1995; Sparks et al., 2001). In the TPB, the salience of a role for an individual is expected to influence intentions and may be more important for those behaviours which are repeated often (Conner & Armitage, 1998).

Self identity has been examined in relation to several dietary behaviours including organic vegetables, and fruit (Dennison & Shepherd, 1995; Sparks & Shepherd, 1992), and the consumption of a healthy diet, low fat diet, chocolate, sweets, meat, butter/margarine, cheese, hot potato chips, and type of diet normally consumed (e.g., meat, vegetarian, vegan [Armitage & Conner, 1999ab; Astrom & Rise, 2001; Dennison & Shepherd, 1995; Povey et al., 2001; Sparks et al., 1995, 2001; Sparks & Guthrie, 1998]). The impact of self identity on intentions tends to be moderate-large. Self identity as a healthy eater and green consumer, have also been independently related to intentions when other TPB variables have been controlled for (e.g., Armitage & Conner, 1999ab; Astrom & Rise, 2001; Dennison & Shepherd, 1995; Sparks & Guthrie, 1998; Sparks & Shepherd, 1992). Although Sparks and colleagues (2001) found self identity was not consistently related to intentions of performing the behaviour tomorrow. At a bivariate level, self identity has been moderately related to

the consumption of a healthy and low fat diet (e.g., Armitage & Conner, 1999a; Astrom & Rise, 2001). There is however a paucity of research assessing the impact of self identity on behaviour when intentions and other TPB variables are taken into account. The study therefore plans to assess the independent impact of self identity on behaviour.

Self identity has been examined across the stages of change for dietary fat intake. Armitage and Arden (2002) assessed self identity as a healthy eater including concerns about the consequences of diet for health. Those in the precontemplation stage were least likely to think of themselves as a healthy eater. Self identity nevertheless increased across the stages of change, with those in the maintenance stage being more likely to believe they were a healthy eater. While only small differences in self identity were detected between the precontemplation and contemplation stages, larger differences were found between the contemplation and preparation stages, and action and maintenance stages. As a result, the overall pattern of scores on self identity reflected a linear trend (Armitage & Arden, 2002). Using a conceptually similar measure, Sporny and Contento (1995) found overall health concern increased in a linear pattern across the stages of change for dietary fat reduction. Self identity therefore appears to be important in all stages of change. As there is a lack of research examining self identity across the stages of change for F&V intake, the current study plans to also contribute to the literature by examining this relationship.

Susceptibility to Disease

Perceived susceptibility to disease is a key component of the HBM and refers to subjective beliefs about the risk of contracting a health condition, such as high blood cholesterol or heart disease in the future (Janz, Champion & Strecher, 2002)[27]. A family history or personal experience of disease, age, education and gender appear to influence risk perceptions (Cadarette, Beaton & Hawker, 2004; Dittus et al., 1995; Ey, Klesges, Patterson, Hadley, Bernard & Alpert, 2000; Forsyth & Goetsch, 1997;

[27] For medically diagnosed diseases, the dimension has been reformulated to include acceptance of a diagnosis, personal estimates of re-susceptibility, and susceptibility to illness in general (Janz et al., 2002).

Hanson & Benedict, 2002; Humphries & Krummel, 1999; Kloeblen & Batish, 1999). For example, males in N.Z. have a slightly higher risk of being diagnosed with a chronic disease, but females believe they are more susceptible to chronic health problems (Dittus et al., 1995; Hanson & Benedict, 2002; MOH, 2004b).

The impact of perceived susceptibility to disease has been examined for several dietary behaviours (e.g., Contento & Murphy, 1990; Humphries & Krummel, 1999; Kelly, Zuzanski & Alemagno, 1991; Ransford, 1986; Schafer et al., 1995; Umeh, 2003), including F&V intake (Dittus et al., 1995). Risk perceptions do not appear to influence intentions (e.g., Humphries & Krummel, 1999; Umeh, 2003). Although, limited sample variability in risk perceptions (e.g., in adolescents and healthy adults), and intentions, may have contributed to these findings (e.g., by excluding women who were intending on changing). Perceived susceptibility to disease on the other hand has a small-moderate and independent impact on behaviour (e.g., Contento & Murphy, 1990; Dittus et al., 1995; Schafer et al., 1995). That is, those who perceive their risk of disease as being higher tend to eat a healthier diet. A survey of supermarket shoppers (Contento & Murphy, 1990) for example found perceived susceptibility to disease discriminated between those who had made desirable changes to their diet and those who had not, when perceived benefits, norms, health concern, chance health locus of control, and cues to action were controlled for. There is nevertheless a lack of research examining the independent impact of risk perceptions on dietary behaviour when intentions have been included in the same model. The study therefore plans to address this gap in the literature.

According to Weinstein and colleagues (Weinstein & Nicolich, 1993), the impact of risk perceptions on behaviour should be considered over time. Some people for example may modify their behaviour if they believe they are susceptible to a disease. Once the behaviour has been undertaken however, their risk perceptions may be lower. The stages of change take into account the temporal dimension of behaviour change. While Van Duyn and colleagues (2001) found no differences in perceived threat between the pre- and post-action stages of change for F&V intake, findings may reflect the measures used and stages compared. Sporny and Contento (1995) on the other hand found significant mean differences in perceived risk across the stages of change for dietary fat reduction. Between the precontemplation and contemplation

stages risk perceptions moderately increased with those in the contemplation stage believing they were more susceptible to disease on average. Among those who had been eating a reduced fat diet in the postaction stages, perceived susceptibility to disease was lower[28]. Although there is a paucity of research examining other dietary behaviours, similar findings have been reported with respect to meat consumption during a livestock epidemic, exercise among coronary heart disease patients, and hepatitis A vaccinations (Reid et al., 2007; Rhodes & Herngenrather, 2003; Sniehotta, Luszczynska, Scholz & Lippke, 2005). Although the pattern is less consistent for disease screening behaviours where the risk of disease may not abate (e.g., mammography and prostate cancer screening[29] [e.g., Champion & Skinner, 2003; Russell, Monahan, Wagle & Champion, 2006; Menon, Belue, Skinner, Rothwell & Champion, 2007]), successful behavioural performance appears to result in lower risk perceptions among those in the postaction stages. Perceived susceptibility to disease therefore appears to differ across the stages of change in a non-linear pattern[30].

In summary, the psychosocial factors examined in this section included the perceived pros and cons, self efficacy, control, subjective and descriptive norms, self identity, and susceptibility to disease. While most of the psychosocial factors have been related to intentions for F&V intake in previous research, the study plans to contribute to the literature by examining the association between perceived susceptibility to disease and intentions. A number of psychosocial factors also appear to be related to behaviour including self efficacy, descriptive norms, self identity, and susceptibility to disease. However, further research is required to examine the relationship between F&V intake and descriptive norms, as well as self identity. The current study therefore plans to address these gaps in the literature. While self efficacy has been independently related to F&V intake when intentions have been controlled for, there is also a lack of research examining the unique contribution of descriptive norms, self identity and perceived susceptibility to disease. The study therefore plans to examine the independent impact of these factors. There is also a paucity of research examining whether intentions is the mechanism by which the psychosocial factors influence behaviour. The study plans to also contribute to the literature by examining whether

[28] Sporny and Contento (1995) did not examine the preparation stage for dietary fat reduction.
[29] For mammography and prostate screening some studies have found decreases in perceived susceptibility between the contemplation and action stages and others have found no change.
[30] Sporny and Contento (1995) tested for linear trend and found this was not significant.

the psychosocial factors have a direct impact on behaviour or indirect impact mediated by intentions. Whether the impact of intentions on behaviour differs in relation to self efficacy will also be assessed.

For dietary behaviours including F&V intake, the psychosocial factors appear to differ across the stages of change. In contrast to the assumptions of the TTM however, a number of psychosocial factors appear to increase across the stages of change in a linear pattern. These factors include self efficacy, control, self identity, subjective and descriptive norms. Between adjacent stages of change small-moderate differences in these factors tend to be found. There is however a lack of research examining perceived control and self identity across the stages of change for F&V intake. The current study therefore plans to contribute to the literature by examining these factors as well as specifically testing the nature of the relationship between factors and the stages of change. Other psychosocial factors including perceived susceptibility to disease appear to differ across the stages of change in a non-linear pattern. Risk perceptions appear to moderately increase across the preaction stages then decline slightly in the postaction stages. A number of studies have examined the pros and cons for F&V intake across the stages of change. Small-moderate increases in the pros tend to be found across the preaction stages, and small differences in the postaction stages. For the cons, small decreases have also been found between the contemplation and maintenance stages. The pattern of cons between the precontemplation and contemplation stages is less clear. The study plans to contribute to the literature by specifically testing the nature of the relationship between the pros and cons with the stages of change. Summarised in the following chapter are the research objectives and hypotheses which the study plans to examine.

4. Research Objectives

The aim of the study is to develop a better understanding of the process of behaviour change and those factors which contribute to a higher level of F&V consumption. A number of theoretical models have been used to understand health behaviour. The transtheoretical model (TTM), in particular has generated enthusiasm and optimism about behaviour change. According to the TTM, successful behaviour change involves progressing through a series of discrete stages over time. The five stages of change include precontemplation, contemplation, preparation, action and maintenance. Factors which facilitate movement from one stage of change to the next are expected to differ depending on the stage of change one is in. Consequently, stage matched interventions (i.e., one intervention matched to each stage) are expected to be more effective in facilitating behaviour change than standardised intervention programmes. Despite the popularity of the TTM, empirical support for the model is relatively weak. There are nevertheless a number of limitations and areas of confusion in the literature which the current study will seek to clarify.

Validity of Stage of Change Measures

The efficacy of stage matched interventions depends in part on accurate classification into the stages of change. Reviews of the TTM have nevertheless noted the frequent use of unvalidated stage of change measures. As a result, misclassification into the stages of change may occur and inappropriate stage matched interventions may be delivered. For dietary behaviours, the validity of stage classification methods has been improved by examining food based goals and including a specific action criterion. The study therefore plans to examine the stages of change for F&V intake using a clearly defined action criterion of 5 servings of F&Vs a day. The validity of the measure will also be assessed in relation to a more objective measure of F&V consumption.

Pseudo-Maintainers

Stage measures which include a specific action criterion have nevertheless misclassified a proportion of people based on their F&V consumption. The validity of stage measures has been improved in some studies by reclassifying pseudo-maintainers or those classified in the maintenance stage who do not meet the action criterion (e.g., 5 or more servings of F&Vs a day) into an earlier stage of change based on their intentions. However, other studies suggest pseudo-maintainers are more similar to true-maintainers (i.e., those meeting the action criterion) than those in earlier stages based on cognitive variables. In order to determine whether the reclassification of pseudo-maintainers is necessary, the study will compare the level of intentions and self identity as a healthy eater among pseudo-maintainers to true-maintainers and those in earlier stages of change.

Model Specification

The development of robust stage matched interventions requires a clear understanding of those factors which facilitate progression from one stage of change to the next. While the TTM provides a general guide to the pattern of scores expected on key theoretical variables across the stages of change, it does not clearly specify which factors help people move from one stage of change to the next. The study therefore plans to contribute to a better understanding of factors which discriminate between adjacent stages of change for F&V intake.

Additional Factors

According to the TTM, the pros, cons, and self efficacy aid progression through the stages of change. Nevertheless, other factors not included in the TTM may also help facilitate successful behaviour change. Following a review of other prominent theories of health behaviour including the health belief model (HBM), social cognitive theory (SCT), theory of reasoned action (TRA) and theory of planned behaviour (TPB), a number of psychosocial factors were identified which may be useful to integrate into a single model underpinned by the TTM. An integration of pivotal variables from alternative theoretical approaches is currently being advocated in health behaviour research to provide a more complete and comprehensive

understanding of behaviour, and thereby the development of more robust interventions. After taking into account the conceptual overlaps among variables to aid the development of a parsimonious model, the additional psychosocial factors identified were perceived control, subjective and descriptive norms, self identity, and susceptibility to disease. While psychosocial factors are more amenable to change, other factors more external to the individual may also contribute to a better understanding of behaviour. A number of contextual factors were also identified including age, education, income, food insecurity and awareness of F&V guidelines. The study therefore plans to integrate the psychosocial and contextual factors into an extended stage model of F&V intake as illustrated in Figure 4.1.

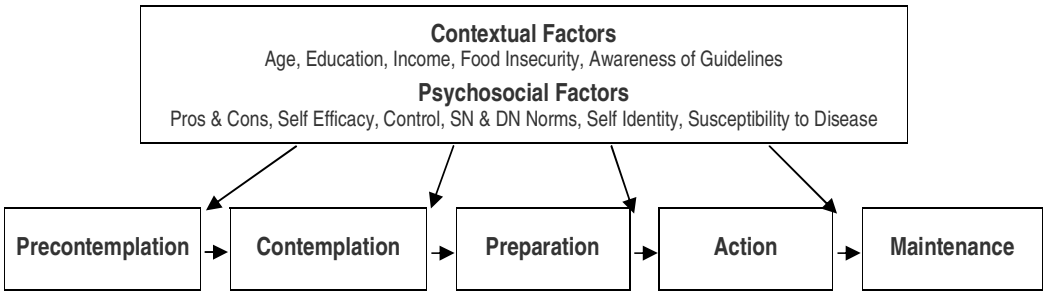

Figure 4.1. Extended stage model of fruit and vegetable intake.

Note. SN = subjective norms, DN = descriptive norms.

Linear or Non-Linear Relationships?

The TTM conceptualises behaviour change as involving a series of discrete stages. It has been questioned however whether the stages of change reflect genuine stages or pseudo-stages based on an underlying continuum. Sutton (2000) and Weinstein et al. (Weinstein, Rothman & Sutton, 1998) have pointed out how any number of categories could be created by arbitrarily dividing a continuous measure. While these categories may be useful for describing individual readiness to change, stages created in this manner are not genuine stages. A pseudo-stage model is indicated if there are consistent increases (or decreases) in factors across the stages of change in a linear pattern (Sutton, 2000; Weinstein, Rothman et al., 1998). Linear patterns do not support the assumption that different factors are important in different stages of change. Furthermore, a pseudo-stage model would not assume behaviour change

follows a sequence of stages. Sutton (2000) has recommended examining the overall pattern of mean scores on factors across the stages of change. The current study therefore plans to use trend analyses to determine whether a linear or non-linear (i.e., quadratic or cubic) component of trend accounts for a larger proportion of variance in psychosocial and contextual factors across the stages of change for F&V intake. If most variables reveal linear patterns then similar factors may facilitate behaviour change irrespective of stage. Consequently, the matching of interventions to stages would be unnecessary. In other words, "a single intervention could be used for everyone" (Weinstein, Rothman et al., 1998, p. 291).

Alternative Model of Behaviour

If the TTM represents a pseudo-stage model then a more parsimonious continuous model may be sufficient for understanding F&V intake (see Weinstein, Rothman et al., 1998). Continuous models conceptualise behaviour change as involving small naturally occurring shifts along a continuum and may have several practical advantages over stage models. As continuous models combine factors into a single prediction equation they are simpler and easier to examine. The sample size required to detect significant relationships among variables is also comparatively less than that needed to detect significant mean differences in factors between stages of change. The TPB has been identified as one continuous model which may be useful to extend for F&V intake. The study therefore plans to examine the psychosocial and contextual factors identified above in an extended continuous model of F&V intake as outlined in Figure 4.2. As the contextual factors may directly or indirectly impact on behaviour through psychosocial factors, the study plans to examine the influence of contextual factors prior to the impact of the psychosocial factors.

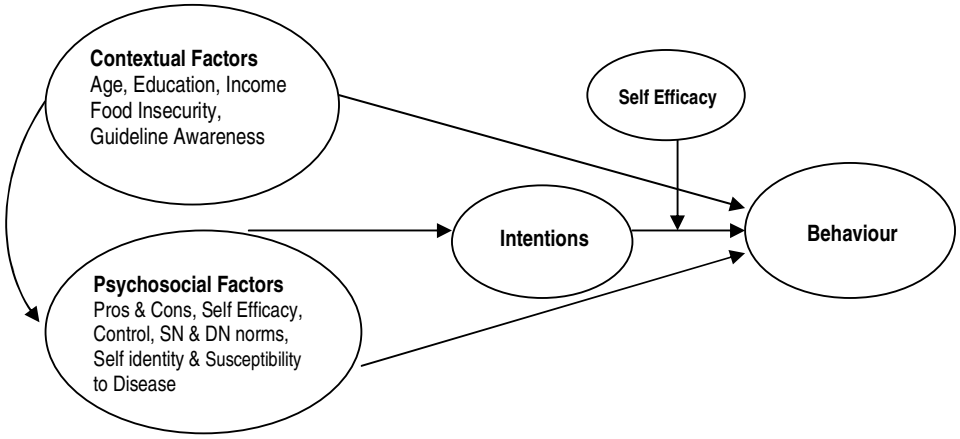

Figure 4.2. Psychosocial and contextual extended (PACE) model of fruit and vegetable intake.

Note. SN = subjective norms, DN = descriptive norms.

Mediating Effects

As outlined in Figure 4.2, intentions are considered to be the proximal determinant of behaviour in the TPB. Intentions in turn are influenced by psychosocial factors. Therefore, the mechanism by which the psychosocial factors influence behaviour is expected to be largely indirect and mediated by intentions. That is, intentions are assumed to be the mechanism by which the psychosocial factors impact on behaviour. The current study therefore plans to examine whether the impact of the psychosocial factors on behaviour is direct or mediated by intentions.

Moderating Effects

In the TPB, the impact of intentions on behaviour is expected to depend in part on beliefs about the behaviour being under one's own control and the perceived difficulty of behavioural performance (Ajzen, 1991, 2002). Perceived control over behaviour in the TPB has been examined with self efficacy and/or control items. Self efficacy and control nevertheless appear to reflect different factors. Self efficacy also has a larger impact on behaviour than perceived control. As illustrated in Figure 4.2, the study also plans to examine whether self efficacy interacts with intentions in predicting F&V intake.

Objectives

The objectives of the study are summarised as follows:

1. To provide a descriptive account of the level of fruit and vegetable (F&V) intake among men in N.Z., food insecurity, and awareness of F&V guidelines.
2. To determine the proportion of men in each stage of change for F&V intake.
3. To determine the validity of a stage of change measure by examining mean differences in F&V consumption across the stages of change.
4. To determine the proportion of men correctly classified into the stages for F&V intake based on the consumption of 5 servings of F&Vs a day.
5. To determine whether men classified in the action and maintenance stages who are *not* eating 5 or more servings of F&Vs a day should be reclassified into an earlier stage of change based on their intentions and self identity.
6. To determine the minimum number of components required to account for the intercorrelations among items used to assess the psychosocial factors (i.e., the pros, cons, self efficacy, control, subjective norms, descriptive norms, self identity, and susceptibility to disease).
7. To determine whether there are any significant mean differences in contextual factors (i.e., age, education, income, food insecurity and awareness of F&V guidelines) and psychosocial factors across the stages of change for F&V intake.
8. To determine which psychosocial and contextual factors discriminate between adjacent stages of change for F&V intake.
9. To determine whether the relationship between the psychosocial and contextual variables and the stages of change is best explained by a linear, quadratic or cubic component of trend.
10. To evaluate the impact of the psychosocial factors on intentions to eat F&Vs.
11. To evaluate the impact of the contextual factors on F&V intake.
12. To evaluate the impact of the psychosocial factors on F&V intake after controlling for contextual factors.
13. To determine whether intentions is the mechanism by which the psychosocial factors impact on F&V intake.
14. To determine whether self efficacy moderates the impact of intentions in predicting F&V intake.

Hypotheses

Based on the objectives of the study and previous research, several hypotheses have been formulated as follows:

1. On average men in the action and maintenance stages of change for F&V intake will have the highest level of F&V consumption.
2. A greater proportion of men in the action and maintenance stages will consume 5 or more servings of F&Vs each day compared to the precontemplation, contemplation and preparation stages.
3. Mean scores on contextual and psychosocial factors will significantly differ across the stages of change for F&V intake.
4. A greater proportion of variance between the stages of change for F&V intake and age, income, food insecurity, and susceptibility to disease will be explained by a non-linear component of trend.
5. A greater proportion of variance between the stages of change for F&V intake and education, awareness of F&V guidelines, self efficacy, control, subjective and descriptive norms, and self identity will be explained by a linear component of trend.
6. The psychosocial factors will make a unique and significant contribution to the variance explained in intentions to eat 5 or more servings of F&Vs a day in the future.
7. The contextual factors will make a unique and significant contribution to the variance explained in F&V intake.
8. The psychosocial factors will make a unique and significant contribution to the variance explained in F&V intake, over and above that accounted for by significant contextual factors.
9. Intentions will partially mediate the impact of the psychosocial factors on F&V intake.
10. Self efficacy will moderate the impact of intentions in predicting F&V intake.

5. Method

Sample

A sample of 1200 men aged 18 years and over was randomly selected from the New Zealand (N.Z.) electoral roll. A CD of the electoral roll was obtained in August 2006 from the Electoral Enrolment Centre and participants were selected from the complete roll[31]. In total, 35 men could not be contacted due to incorrect address details, 10 were currently living overseas, and 14 were too ill to participate or were deceased. Of those who remained, 45% (n = 518) completed the survey. Similar telephone and mail surveys have achieved response rates of approximately 51% (Auld et al., 1998; Kloek, van Lenthe, van Nierop & Mackenbach, 2004; Krebs-Smith, Heimendinger, Patterson, Subar, Kesler & Pivonka, 1995; Steptoe & Wardle, 1999; Trudeau, Kristal, Li & Patterson, 1998; Van Duyn et al., 1998, 2001)[32]. Response rates for males tend to be lower however, with women comprising 58% of samples on average.

Procedure

Survey Questionnaire

A survey questionnaire was developed based on a range of measures used in previous research. A pilot study was conducted to identify aspects of the questionnaire which could be improved before the main study was undertaken. Based on the initial pilot study of 22 respondents, the wording of several items and order of some response options were modified. A copy of the final questionnaire is attached in Appendix B. The questionnaire was expected to take 15 to 20 minutes to complete. The study was conducted in accordance with the ethical guidelines laid down by the Massey University Human Ethics Committee. A low risk notification of the research project was completed and recorded by the Human Ethics Committee in August 2006.

[31] Including Maori.
[32] Yu and Cooper (1983) found the weighted average response rate to mail surveys was 47%, and 72%and 82% to telephone and personal interviews respectively for studies conducted between 1965 and 1981.

Data Collection

Data collection occurred during September and October 2006 using a three stage Dillman (2000) method. Attached in Appendix C are copies of printed materials sent to potential participants including a pre-letter advising them they had been randomly chosen to take part in the study. Ten days later a copy of the self administered survey questionnaire, information sheet, and pre-paid reply envelope were mailed to participants. The information sheet described the nature of the study, rights of participants, and responsibilities of the researchers. Consent to take part in the study was implied by completion and return of the survey questionnaire. In total, 3% (n = 34) returned a blank uncompleted questionnaire. Finally, a thank you/reminder postcard was posted out two weeks later. During the period of data collection participants could contact the researchers by e-mail or a toll-free telephone number. Participants could ask additional questions or seek clarification about any aspects of the study. Approximately 20 participants contacted the researchers to primarily advise new or incorrect address details or of their completion and return of the questionnaire. Replacement survey questionnaires were sent to two participants upon their request.

Measures

Self Rated Health

Self rated health (SRH [self assessed or self perceived health]) was assessed using a single global question frequently used in population health surveys (Manderbacka, Lahelma & Martikainen, 1998), including the 2002/03 N.Z. Health Survey (Ministry of Health [MOH], 2004b). Previous research indicates the measure has an acceptable level of reliability (Miilunpalo, Vuori, Oja, Pasanen & Urponen, 1997) and is related to other measures of health status including physician ratings (Bakken, Jezewska-Zychowicz & Winter, 1999; Gillis, 1993; LaRue, Bank, Jarvik & Hetland, 1979; Miilunpalo et al., 1997). SRH is also related to functional limitations, health care utilisation, subsequent risk of poor health and mortality (Benjamini, Leventhal & Leventhal, 2000; Idler & Angel, 1990; Idler, Russell & Davis, 2000; LaRue et al., 1979; Mackenbach, Simon, Looman & Joung, 2002; Manor, Mathews & Power, 2000; Miilunpalo et al., 1997; Osler, Heitmann, Hoidrup, Jorgensen & Schroll, 2001).

Respondents were asked to rate their general health (e.g., "in general, would you say your health is") on a 5-point spectrum ranging from 1 (*poor*) to 5 (*excellent*).

Chronic Health Problems

A checklist was used to examine the lifetime incidence of chronic health conditions. The measure was adapted from an existing measure (Belloc, Breslow & Hochstim, 1971) and items used in other surveys (Flett, Millar, Long & McDonald, 1996; MOH, 2004b; Alpass, Towers, Stephens, Fitzgerald, Stevenson & Davey, 2007). Similar items have been recommended by the EUROHIS project as indicators of chronic physical conditions (Bullinger, 2003; Buratta, Frova & Gargiulo, 2003; Schmidt, Power, Bullinger & Nosikov, 2005). However, the order in which the items were presented was revised given the EUROHIS project found items examining serious medical conditions such as cancer at the beginning of the list tend to elicit more negative feelings and non-response to subsequent items (Buratta et al., 2003). Respondents were asked to indicate (yes/no) if a doctor, nurse, or other health care worker had told them they had any of the selected health conditions. The total number of chronic health conditions was calculated.

Body Mass Index

Body mass index (BMI) was calculated for each participant by dividing their weight in kilograms by their height in metres squared (kg/m^2). As Maori and Pacific Island people tend to have a lower percentage of body fat at any given BMI due to variations in body build, different criteria were used to define overweight and obesity for these people (Agencies for Nutrition Action, 1996; MOH & University of Auckland, 2003). Maori and Pacific Island men were classified as overweight if they had a BMI ≥ 26 and obese if they had a BMI ≥ 32. All other men were classified as overweight if they had a BMI ≥ 25 and obese if they had a BMI ≥ 30.

Fruit & Vegetable Intake

Fruit and vegetable (F&V) intake was assessed using a brief food frequency questionnaire (FFQ) suitable for inclusion in a mail survey. The FFQ was adapted from items recommended by the Australian Food and Nutrition Monitoring Unit (Marks, Webb, Rutishauser & Riley, 2001; Riley, Rutishauser & Webb, 2001) and used in previous surveys including the Behavioral Risk Factor Surveillance System (BRFSS) and the 5+ A Day programs for Better Health in the U.S. (Block, Gillespie, Rosenbaum & Jenson, 2000; Serdula, Gillespie, Kettel-Khan, Farris, Seymour & Denny, 2004; Serdula et al., 1993; Serdula, Coates, Byers, Simoes, Mokdad & Subar, 1995; Stables et al., 2002). Similar measures have yielded correlations in the range of .50 to .70 with full length FFQs, diet records, and 24 hour recalls (Block et al., 2000; Campbell et al., 1999; Kristal, Glanz, Tilley & Li, 2000; Serdula et al., 1993), and have also been related to biomarkers of F&V intake (Coyne et al., 2005; Resnicow et al., 2000; Rutishauser, Webb, Abraham & Allsopp, 2001).

Estimates of mean F&V intake based on brief FFQs are similar to those obtained from multiple food records but lower than multiple 24 hour recalls and longer FFQs (Beresford, Thompson, Feng, Christianson, McLerran, & Patrick, 2001; Field et al., 1998; Fuemmeler et al., 2006; Kristal et al., 2000; Kristjansdottir, Andersen, Haraldsdottir, de Almeida & Thorsdottir, 2006; Li, Serdula, Bland, Mokdad, Bowman & Nelson, 2000; Plesko, Cotugna & Leta, 2000; Resnicow et al., 2000; Serdula et al., 1993, 2004; Snyder et al., 2004). The underestimation of intake on brief FFQs appears to be primarily due to estimates of vegetable intake (Field et al., 1998; Kristal et al., 2000). For example, Field et al. (1998) found the average level of under reporting of vegetables on brief FFQs compared to 24 hour recalls was between 1.1 and 1.5 servings a day. It has been suggested a lack of consideration of vegetables contained in mixed dishes may result in lower estimates of vegetable intake (e.g., Field et al., 1998; Kim & Holowaty, 2003; Kristal et al., 2000; Thompson et al., 2000, 2002). Participants were therefore asked to include vegetables eaten in mixed dishes (i.e., casseroles and stir-frys), when considering their vegetable consumption.

The six items included in the current study were fruit juice such as orange, apple or tomato; servings of fruit (fresh, frozen, canned or stewed); hot potato or kumara chips, french fries or wedges; potatoes (not counting chips, fries, or wedges); salad (including mixed green salad and other mixtures of raw vegetables); and other cooked vegetables (including vegetables eaten in mixed dishes). Respondents were asked to rate how often they had eaten each type of F&V over the last month. Examples of what constituted a serving of F&Vs were also outlined to participants. Response options included rarely or never, 1-3 per month, once per week, 2-4 per week, 5-6 per week, once per day, 2 per day, 3 per day, and 4+ per day. Scores on each item were converted into daily servings and combined to calculate total F&V intake. Only one serving of juice was included in total F&V intake however and consistent with the 5+ a day recommendations, chips, fries and wedges were excluded (Eldridge, Smith-Warner, Lytle & Murray, 1998; Horticulture N.Z., 2007; Serdula et al., 2004). Full details of the FFQ are attached on page 194.

Stage of Change for Fruit & Vegetable Intake

Stage of change was assessed with a single item measure adapted for F&V intake from those used in previous research (e.g., DeVet, De Nooijer, De Vries & Brug, 2005b; Greene & Rossi, 1998; Nigg et al., 1999; Rapley & Coulson, 2005). While Rapley and Coulson (2005) examined F&V intake among adolescents, the current study used a more parsimonious item. In line with recommendations and previous research (i.e., Armitage, Povey & Arden, 2003; Howarth, 1999; Laforge, Greene & Prochaska, 1994; Povey, Conner, Sparks, James & Shepherd, 1999), the measure included a clear food based goal and action criterion of 5 or more servings of F&Vs each day. The action criterion is a widely accepted minimum level of F&V intake required for good health (5+ A Day, 2007; MOH, 2003a; World Health Organization [WHO], 2003). The time frames used to define the stages of change were consistent with those used in previous research (i.e., Prochaska & DiClemente, 1992). An acceptable level of test-retest reliability over a period of 8 months (r = .71) has been reported for a similar single item measure examining the consumption of a low fat diet (Armitage & Arden, 2007; Armitage, Sheeran, Conner & Arden, 2004).

In the current study the assignment to a discrete and mutually exclusive stage of change for F&V intake was based on intentions and current behaviour. Respondents were asked to select the most appropriate statement for themselves from a list of five each representing a stage of change, in response to the question "Do you consistently eat at least 5 servings of fruit and vegetables each day?". Based on item responses participants were classified as being in either precontemplation (*no, and I do not intend to change within the next 6 months*), contemplation (*no, but I intend to change within the next 6 months*), preparation (*no, but I intend to change within the next month*), action (*yes, and I started doing this less than 6 months ago*), or maintenance (*yes, and I have done so for more than 6 months*). Prior to stage of change being assessed, examples of what constituted a serving of F&Vs was outlined to participants. Details of the stage of measure are attached in Appendix B, page 194.

Food Insecurity

Food insecurity was assessed with the items used in the 1997 National Nutrition Survey (NNS97 [Russell, Parnell, Wilson et al., 1999]). The measure was originally developed following a review of the literature, focus group interviews with low income men and women, pilot testing, and an item content review by experts in the area (Parnell, Reid, Wilson, McKenzie & Russell, 2001). The final scale contained 8 items (see page 199) examining the themes of food insecurity, food inadequacy, coping strategies, alternative sources, and cultural issues. Each item was assessed at the household rather than individual level as this appeared more acceptable to respondents (Parnell et al., 2001). Participants were asked to rate each item on a 7-point scale ranging from 1 (*never*) to 7 (*all of the time*). The item, "we can afford to eat properly" was reversed scored. Participants were classified as being food secure (food insecurity was never a problem), having a low level of food insecurity (food insecurity was seldom a problem), moderate level (1-2 aspects of food insecurity experienced at least once in awhile), or high level (3 or more aspects of food insecurity experienced at least once in a while). The scoring method is based on that used in the U.S. (Nord, Andrews & Carlson, 2007; Radimer, 2002)[33].

[33] In the U.S. households responding positively to 0-2 items were previously classified as food secure. Currently, households affirming no items are classified as food secure, those affirming 1 or 2 items are classified 'at risk' of food insecurity or as 'marginally food-secure' (Radimer, 2002).

Awareness of Fruit & Vegetable Guidelines

Awareness of the guidelines for F&V intake has been assessed in previous research by examining the total number of recommended servings (e.g., Havas, Anliker, Damron, Lagenberg, Ballesteros & Feldman, 1998; Kloek et al., 2004; Steptoe, Perkins-Porras, McKay, Rink, Hilton & Cappuccio, 2003; Van Duyn et al., 1998). However, as the phrase "5 servings of fruit and vegetables" was used frequently in the survey questionnaire, the guidelines were assessed separately and prior to other items relating to F&V intake. Respondents were asked to indicate "how many servings of fruit (vegetables) do doctors recommend each day?" Response options were 1 or fewer, at least 2, 3, 4 and 5 or more. Based on responses to both items, awareness was rated as low (total recommended servings less than 5 a day), moderate (total servings between 5 and 9 but not in line with any guideline), good (5 servings of fruit *and* 5 servings of vegetables a day), or high (2 servings of fruit and 3 servings of vegetables each day). Higher scores therefore reflect a higher level of awareness of F&V guidelines.

Health Locus of Control

Health locus of control (HLOC) was assessed using the Multidimensional Health Locus of Control (MHLC) scale developed by Wallston and colleagues (1978 [Form A]). The measure has been widely used in previous research and contains 18 items examining beliefs about sources of control for outcomes in the domain of health. The scale includes three subscales; internal (health outcomes are within one's control), powerful others (health outcomes are controlled by powerful others such as doctors, nurses and family members), and chance (health outcomes are controlled by external factors such as luck and fate). Previous research supports the three factor structure of the MHLC scale (Casey, Kingrey, Bowden & Corbett, 1993; Hartke & Kunce, 1982; Marshall, Collins & Crooks, 1990; Naja Raja, Williams & McGee, 1994; Talbot, Nouwen & Gauthier, 1996). The MHLC is also correlated with other measures of control (Baken & Stephens, 2005; Marshall et al., 1990), and has an acceptable level of test-retest reliability and internal consistency (Baken & Stephens, 2005; Contento & Murphy, 1990; Hubley & Wagner, 2004; Wallston, 2005; Weiss & Larsen, 1990). In the current study the Cronbach alpha coefficients were .69, .63 and .76 for the internal, chance and powerful others subscales respectively. Participants were asked

to rate each item on a 6-point likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). For each participant a total mean subscale score was calculated.

Pros and Cons

A scale previously developed by Ling and Horwath (2001) was used in the current study to assess the pros and cons associated with F&V intake. The measure is based on the decision making model of Janis and Mann (1977) and assesses the more immediate gains (pros) or losses (cons) associated with eating F&Vs. For example "eating more fruit and vegetables each day would keep me regular (avoid constipation)" and "eating more fruit would be expensive". Items were adapted from those used in previous research and focus group interviews, then reviewed by researchers who were familiar with the decisional balance construct (Ling, 1999). Factor analysis yielded two factors with factor loadings ranging from 0.64 to 0.79 on the pros subscale and 0.57 to 0.77 on the cons subscale. The pros and cons explained 31% and 19% of the variance in the solution and were weakly correlated (r = .22 [Ling, 1999]). Ling & Horwath (2001) reported internal consistency alpha coefficients for the two scales ranging from 0.79 (cons) to 0.86 (pros). Mean scores for men[34] on both 7-item scales were 24.40 (SD = 6.46) and 12.59 (SD = 5.03) for the pros and cons respectively. Scores on the subscales have been related to F&V intake and differ across the stages of change for F&V intake in line with the predictions of the transtheoretical model (TTM).

As the scale was originally developed and validated on Chinese Singaporeans, one item was adapted for use in the current study. The item "I would be following the advice of the government's national healthy lifestyle campaign if I ate more fruit and vegetables" was amended to "I would be following food and nutrition guidelines if I ate more fruit and vegetables". To broaden the content domain of the scale, several additional items were included based on those used by Ma and colleagues (2002). The two additional pro items were "fruit and vegetables help add variety to my meals" and "fruit and vegetables would help to control my weight". The additional cons items included "it would be difficult for me to find fruit and vegetables that I liked"

[34] The pros mean scale score for women was 25.37 (SD = 5.82) and 12.13 (SD = 4.72) for the cons (Ling, 1999).

and "I would have to give up other foods to eat more fruit and vegetables". Consequently, the pros and cons subscales used in the current study each contained 9 items. Participants were asked to rate how important each statement would be to them if they were thinking about eating more F&Vs. Ling (1999) found ratings of importance as opposed to agreement better reflected value evaluations rather than knowledge. Responses were rated on a 5-point likert scale ranging from 1 (*not important*) to 5 (*extremely important*). Full details of items are attached on page 195.

Self Efficacy

Traditional measurement of self efficacy requires individuals to rate their level of self efficacy on a specific task and the strength of their confidence in performing at each level (AbuShabha & Achterberg, 1997; Bandura, 1997). Likert scales which combine negative and positive ratings of confidence provide an acceptable alternative method for the assessment of self efficacy (Maurer & Pierce, 1998). Self efficacy was therefore assessed with a shortened version of the scale originally developed by Ling (1999; Ling & Horwath, 1999). The measure assessed confidence in a range of specific situations with varying levels of difficulty. The scale items were generated by Ling and Horwath (1999) on the basis of those used in previous research and focus group interviews, then reviewed by researchers who were familiar with the self efficacy construct. Factor analysis of scale yielded a two factor structure (see Ling, 1999). The first subscale described potentially difficult situations with factor loadings ranging from 0.59 to 0.86. The second subscale was labelled confidence in remembering to include F&Vs and had factor loadings ranging from 0.61 to 0.85. The factors accounted for 47% and 11% of the variance respectively and were highly correlated (r = .59 [Ling, 1999]). Ling reported internal consistency alpha coefficients for the two subscales of 0.77 (able to remember situations) and 0.89 (difficult situations). The mean score for men on the seven item difficult situations subscale was 25.53 (SD = 5.75) and 13.81 (SD = 4.38) for the five item being able to remember situations subscale[35]. Ling found the scales significantly differed across the stages of change for F&V intake consistent with TTM predictions.

[35] The mean score for women on the difficult situations subscale was 26.29 (SD = 5.84) and 14.73 (SD = 4.86) on the being able to remember situations subscale (Ling, 1999).

As the measure was originally developed and validated on Chinese Singaporeans, two items were deleted in order to make the content of the scale relevant in the current study. The deleted items were "I can usually buy a piece of fruit when I eat at a hawker center or workplace canteen" and "I can ask for extra vegetables when I order dishes such as chicken rice, dry or soup noodles". An additional item, "I can bring along some fruit when I know I won't be buying it at work" was deleted as the item content overlapped with another item "I can eat fruit as part of my lunch on most days" that had a similar factor loading. Therefore the measure used in the current study included nine items which asked participants to rate how confident they were in having F&Vs in specific situations on a 5-point likert scale ranging from 1 (*not at all confident*) to 5 (*totally confident*). Full details of the items used are on page 196.

Control

As no pre-existing measure of specific control beliefs with respect to F&V intake was found, items were developed based on those used in other behaviour specific measures of control and the MHLC (e.g., Ajzen, 2006; Armitage & Conner, 1999a; Holt, Clark & Kreuter, 2001; Manstead & van Eekelen, 1998; Povey, Conner, Sparks, James & Shepherd, 2000a; Sparks, Guthrie & Shepherd, 1997; Terry & O'Leary, 1995; Wallston et al., 1978; White, Terry & Hogg, 1994). The items were also based on those which loaded onto control rather than self efficacy in earlier factor analyses (e.g., Armitage & Conner, 1999ab; Manstead & van Eekelen, 1998; Povey et al., 2000; Sparks et al., 1997; White et al, 1994). Two items examined the attribution of outcomes to self or internal control. For example, "when I don't eat enough fruit and vegetables, I am to blame". Four additional items examined external control by others including "other people usually decide how much fruit and vegetables I eat each day". Similar items have been related to behaviour and behavioural intentions in previous research (e.g., Armitage & Conner, 1999b; Hagger & Chatzisarantis, 2005; Manstead & van Eekelen, 1998; Povey et al., 2000a; Terry & O'Leary, 1995). Participants were asked to rate their level of agreement with each statement on a 6-point likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The four external items were reverse scored so higher scores reflect higher levels of internal control.

Subjective Norms

Subjective norms or the approval or disapproval from significant others to consume 5 or more servings of F&Vs a day was assessed with items adapted for F&V intake from those used in previous research (Armitage & Arden, 2002; Armitage et al., 2004, 2003) and the recommendations of Ajzen (2006) for the development of theory of planned behaviour measures. The measure contained three items; participants were asked to rate two items on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). For example, "people who are important to me think I should eat 5 or more servings of fruit and vegetables every day". The third item asked participants how likely it was other people important to them would expect them to eat 5 or more servings of F&Vs each day. Previous research shows similar items have an acceptable level of reliability with Cronbach alpha coefficients ranging from 0.63 to 0.83 (Armitage & Arden, 2002; Armitage & Conner, 1999ab; Armitage et al., 2004), and are associated with intentions of eating F&Vs in the future (e.g., Bogers, Brug, van Assema & Dagnelie, 2004; Cox, Anderson, Lean & Mela, 1998; Sparks & Shepherd, 1992).

Descriptive Norms

Due to a lack of pre-existing multi-item scales assessing descriptive norms with respect to F&V intake, items were developed and adapted from those used in previous research (e.g., Povey et al., 2000ab), as well as the recommendations of Ajzen (2006). The items assessed the behaviour of significant others including family and friends as earlier studies show these groups are important (Abella & Heslin, 1984; Zey & McIntosh, 1992). Respondents were asked to rate three items on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). For example, "most of my family eat 5 or more servings of fruit and vegetables each day". Two additional items asked participants how likely and how true it was that other people ate 5 or more servings of F&Vs a day. Previous research indicates similar items are related to intentions and behaviour for other health behaviours (e.g., Abella & Heslin, 1984; Hagger & Chatzisarntis, 2005; Povey et al., 2000b). Full details of the items are attached on pages 197-198.

Self Identity

Self identity with respect to eating healthily was assessed with four items used previously by Armitage and Arden (2002; Armitage & Conner, 1999ab) and are similar to those used by Sparks and colleagues (1995; Povey, Wellens & Conner, 2001; Sparks & Shepherd, 1992; Sparks, Conner, James, Shepherd & Povey, 2001). A sample item is "I think of myself as a healthy eater". Participants were asked to rate their level of agreement with each statement on a 5-point likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Internal consistency reliability estimates in previous research range from 0.64 to 0.68 (Armitage & Arden, 2002; Armitage & Conner, 1999ab). These and similar items have been related to intentions and behaviour for the consumption of sweets, meat, margarine and butter, cheese, and a low fat diet (Armitage & Conner, 1999ab; Sparks et al., 1995).

Susceptibility to Disease

Perceived susceptibility to disease was assessed using a shortened version of the scale developed by Sporny and Contento (1995). The measure contained six items examining chronic conditions that respondents may get in the future including high cholesterol, high blood pressure, becoming overweight, diabetes, a heart attack and cancer. The original scale also contained two negatively worded items examining susceptibility to a heart attack and cancer that were not used in the current study due to item content overlap. The items were also similar to those contained in validated measures of perceived susceptibility to osteoporosis and breast cancer screening (Cadarette, Beaton & Hawker, 2004; Champion, 1984, Champion, & Skinner, 2003; Kim, Horan, Gendler & Patel, 1991). Respondents were asked to rate their level of agreement on a 5-point likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The use of verbal measures such as this have been recommended for the assessment of risk perceptions as many people find it difficult to assess risk probabilities presented in numerical formats (e.g., 50% chance, 1 in 5 chance [Katapodi, Lee, Facione & Dodd, 2004; Windschitl & Wells, 1996]). An alpha reliability coefficient of 0.70 was reported by Sporny and Contento (1995) in their study of government employees. The scale has been found to discriminate between the precontemplation and contemplation stages for dietary fat reduction (Sporny & Contento, 1995). The mean score among those in the precontemplation stage for

dietary fat intake was 2.71 (*SD* = .75) and 3.08 (*SD* = .58) in contemplation stage, while those in the action and maintenance stages had mean scores of 2.99 (*SD* = .70) and 2.80 (*SD* = .69) respectively (Sporny & Contento, 1995). These findings are in line with the predictions of the health belief model in which perceptions of susceptibility to disease are considered to be one of the main impetuses for action (Janz & Becker, 1984; Janz, Champion & Strecher, 2002).

Intentions

Intentions have been assessed in a number of ways in previous research. Armitage and Conner (2001) distinguished however between measures of desire (e.g., "I want to perform behaviour x") and behavioural intentions (e.g., "I intend to perform behaviour x"), and found the latter to be a better predictor of behaviour in a meta-analysis. Ajzen (2006) also suggests theory of planned behaviour measures should be compatible with other variables in terms of action, target, context, and time elements. Consequently, respondents were asked to indicate the extent to which they agreed with the statement, "I intend to eat 5 or more servings of fruit and vegetables each day in the future" on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Similar measures have been used in previous research (e.g., Armtiage et al., 2004; Armitage & Arden, 2002; Armitage & Conner, 1999ab; Bogers et al., 2004; Povey et al., 2000ab; Sparks & Shepherd, 1992), and are associated with other theory of planned behaviour psychosocial variables, behaviour, and also differ across the stages of change for dietary behaviours.

Sociodemographic Data

Sociodemographic data was collected using questions modelled on the 2006 Census (Statistics N.Z., 2006). Education was coded onto an ordinal scale based on highest educational qualification ranging from 1 (*no school qualification*), 2 (*secondary school qualification*), 3 (*trade or professional qualification*), 4 (*university qualification*). Income was assessed in bands to minimise non-response and was coded onto an ordinal scale ranging from 1 (*loss/zero - $20,000*), 2 (*$20,001 - $40,000*), 3 (*$40,001 - $70,000*), and 4 (*$70,000 or more*). Participants were also

asked to indicate which ethnic group(s) they belonged. In total, 22 participants belonged to more than one ethnic group.

Analyses

Data Screening

The data was examined prior to analysis to assess the accuracy of data entry. Descriptive statistics were used to check values on each variable were within the expected range, and means and standard deviations were plausible. The specification of missing value codes was also checked. In addition, the proportion of missing data was examined. Based on a cut-off point used in previous research (i.e., de Vet, Ader, Terwee & Pouwer, 2005), 4 cases with more than 25% of missing data were removed from the study[36]. Of the remaining participants, 10% had a low proportion of data missing (3% on average), and the percentage of missing data on each item and measure was 1.5% and 3.5% respectively. An inspection of the missing data revealed no discernable pattern[37]. When a small proportion of data (i.e., less than 5%) is randomly missing in a large data set, Tabachnick and Fidell (2007) claim most procedures for handling missing data will yield similar results. Pairwise and listwise deletion were therefore used in univariate and multivariate analyses respectively, due to the small proportion of randomly missing data, and the sufficient number of cases available for analysis following deletion. In analyses examining education, 14 respondents with qualifications obtained overseas were also deleted as no basis was found for recoding them onto an ordinal scale.

To identify univariate outliers or cases with extreme values on variables, frequency distributions and *z* scores were produced (Tabachnick & Fidell, 2001). Potential univariate outliers among continuous variables are cases with *z* scores in excess of 3.29 ($p < .001$, two tailed test), although a few larger *z* scores are expected in larger sample sizes (Tabachnick & Fidell, 2007). The normality of distributions was also

[36] There are no firm guidelines for how much missing data can be tolerated for a given sample size (Tabachnick & Fidell, 2001). Hair and colleagues (1998) suggest cases or observations with less 10% data missing can usually be ignored. de Vet, Ader et al., (2005) considered 25% of missing values on items to be the maximum acceptable level in a review of factor analytic studies.

[37] SPSS multivariate analysis can be used to highlight patterns of missing data for variables with at least 5% of data missing (Tabachnick & Fidell, 2001).

assessed with measures of skewness and kurtosis. Skewness is evident if the mean is not in the centre of the distribution and kurtosis reflects its peakedness (Tabachnick & Fidell, 2001). The significance of skewness and kurtosis was evaluated by dividing each by their respective standard error (see Tabachnick & Fidell, 2007). The shape of distributions was also assessed given skewness and kurtosis are more likely to be significant in larger samples with minor deviations of normality (Tabachnick & Fidell, 2001).

Items. The distribution on the pros, cons, self efficacy, control, subjective norms, descriptive norms, self identity, and susceptibility to disease items were assessed prior to conducting the principal components analysis (PCA). While factor analysis is fairly robust to violations of assumptions of normality (Gorsuch, 1983), several items were identified with substantial violations. Tabachnick and Fidell (2007) recommend considering data transformations to remedy non-normality unless interpretation is hindered. A logarithmic transformation was subsequently performed on all cons items, and a square root transformation on all control items. The transformations substantially improved the distribution on each item and subsequent references to the cons and control items pertain to their transformations. Following transformation, two cases on the "overeating if I ate more fruit" cons item were identified as outliers. As factor analysis can be sensitive to outliers, analyses were run with and without the outliers included to evaluate their impact (see Tabachnick and Fidell, 2007). As the outliers did not influence the results, all cases were included in the analysis.

An item analysis was performed to identify items that did not correlate well with other items intended to measure the same construct. Two items had inter-item and item-total correlations less than .30 and were therefore weakly associated with other items and the total scale (DiLorio, 2005). These items included "social pressure to eat 5 or more servings of fruit and vegetables every day" and "I think of myself as someone who enjoys the pleasures of eating", which were intended to measure subjective norms and self identity respectively. The items were subsequently deleted from further analysis. To identify redundant items the inter-item correlations were also examined but no correlations exceeding .80 were found (see DiLorio, 2005).

Ungrouped Data. Prior to performing regression analyses the data were screened for univariate outliers. One case on the measure of cons and four cases with BMIs greater than 45.00 were identified as outliers and deleted from further analysis[38]. The assumption of linearity was also assessed as the linear relationship between variables is only captured by Pearson's *r* (Tabachnick & Fidell, 2001). The assumption of homoscedasticity or constant variability in scores across values of continuous variables was also assessed (Tabachnick & Fidell, 2001). Following inspection of the bivariate scatter plots no substantial violations of the assumptions of linearity and homoscedasticity were detected.

The distribution on each variable was also examined. The measures of cons and control were positively and significantly skewed along with food insecurity. Intentions and self efficacy were also negatively skewed. In addition, there was significant positive kurtosis (peaked distribution) on the measure of cons and negative kurtosis (flat distribution) on the measures of income, education, awareness of F&V guidelines, and food insecurity. While skewness and kurtosis can result in an underestimation of the variance and strength of relationships, the impact is minimised in larger sample sizes (Tabachnick & Fidell, 2001). Therefore, no further action was taken to remedy these assumption violations. On the other hand, F&V intake was positively and more severely skewed. A square root transformation was therefore performed and improved the distribution on this variable. References to F&V intake in regression analyses therefore refer to the transformed variable[39] [40].

Grouped Data. In the stages of change for F&V intake only a small proportion of men (3%, $n = 15$) were classified in the action stage, in line with earlier research and stage model assumptions[41] (e.g., De Vet et al., 2005a; Laforge et al., 1994; Ling & Horwath, 1999; Ma et al., 2002). As the power to detect significant mean differences is influenced by sample size (Hair, Black, Babin, Anderson & Tatham, 2006; Tabachnick & Fidell, 2007), the action and maintenance stages were combined in

[38] This therefore limits the generalisability of the results to men with extreme BMIs
[39] Transformation of the dependent variable usually helps correct violations of the homogeneity assumption as well (see Tabachnick & Fidell, 2001, p. 80).
[40] In post hoc analyses examining food insecure men the skewness and kurtosis which was evident on variables in the full sample was no longer found.
[41] The contemplation, preparation and action stages are more dynamic with only a small percentage of the population expected to take meaningful action to change their behaviour at any given time.

subsequent analyses using the strategy used in previous research (e.g., Auld et al., 1998; Lechner, Brug, DeVries, van Assema & Mudde, 1998; Ling & Horwath, 2000). Prior to analysis, the data was also grouped by stage of change and screened for outliers. In the action/maintenance stage, 7 cases were identified as outliers on the measure of intentions, 3 cases on self efficacy and cons, 1 case on control and self identity. In the precontemplation stage, 1 case on the measure of cons was also identified as an outlier. In addition, 3 cases were identified as outliers on the measure of intentions among those in true-action/maintenance. Each case was deleted from respective stage of change analyses. The distribution on each variable was also examined. The measures of cons and perceived control were significantly and positively skewed in the action/maintenance stage along with food insecurity, while intentions were negatively skewed[42]. In the precontemplation stage, awareness of F&V guidelines and cons were positively skewed. Positive kurtosis on the measure of cons in the action/maintenance stage was also found. As large sample sizes help minimise the impact of non-normal distributions (Hair et al., 2006), no further action was taken to remedy these assumption violations.

The assumption of homogeneity of variance was assessed by examining the variance in continuous variables across the stages of change. The ratio of variance F_{max} was calculated for each variable based on the group with the largest to smallest variance. While most variance ratios were below the 3:1 rule of thumb[43] (see Tabachnick & Fidell, 2007), Levene's tests indicated the variances on intentions, F&V intake, education, awareness of F&V guidelines, pros, cons and self identity were heterogeneous. While analysis of variance (ANOVA) tends to be robust to moderate violations of the homogeneity of variance assumption (Box, 1954), departures are less acceptable with unequal sample sizes (Hair et al., 2006; Lix, Keselman & Keselman, 1996).

[42] The distribution of F&V intake among those in true-action/maintenance was also significantly positively skewed as 5 servings of F&Vs a day was the minimum level of intake required for classification into this group.
[43] Intentions was 4:1

The influence of heterogeneous variances and unequal sample sizes was assessed by examining their pattern (Lix et al., 1996; Keppel, 1991; Tomarken & Serlin, 1986). On the measures of pros, intentions and F&V intake the largest variances were associated with the largest group sizes. In this situation, the chances of making a Type I error tends to be below nominal levels in ANOVA at the expense of increased risk of Type II errors using the usual *F* test (Tomarken & Serlin, 1986). The Welch test in comparison tends to provide better control of both Type I and Type II errors (Tomarken & Serlin, 1986). On the other hand, the smallest variances were associated with the largest group sizes on the measures of education, awareness of F&V guidelines, cons and self identity. In this case, the chances of making a Type I error using the Welch test tends to be slightly higher than nominal levels and the *F* test is even more liberal but tends to provide better control of Type II errors (see Tomarken & Serlin, 1986). Consequently both the *F* and Welch tests were used to evaluate the results of ANOVA.

Descriptive Statistics

Descriptive statistics were used to describe participant characteristics including mean F&V intake, the proportion of men eating 5 or more servings of F&Vs each day, and the number of men classified in each stage of change for F&V intake. The validity of the stage of change measure was also assessed by examining positive and negative predictive values based on F&V consumption assessed with the brief FFQ. The predictive values were calculated using a fourfold contingency table as presented in Table 5.1. The positive predictive value was defined as a/(a + b) and refers to the proportion classified in the postaction stages (i.e., action/maintenance) who were eating 5 or *more* servings of F&Vs a day. The negative predictive value was defined as d/(c + d) and refers to the proportion classified in the preaction stages (i.e., precontemplation, contemplation and preparation) who were eating *less* than 5 servings of F&Vs a day. Those in the action/maintenance stage who were eating 5 or more servings of F&Vs a day were identified as true-action/maintainers. Men in the action/maintenance stage who were eating less than 5 servings of F&Vs a day were referred to as pseudo-action/maintainers.

Table 5.1. *Fourfold Contingency Table*

	Results based on FFQ		
Stage of Change	>5 day	<5 day	Total
Postaction stages	(a) True positive	(b) False positive	(a + b)
Preaction stages	(c) False negative	(d) True negative	(c + d)
Total	(a + c)	(b + d)	

Note. Adapted from "Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology", by D.V. Cicchetti, 1994, *Psychological Assessment, 6*(4), p. 286. Copyright 1994 by the American Psychological Association.. FFQ = food frequency questionnaire.

On the measures of psychosocial variables, mean scores were converted into T scores (M = 50, SD = 10) to facilitate comparison with earlier studies. Following post hoc analyses, descriptive characteristics were also used to describe men who were food secure (never or seldom experienced food insecurity) and food insecure (1-3 aspects of food insecurity experienced at least once in awhile).

Principal Components Analysis

PCA was used to determine the minimum number of components required to account for the total variance in the pros, cons, self efficacy, control, subjective norms, descriptive norms, self identity, and susceptibility to disease items. PCA is a data driven approach appropriate for use in the early stages of research, whereas confirmatory factor analysis may be used in the latter stages of scale development to test whether a hypothesised factor structure or model provides a good data fit (see Floyd & Widaman, 1995; Fabrigar et al., 1999; de Vet, Ader et al., 2005; Reise et al., 2000; DiLorio, 2005). There are several rules of thumb for determining the sample size required for factor analysis to produce stable and valid results. The ratio of participants per variable should be between 5 and 10 (Coakes, Steed & Dzidic, 2006; Gorsuch, 1983), and a minimum sample size of between 300 and 500 should be obtained where possible (Kahn, 2006; Tabachnick & Fidell, 2007). However, when communalities are high (percentage of variance in each item explained by all factors is .60 or more) and factors are well determined (at least 3 to 4 items with large

loadings on each factor), smaller sample sizes may be sufficient[44] (Fabrigar, Wegener, MacCallum & Strahan, 1999; Kahn, 2006; MacCallum, Widaman, Zhang & Hong, 1999; Reise, Waller & Comrey, 2000).

The sample size therefore permitted separate PCAs to be performed on the 49 items in two randomly selected split half samples. While the split half PCA solutions permitted the internal replicability of the results to be evaluated, Thompson (2004) recommends using the full sample results as the basis for interpretation as more confidence can be vested in results obtained from larger samples. A PCA was therefore also performed on all 49 items in the full sample. Separate PCA solutions were compared using coefficient of congruence values, which assess the degree of similarity in component loadings[45] (Everett, 1983; Floyd & Widaman, 1995; Guadagnoli & Velicer, 1991). Coefficient of congruence values greater than .90 have been interpreted as high (Reise et al., 2000; Sakamoto, Kijima, Tomada & Kambara, 1998) and were calculated using software developed by Watkins (2006).

The number of factors extracted in PCA was determined using a scree plot and parallel analysis as different rules can produce different results (Fabrigar et al., 1999; Kahn, 2006). A scree plot of eigenvalues was visually inspected to locate the break in the curve at which point the eigenvalues level out (Ho, 2006; Kahn, 2006; Reise et al., 2000; Weiss, 1971). Factors above this point are deemed meaningful, while those below it are considered to represent error or residual factors (Ho, 2006; Weiss, 1971). A parallel analysis was also performed as it requires few arbitrary decisions and takes into account the number of items and cases in the analysis (Weiss, 1971). The parallel analysis was performed using a randomly generated data matrix of the same size (i.e., 49 items x 458 respondents) using software developed by Watkins (2000). The eigenvalues obtained from the random data were compared to the sample data. Components which had eigenvalues higher than the randomly generated eigenvalues were retained as they explain more variance than chance (Fabrigar et al., 1999; Floyd & Widaman, 1995; Khan, 2006; Reise et al., 2000). The eigenvalue greater than one

[44] The communalities represent the variance in items accounted for by the factors. Communalities can also be viewed as a lower bound estimate of reliability of scores on the variable. For example, if an tem has a communalities of 50% then the reliability of the scores on the item is not less than .50 (Thompson, 2004).

[45] Sum of cross products of the loadings for the 2 factors being compared, divided by the square root of the product of the sums of the squared loadings (see Everett, 1983).

rule was not used as it often results in the over extraction of factors in larger sample sizes, with some factors accounting for a small proportion of variance (Kahn, 2006; Russell, 2002; Velicer & Jackson, 1990a).

An oblique promax rotation was first used to rotate the components as it is more realistic to assume the components are correlated (Fabrigar et al., 1999; Ho, 2006; Reise et al., 2000). The results of the PCA indicated the intercorrelations among the components were however moderate to small. Consequently, an orthogonal varimax rotation was performed as it often results in simple structure and thereby making interpretation easier (Kahn, 2006; Tabachnick & Fidell, 2007; Weiss, 1971). Items with loadings of +/- .40 were considered to load onto a component as they would be sharing at least 15% of variance with the component. In addition, summated average scale scores were calculated for each participant based on salient items loading onto each component. Factor scores based directly on all component loadings were also generated[46]. The relationship between the summated scale scores and factor scores was examined, along with the intercorrelations among the summated scales. The internal consistency of the summated scales was evaluated using Cronbach's alpha[47].

Analysis of Variance

One way between groups ANOVA was used to determine whether there were any mean differences on factors across the stages of change for F&V intake. All ANOVAs were conducted using the General Linear Model (GLM) and Type III sums of squares using estimated marginal means as sample sizes were unequal[48]. Following significant omnibus *F* and Welch tests, post hoc comparisons were used to determine which means were significantly different. The Games Howell modification of the Tukey post hoc test was used as it appears to be least affected by the pairing of large and small variances with large sample sizes, maintains nominal Type I error

[46] A factor score is computed for a given case for a given factor by taking the case's standardised score on each variable and multiplying it by the corresponding factor loading of the variables for the given factor and summing these products (Garson, 2006). The disadvantage of factor scores is that they are not easily replicated across studies because they are based on the factor matrix, which is derived separately in each study (Hair et al., 2006).

[47] Nunnally & Bernstein (1994) and others suggest an alpha coefficient of .70 or greater be used as a standard to estimated reliability (DiLorio, 2005)

[48] See http://web.uccs.edu/lbecker/SPSS/glm_uneqn.htm

rates, and has more power than alternate tests (Day & Quinn, 1989; Keselman & Rogan, 1978)[49].

Magnitude of Standardised Mean Differences. To facilitate the comparison of results measured on different scales, standardised mean differences were used (Kline, 2004). The magnitude of difference in two group means was assessed with Cohen's *d.* The standardiser in Cohen's *d* is the standard deviation of the two groups being compared[50] and was calculated as follows:

$$\text{Cohen's } d = \frac{M_a - M_b}{\sqrt{(SD_a^2 + SD_b^2)/2}}$$

Cohen's *d* is interpreted in standard deviation units. A *d* of 1.00 for example indicates the groups differ by a full standard deviation, while 0.50 indicates they differ by half a standard deviation (Leong & Austin, 1996). Guidelines for interpreting Cohen's *d* suggest .20, .50, and .80 reflect small, medium and large effect sizes respectively (Cohen, 1992).

Strength of Association for Grouped Data. While Cohen's *d* is appropriate for comparing the difference between two group means (e.g., two stages of change), when there are three or more group means (e.g., all stages of change) measures of association can also be used to assess the proportion of total variance accounted for in the dependent variable due to differences among group means (Henson, 2006). Eta squared (η^2) was the measure of association used for the grouped data[51]. While alternative inferential measures of association such as omega squared are available and are less positively biased, eta squared is more appropriate when ANOVA is unbalanced (Keppel, 1991; Kline, 2004; Olejnik & Algina, 2000).

[49] As for ANOVA, when larger variances are associated with smaller sample sizes the Games Howell test can have inflated Type I error (see Day & Quinn, 1989).
[50] Hedge's *g* uses the pooled standard deviation of all cells in the design while Glass' delta uses the standard deviation of one of the groups, typically the control group (see Olejnik & Algina, 2000, p245).
[51] η^2 = partial η^2 in one way ANOVA (Levine & Hullett, 2002).

Eta squared was calculated using the following formula:

$$\text{Eta squared} = \frac{\text{Sum of squares between groups}}{\text{Total sum of squares}}$$

For measures of association, Cohen's (1988) guidelines suggest 1%, 6% and 14% represent small, medium and large effects respectively.

Trend Analysis. Trend analysis using orthogonal polynomial contrasts was used to determine whether the relationship between each factor and the stages of change was best explained by a linear, quadratic or cubic component of trend, in line with the recommendations of Sutton (2000) and previous research (e.g., Armitage & Arden, 2002; Armitage et al., 2003; V. Stroebl, personal communication, August 14, 2007). A linear relationship reflects consistent increases or decreases in a factor across the stages of change (i.e., straight line). In contrast to stage model assumptions, a linear pattern suggests a factor is important in all stages of change. A quadratic relationship is evident if the slope of the factor increases or decreases (i.e., U-shaped or inverted U-shaped), and a cubic relationship indicates the slope changes twice (e.g., up-down-up [Rosenthal & Rosnow, 1991; Rosenthal, Rosnow & Rubin, 2000]). Non-linear patterns indicate factors are important in different stages of change in line with stage model assumptions. The results of trend analysis were evaluated using unweighted means as sample sizes were unequal[52] (see Rosenthal & Rosnow, 1991). Eta squared was used to determine the proportion of variance explained by each component of trend.

[52] Harmonic and estimated marginal means. For more detailed information on performing trend analysis see www.visualstatistics.net and Wuensch (2006).

Hierarchical Multiple Regression Analyses

Pearson product-moment correlations were used to determine the strength and direction of bivariate relationships. The coefficient of determination (r^2) was used to assess the variance shared between two factors and was interpreting using Cohen's (1988) guidelines for measures of association[53].

Hierarchical multiple regression (HMR), which takes into account the inter-correlations among predictor variables was used to determine the collective and independent impact of the independent variables on the dependent variable. HMR also provides a means of evaluating the variance explained by independent variables in a dependent variable at their own point of entry into the equation (Hair, Anderson, Tatham & Black, 1998). Relevant variables which had a significant relationship at the bivariate level with the dependent variable were entered into the HMR. For each HMR the R^2, adjusted R^2, and the change in R^2 were examined. The R^2 reflects the total variance explained by the set of independent variables collectively in the dependent variable, while the adjusted R^2 takes into account the inflation due to the number of variables in the model and sample size (Hair, Anderson, Tatham & Black, 1998). The change in R^2 indicates the additional variance explained in the dependent variable by the set of independent variables entered in on subsequent steps of the analysis (Tabachnick & Fidell, 2001). Also examined were the unstandardised (B) regression coefficients which indicate the expected change in the dependent variable for every unit increase in the independent variable, and the standardised regression coefficients (β) which can be used to assess the relative importance of independent variables.

Mediating Effects. The mediating effects of intentions on the main effects of the psychosocial variables on F&V intake was assessed using HMR. A mediator is the mechanism by which an independent variable influences a dependent variable (Baron & Kenny, 1986).

[53] See measures of association for grouped data.

According to Baron and Kenny (1986) and Holmbeck (1997) a variable functions as a mediator if it meets the following conditions as outlined in Figure 5.1.

(1) The independent variable is significantly associated with the hypothesised mediating variable (i.e., Path *a*).

(2) The mediating variable is significantly associated with the dependent variable (i.e., Path *b*).

(3) The independent variable is significantly associated with the dependent variable (i.e., Path *c*), and

(4) The impact of the independent variable on the dependent variable is less after controlling for the mediating variable. The degree to which the relationship is reduced reflects the potency of the mediator, with the strongest demonstration of mediation occurring when Path *c* becomes zero.

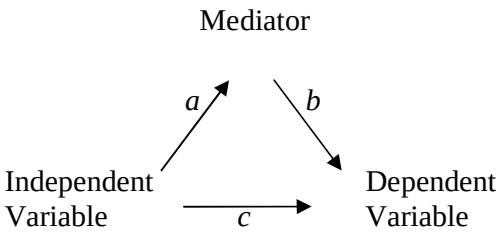

Figure 5.1. Mediational model.

Note. From "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", by R.M. Baron and D.A. Kenny, 1986, *Journal of Personality and Social Psychology, 51*(6), p. 1176.

A series of HMRs were performed to test the mediating effects of intentions based on the recommendations of Baron and Kenny (1986) and Holmbeck (1997). In the first HMR, path *a*, or the relationship between the independent variables and intentions was examined. In the second HMR, path *c*, or the relationship between the independent variables and F&V intake was assessed. Path *b*, or the relationship between intentions and F&V intake (controlling for the independent variables) was assessed by subsequently including intentions in on the same step as the psychosocial variables in the second HMR. By including intentions in on the same step as the psychosocial variables the impact of the independent variables on F&V intake could

also be assessed after controlling for the mediating variable (step 4 above)[54]. The degree to which the relationship between the independent variables and F&V intake was mediated by intentions was assessed by comparing the beta values in the HMR of F&V intake prior to and after the inclusion of intentions to the model.

Moderating Effects. HMR analyses were also used to determine whether self efficacy moderated the impact of intentions in predicting F&V intake. In post hoc analyses possible interactions between psychosocial factors with self efficacy and intentions in predicting behaviour were also examined. As illustrated in Figure 5.2, a moderating variable influences the direction and/or strength of the relationship between an independent and dependent variable (Baron & Kenny, 1986). Based on the recommendations of Holmbeck (1997), the variables were centred prior to analysis by subtracting the sample mean from individual scores on each variable. The interaction terms were then represented by the product of the two main effects (e.g., food insecurity x intentions) and entered into the HMR following the main effects of the independent variables.

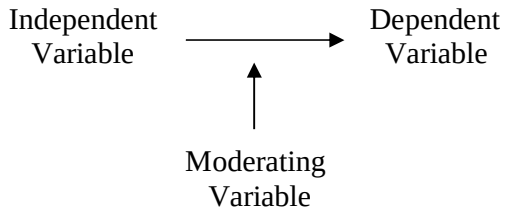

Figure 5.2. Moderator model.

Note. Adapted From "Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: examples from the child-clinical and pediatric psychology literatures", by G.N. Holmbeck, 1997, *Journal of Consulting and Clinical Psychology*, 65(4), p. 600. Copyright 1997 by the American Psychological Association.

Assumptions. The assumptions of multiple regression were also assessed following analysis using the strategies recommended by Hair and colleagues (1998) and Pallant (2001). The ratio of cases-to-independent variables was more than sufficient following the use of listwise deletion to delete cases with missing data[55]. In addition, the smallest sample size (n = 144) had sufficient power to detect R^2 values of at least

[54] Baron and Kenny (1986) have recommended using simultaneous entry (rather than hierarchical entry) in the third equation, so that the effect of B on C is examined after A is controlled and the effect of A on C is examined after B is controlled (Holmbeck, 1997, p. 602).
[55] The ratio should not be below 5:1 and should ideally be between 15 and 20 (Hair et al., 2006).

15%, 80% of the time (see Hair et al., 2006). Furthermore, the bivariate correlations and collinearity statistics revealed no evidence of multicollinearity. An inspection of the residuals scatter plot and normal probability plot of the regression standardised residuals also revealed the assumptions of normality, linearity, and homoscedasticity were adequately met. The independence of error terms was also assessed by examining the degree to which the Durbin-Watson statistic varied from two.

Mahalanobis distances were used to identify multivariate outliers. One multivariate outlier in the analysis of intentions had extreme responses on several scales. Two multivariate outliers in the analysis of F&V intake did not intend to eat F&Vs in the future but rated perceived norms as high and considered themselves to be healthy eaters. When the interaction terms were included in the analysis of F&V intake an additional five multivariate outliers were identified who had a low level of F&V intake and high level of food insecurity but strong intentions of eating F&Vs in the future, as well as four multivariate outliers who had a high level of food insecurity, moderate level of F&V intake and low intentions of eating F&Vs in the future. Each case had a Mahalanobis distance which exceeded the critical Chi-square value using a conservative alpha level of $p < .001$ as recommended by Tabachnick and Fidell (2007) and was deleted from the analysis.

Data analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 14.0. The results were evaluated with an alpha level of .05.

6. Results

The results in this section are presented in relation to each research objective. The descriptive characteristics of participants are presented first followed by the level of fruit and vegetable (F&V) intake, food insecurity, and awareness of F&V guidelines. The proportion of men classified in each stage of change for F&V intake is then examined along with the validity of the stage of change measure. In the next part of the chapter, analyses relating to the reliability and validity of psychosocial scales are presented. Analyses examining factors across the stages of change are then reported followed by the relationship between factors and F&V intake. Tests of the mediating effects of intentions and moderating effects of self efficacy on intentions in predicting F&V intake are then presented. In the final part of this chapter post hoc tests investigating moderating effects of factors in relation to intentions and self efficacy are reported.

Descriptive Characteristics

The sociodemographic characteristics of the survey participants are presented in Table 6.1. In total, 518 men took part in the survey who were aged between 18 and 97 years (M = 51.20, SD = 16.16). Compared to the 2001 New Zealand (N.Z.) Census, respondents were more likely to be N.Z. Europeans/Other (89% vs. 82%), over the age of 45 (67% vs. 44%), and more educated (25% vs. 12% university qualification; 18% vs. 28% no qualification [Statistics N.Z., 2002ab[56]]). Participants also had a higher level of income, with 53% earning at least $40,000 a year compared to the median income of $31,500 for men in 2006 (Statistics N.Z., 2007b). The health characteristics of participants are also summarised in Table 6.1. The body mass index (BMI) of respondents ranged from 14.95 to 43.66[57] (M = 26.59, SD = 3.99), and approximately 2 in 3 men were either overweight or obese. Compared to the results of the 2002/03 N.Z. Health Survey (NZHS) a greater proportion of men in the current study were overweight (49% vs. 41%) but less were obese (16% vs. 19%) (Ministry of Health [MOH], 2004b[58]).

[56] In 2006, 25% no qualification, 11% bachelors and 5% post-graduate degree (Statistics N.Z., 2008).
[57] Four participants were identified as outliers with a body mass index (BMI) greater than 45.
[58] Results from the 2007 NZHS indicate 41% of men are overweight and 25% obese (MOH, 2008).

Table 6.1. *Descriptive Characteristics of Study Participants, N = 514*

	n	%
Ethnicity		
NZ Maori	35	6.8
NZ European/Other	454	88.9
Pacific Islander	12	2.3
Asian	32	6.3
Age (years)		
18 – 24	32	6.3
25 – 44	138	27.0
45 – 64	234	45.8
65+	107	20.9
Highest educational qualification		
No school qualification	89	17.6
Secondary school qualification	107	21.1
Trade or professional qualification	170	33.5
University qualification	127	25.0
Qualification gained overseas	14	2.8
Income		
Loss/Zero - $20,000	102	20.3
$20,001 - $40,000	137	27.2
$40,001 - $70,000	158	31.4
$70,000 or more	106	21.1
Overweight & obese		
Normal weight	176	34.9
Overweight	249	49.4
Obese	79	15.7
Chronic health problems		
None	190	37.0
1 – 2 chronic health problems	233	45.4
3 or more chronic health problems	90	17.6
Self rated health		
Excellent	53	10.4
Very good	187	36.6
Good	212	41.5
Fair	53	10.4
Poor	6	1.2

The differing rates of overweight and obesity may be due to the use of self report measures in the current study compared to objective measures in the 2002/03 NZHS[59]. In comparison to the 2002/03 NZHS, a similar proportion of men rated their health as good, very good or excellent (86% vs. approximately 90%)[60]. Among the specific chronic health conditions examined, high blood pressure was reported most frequently (22%), followed by a hearing impairment (19%), and arthritis (16%). In addition, 10% of respondents reported heart disease, 5% diabetes, 3% stroke, and 2% cancer. In the 2002/03 NZHS similar rates were reported for high blood pressure (18%), heart disease (10%), diabetes (6%), stroke (2%) and cancer (3%), but arthritis which is more common in older people was lower (12% [MOH, 2004b]).

Fruit & Vegetable Intake, Food Insecurity & Guideline Awareness

The first objective of the study was to provide a descriptive account of the level of F&V intake, food insecurity and awareness of F&V guidelines.

Fruit & Vegetable Intake

Average F&V intake was 3.92 (*SD* = 2.08) servings a day as summarised in Table 6.2 (including one serving of juice and excluding hot potato chips). However, the median was lower (3.54) as a large proportion of men had a low level of F&V intake.

Table 6.2. *Mean Daily Intake of Fruit & Vegetables*

	M	*SD*
Fruit intake	1.79	1.27
Fruit	1.39	1.17
Juice	.40	.40
Vegetable intake	2.13	1.26
Potatoes	.56	.43
Salad	.50	.48
Cooked vegetables	1.06	.97
Fruit & vegetable intake	3.92	2.08
Hot Potato Chips	.26	.29

[59] There is a tendency for weight to be under reported and height over reported when self reported (Sturm, 2002), which results in lower BMIs. The 2002/03 NZHS on the other hand assessed weight using scales and height with a stadiometer in face to face interviews (MOH, 2004b).
[60] The 2007 NZHS (MOH, 2008) found 60% of men rated their health as very good or excellent compared to 47% in the current study. Chronic diseases were also examined in the 2007 NZHS.

Approximately 1 in 3 men (30.4%) were eating 5 or more servings a day in line with dietary guidelines. The proportion of men eating 2 or more servings of fruit and 3 or more servings of vegetables a day were 44.8% and 21.8% respectively[61]. Hot potato chips were also consumed on average nearly 2 times a week. The mean intake of hot potato chips was also inflated however by the small proportion of men with a high level of consumption. In total, 41% of men ate hot potato chips less than once a week, 26% once a week, and 33% three or more times a week.

Food Insecurity

The proportion of men reporting different aspects of household food insecurity is presented in Table 6.3. Overall, 49% of men indicated all aspects of household food insecurity were never a problem for them. For 19% of men food insecurity was seldom a problem[62]. On the other hand, 18% of men experienced 1-2 aspects of household food insecurity at least once in awhile and 14% experienced 3 or more aspects of food insecurity at least once in awhile.

Table 6.3. *Proportion Reporting Different Aspects of Household Food Insecurity*

Food Insecurity Item	Never %	Seldom %	Once in awhile or more %
Can afford to eat properly[a]	63.3	25.4	11.3
Food runs out	71.3	15.2	13.5
Eat less	70.6	17.4	12.0
Variety of foods limited	59.8	16.5	23.7
Rely on others	90.3	5.7	4.0
Use food grants/banks	94.7	2.4	2.9
Stressed about lack of money for food	82.5	9.6	7.9
Stressed when no food for social occasions	79.7	11.6	8.7

[a] Item reverse scored

[61] The 2007 NZHS (MOH, 2008) in comparison found 56.1% of men eating 3 servings of vegetables and 49.6% eating 2 servings of fruit.

[62] Indicating one or more aspects of household food insecurity were seldom a problem, and other aspects were never a problem.

Awareness of Fruit & Vegetable Guidelines

In total, 23% of men thought recommendations were to eat *less than* 5 servings of F&Vs a day. On the other hand, 40% had a moderate level of awareness, indicating 5 or more servings a day but not in line with any guideline. A further 21% appeared to be aware of the 5 a day message, indicating guidelines were to eat at least 5 servings of fruit *and* 5 servings of vegetables. However, only 16% of men were aware of specific recommendations for both vegetables and fruit. Over three quarters of men therefore appeared to be aware of the general guidelines which recommend eating at least 5 servings of F&Vs a day, but only a small proportion were aware of specific recommendations.

Stages of Change

The next objective of the study was to determine the proportion of men classified in each stage of change for F&V intake and the validity of the measure. The validity of the stage of change measure was assessed by examining mean differences in F&V intake across the stages of change, as well as the proportion of men in each stage consuming at least 5 servings of F&Vs a day. To determine whether men in the action/maintenance stage who were not eating 5 or more servings a day should be reclassified into another stage, their intentions and self identity as a healthy eater were compared to other stages of change.

Stage of Change Distribution

The proportion of men classified in each stage of change for F&V intake is summarised in Table 6.4. Approximately half (51%) of the men were in the action/maintenance stage. In total, 32% of men were in the precontemplation stage, 10% in the contemplation stage, and 7% in the preparation stage[63].

[63] A similar level of intentions was found among men in the preaction stages with 26% (of all men) strongly disagreeing-neither agreeing or disagreeing they intended to eat 5 or more servings of F&Vs a day in the future, and 20% mildly-strongly agreeing.

Table 6.4. *Stage of Change Distribution for Fruit & Vegetable Intake, N = 509*

	Total		PC		C		P		A/M	
	N	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Total	509	(100)	162	(32)	52	(10)	37	(7)	258	(51)
Less than 5 a day	346	(68)	140	(86)	45	(87)	35	(95)	126	(49)
More than 5 a day	163	(32)	22	(14)	7	(13)	2	(5)	132	(51)

PC = Precontemplation, C = Contemplation, P = Preparation, A/M = Action and Maintenance

Mean Fruit & Vegetable Intake in each Stage

The mean level of F&V intake in each stage of change was assessed using a brief food frequency questionnaire (FFQ). Men in the postaction stages were expected to have the highest level of F&V consumption on average. ANOVA with Games Howell post hoc tests indicated there was a statistically significant difference in F&V intake across the stages of change $F(3, 505) = 52.04$, $p<.001$, $\eta^2 = .24$). As illustrated in Figure 6.1, mean F&V intake in the action/maintenance stage ($M = 5.08$, $SD = 2.21$) was significantly higher than in the precontemplation ($M = 3.08$, $SD = 1.60$, $d = 1.04$), contemplation ($M = 2.70$, $SD = 1.70$, $d = 1.21$) and preparation stages ($M = 2.80$, $SD = 1.34$, $d = 1.25$). No differences in F&V intake were found among those in the preaction stages (precontemplation, contemplation and preparation). Based on Cohen's *d*, the level of F&V intake in the action/maintenance stage was 1.04-1.25 standard deviations higher than in the preaction stages.

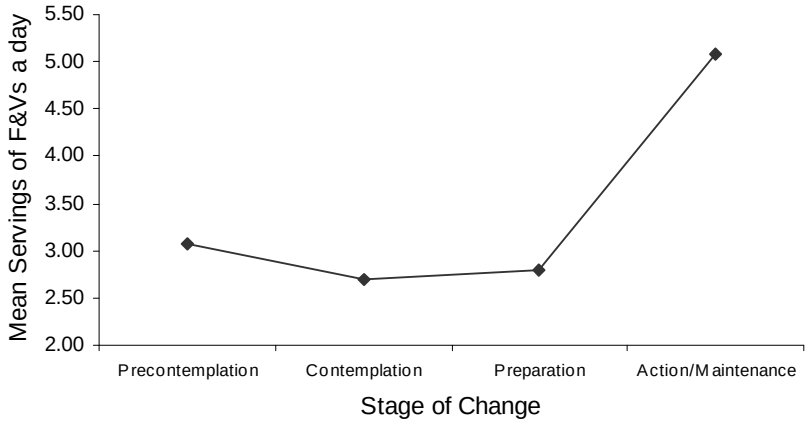

Figure 6.1. Fruit and vegetable intake across the stages of change.

Proportion Classified Correctly in each Stage

Summarised in Table 6.4 is the proportion of men in each stage of change who were eating 5 or more servings of F&Vs a day. Based on the level of F&V consumption among those in the preaction and postaction (action/maintenance) stages a fourfold contingency table was completed as presented in Table 6.5. A greater proportion of men in the postaction stages were expected to be eating 5 or more servings of F&Vs each day. Based on the results presented in Table 6.5, the negative predictive value of the stage of change measure was 88% (220/251) and indicates the proportion in the preaction stages who were consuming less than 5 servings of F&Vs a day. The positive predictive value on the other hand was 51% (132/258) and indicates the extent to which those in the postaction stages were eating at least 5 servings of F&Vs a day.

Table 6.5. *Fourfold Contingency Table based on Stage of Change for Fruit & Vegetable Intake and Consumption of Fruit & Vegetables*

	F&V intake based on FFQ		
Stage of change	>5 day	<5 day	Total
Action/maintenance stages	132	126	258
Preaction stages	31	220	251
Total	163	346	509

Classification of Pseudo-Maintainers

Men in the action/maintenance stage who were consuming *less* than 5 servings of F&Vs a day were referred to as "pseudo-action/maintainers". In total, n = 126 pseudo-action/maintainers were identified with an average F&V intake of 3.24 servings a day (SD = .95). The number of men identified as "true-action/maintainers" who were eating at least 5 servings a day was n = 132. To determine whether pseudo-action/maintainers should be reclassified into an earlier stage of change their intentions and self identity as a healthy eater were compared to true-action/maintainers and the other stages of change. Mean differences in intentions and self identity were examined using ANOVA and Games Howell post hoc tests.

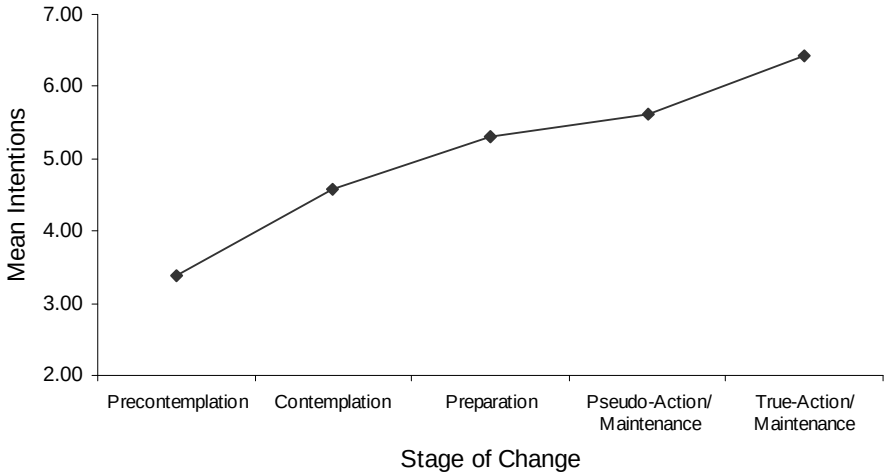

Figure 6.2. Intentions of pseudo-action/maintainers compared to other stages.

Intentions. There was a statistically significant difference in intentions across the stages of change $F(4, 499) = 109.97$, $p<.001$. As illustrated in Figure 6.2, the mean intentions of pseudo-action/maintainers ($M = 5.62$, $SD = 1.18$) was significantly higher than in the precontemplation ($M = 3.37$, $SD = 1.65$, $d = 1.87$) and contemplation stages ($M = 4.59$, $SD = 1.43$, $d = .79$) but lower than true-action/maintainers ($M = 6.43$, $SD = 0.82$, $d = .80$). No significant mean differences in intentions were found between pseudo-action/maintainers and those in the preparation stage ($M = 5.32$, $SD = 1.23$, $d = .25$). Although pseudo-action/maintainers had a higher level of intentions than those in the preparation stage, they were more similar to men in the preparation stage than true-action/maintainers based on the magnitude of standardised mean differences.

Self Identity. Self identity differed significantly across the stages of change, $F(4, 507) = 16.09$, $p<.001$. As illustrated in Figure 6.3, the mean self identity of pseudo-action/maintainers ($M = 3.83$, $SD = 0.69$) was significantly higher than in the precontemplation ($M = 3.52$, $SD = 0.77$, $d = .42$), contemplation ($M = 3.46$, $SD = 0.73$, $d = .52$) and preparation stages ($M = 3.43$, $SD = 0.67$, $d = .59$). A significant mean difference in self identity was also found between pseudo-action/maintainers and true-action/maintainers ($M = 4.08$, $SD = 0.63$, $d = .38$). Based on Cohen's d, pseudo-action/maintainers were more similar to true-action/maintainers based on their level of self identity than those in the preaction stages.

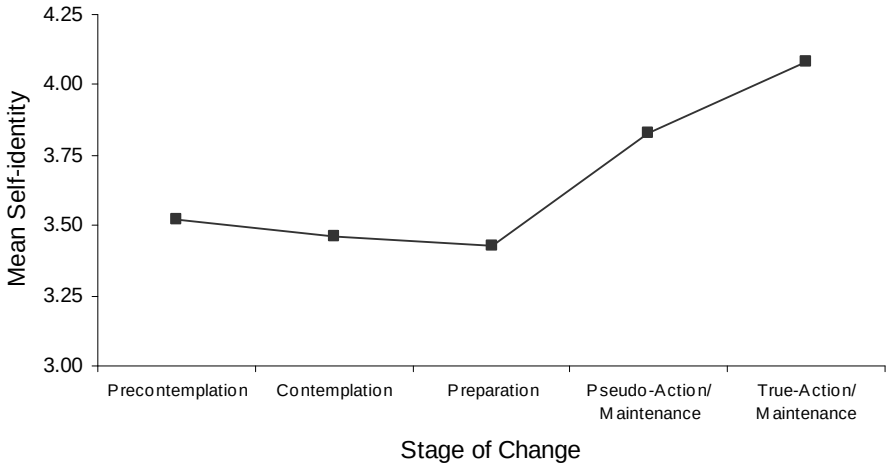

Figure 6.2. Self identity of pseudo-action/maintainers compared to other stages.

Overall, pseudo-action/maintainers appeared to be more similar to true-action/maintainers. On average, the F&V intake, intentions and self identity of pseudo-action/maintainers was higher than in the preaction stages. In addition, pseudo-action/maintainers were more similar to true-action/maintainers than those in the earlier stages of change based on their self identity as a healthy eater. Reclassification of pseudo-action/maintainers into an earlier stage of change was therefore considered unnecessary[64].

Psychosocial Scales

The next objective of the study was to determine the discriminant validity of psychosocial scales. Following item analysis, a principal components analysis (PCA) was used to determine the minimum number of components required to account for the pros, cons, self efficacy, control, subjective norms, descriptive norms, self identity, and susceptibility to disease items. Separate PCAs were performed on the 49 items in two randomly selected split half samples to examine the internal replicability of the solution, followed by a PCA on the 49 items in the full sample. Based on the results of these analyses, summated scales were developed and the reliability of each scale was assessed.

[64] Previous research suggests similar brief FFQs underestimate vegetable intake (see method section). Further evidence suggests the brief FFQ may be underestimating vegetable intake compared to the results of other N.Z. surveys (see discussion section).

The first PCA examined 49 items in a randomly selected split half sample. Bartlett's test of sphericity, the Kaiser-Meyer-Olkin (KMO) statistic and individual measures of sampling adequacy supported the factorability of the correlation matrix. Bartlett's test of sphericity was significant ($\chi^2 = 6071.98$, $p < .001$), the KMO statistic was .82, and all individual measures of sampling adequacy were greater than .70[65]. Seven components were extracted for further analysis based on the results of the parallel analysis presented in Table 6.6 and the scree plot of eigenvalues attached in Appendix D. The component loadings, communalities, and percentage of variance accounted for by each component following varimax rotation are also attached in Appendix E. The rotated factor solution was approaching simple structure (Thurstone, 1947) with each component showing a number of strong loadings, and items loading onto only one component. The results of the second split half PCA yielded similar results and are also attached in Appendix E. The coefficient of congruence values for the split half analyses were all above .99 and therefore indicated a very high degree of similarity.

Table 6.6. *Comparison of Eigenvalues obtained from the Principal Components Analysis (PCA) and Parallel Analysis in the First Split Half Sample, n = 230*

Component number	Actual eigenvalue from PCA	Criterion value from parallel analysis	Decision
1	8.448	2.035	Accept
2	6.344	1.917	Accept
3	4.164	1.839	Accept
4	2.873	1.766	Accept
5	2.372	1.707	Accept
6	2.008	1.641	Accept
7	1.680	1.598	Accept
8	1.209	1.535	Reject

While split half samples can be used to examine the internal replicability of results, Thompson (2004) recommends using the full sample results as the basis for interpretation as more confidence can be vested in results obtained from larger sample sizes. A PCA was therefore performed on all 49 items in the full sample.

[65] Bartlett's test of sphericity should be significant $p < .05$ and the MSA for entire matrix and individual items should be at least .50. Tests of overall measures of correlation to justify application of factor analysis (Hair, Black, Babin, Anderson & Tatham, 2006).

Table 6.7. *Inter-item Correlations, Means and Standard Deviations for Items Designed to Measure Psychosocial Factors, N = 458*

Item	Pros	*M*	*SD*	1	2	3	4	5	6	7	8	9
1	Give me vitamins and minerals	3.58	1.00	-								
2	Feel good about looking after my health	3.46	1.06	0.70	-							
3	Keep me regular (avoid constipation)	3.19	1.27	0.56	0.65	-						
4	Help control weight	3.09	1.23	0.53	0.63	0.61	-					
5	Help me look better	2.76	1.30	0.48	0.58	0.55	0.63	-				
6	Feel good as F&Vs are fresh	3.13	1.16	0.50	0.60	0.59	0.58	0.67	-			
7	Add variety to meals	3.15	1.10	0.49	0.55	0.64	0.55	0.55	0.68	-		
8	Family would be pleased	2.54	1.32	0.42	0.49	0.46	0.44	0.45	0.48	0.49	-	
9	Following food and nutrition guidelines	2.79	1.25	0.47	0.56	0.56	0.54	0.47	0.54	0.56	0.61	-
	Cons			10	11	12	13	14	15	16	17	18
10	Other would think I was fussy	0.13	0.21	-								
11	Meal planning would be difficult	0.14	0.21	0.46	-							
12	Time consuming	0.13	0.20	0.35	0.49	-						
13	Eating more would be expensive	0.20	0.24	0.28	0.29	0.49	-					
14	Worry about pesticides	0.17	0.22	0.23	0.16	0.15	0.28	-				
15	Feel I was overeating if I ate more	0.07	0.15	0.34	0.29	0.35	0.29	0.30	-			
16	Give up other foods	0.11	0.19	0.27	0.32	0.34	0.33	0.21	0.46	-		
17	Difficult to find F&Vs I like	0.12	0.20	0.21	0.34	0.37	0.31	0.19	0.31	0.35	-	
18	Bad reaction	0.12	0.20	0.16	0.27	0.20	0.18	0.30	0.36	0.26	0.32	-
	Self Efficacy			19	20	21	22	23	24	25	26	27
19	Can have for lunch	3.75	1.27	-								
20	Can have when feeling tired	3.82	1.14	0.65	-							
21	Can eat when favourite ones are unavailable	3.79	1.12	0.49	0.61	-						
22	Can eat when in a rush	3.74	1.14	0.57	0.66	0.70	-					
23	Can order when eating out	3.79	1.18	0.39	0.50	0.52	0.52	-				
24	Can have when needs to be peeled and cut	3.77	1.16	0.56	0.47	0.60	0.60	0.48	-			
25	Can have after fast food meal	3.13	1.47	0.39	0.45	0.46	0.53	0.47	0.53	-		
26	Can include when preparing meal for myself	4.11	1.01	0.39	0.50	0.45	0.47	0.59	0.42	0.39	-	
27	Can have small plate of vegetables for dinner	3.87	1.20	0.35	0.46	0.48	0.45	0.50	0.36	0.36	0.66	-

Item	Norms	*M*	*SD*	28	29	30	31	32	33	34
28	People important to me think I should eat 5+ a day (agree)	4.26	1.85	-						
29	Most of my family eat 5+ a day (agree)	3.72	1.46	0.58	-					
30	Most of my friends eat 5+ a day (agree)	4.01	1.65	0.49	0.64	-				
31	Most people important to me eat 5+ a day (agree)	4.22	1.75	0.61	0.77	0.69	-			
32	People important to me expect me to eat 5+ a day (likely)	4.19	1.65	0.60	0.54	0.48	0.57	-		
33	People important to me eat 5+ a day (true)	4.53	1.99	0.50	0.59	0.48	0.64	0.64	-	
34	Other people like me eat 5+ a day (likely)	4.03	1.94	0.36	0.51	0.43	0.50	0.44	0.50	-
	Susceptibility to Disease			35	36	37	38	39	40	
35	High cholesterol level sometime in my life	3.00	1.13	-						
36	Candidate for high blood pressure	2.82	1.16	0.50	-					
37	Overweight some point in my life	2.67	1.24	0.40	0.42	-				
38	Type of person who will get diabetes	2.20	0.98	0.30	0.40	0.44	-			
39	Likely I'll have a heart attack	2.71	0.99	0.46	0.46	0.35	0.41	-		
40	I believe I will get cancer	2.71	0.91	0.23	0.21	0.21	0.28	0.41	-	
	Control			41	42	43	44	45	46	
41	I am in control of the amount of F&Vs I eat	2.27	0.25	-						
42	When I don't eat enough F&Vs, I am to blame	2.26	0.29	0.40	-					
43	Other people determine the amount of F&Vs I eat	2.16	0.39	0.28	0.22	-				
44	Not much I can do about the amount of F&Vs I eat	2.25	0.34	0.24	0.30	0.34	-			
45	Whether or not I eat F&Vs each day is up to other people	2.30	0.30	0.24	0.26	0.49	0.49	-		
46	Other people decide how much F&Vs I eat	2.28	0.31	0.31	0.29	0.61	0.31	0.66	-	
	Self Identity			47	48	49				
47	I think of myself as a healthy eater	3.71	0.90	-						
48	Concerned with healthy eating	3.74	0.89	0.56	-					
49	Concerned with the health consequences of what I eat	3.78	0.89	0.42	0.76	-				

Note. All correlations significant $p = <.01$

Table 6.8. *Component Loadings, Communalities (h^2), and Percentage of Variance for Principal Components Extraction and Varimax Rotation*

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel good about looking after my health	0.81							0.70
Feel good as F&Vs are fresh	0.79							0.67
Keep me regular (avoid constipation)	0.78							0.65
Help control weight	0.77							0.64
Add variety to meals	0.76							0.63
Help me look better	0.75							0.61
Following food and nutrition guidelines	0.74							0.60
Give me vitamins and minerals	0.74							0.56
Family would be pleased	0.68							0.57
Can eat when in a rush		0.82						0.70
Can have when feeling tired		0.78						0.65
Can eat when favourite ones are unavailable		0.78						0.66
Can order when eating out		0.73						0.55
Can have when needs to be peeled and cut		0.72						0.57
Can have fruit for lunch		0.68						0.53
Can have after fast food meal		0.66						0.46
Can include when preparing meal for myself		0.65						0.53
Can have small plate of vegetables for dinner		0.64						0.49
Most people important to me eat 5+ a day (agree)			0.86					0.77
Most of my family eat 5+ a day (agree)			0.83					0.73
People important to me eat 5+ a day (true)			0.78					0.64
People important to me expect me to eat 5+ a day (likely)			0.78					0.63
Most of my friends eat 5+ a day (agree)			0.76					0.60
People important to me think I should eat 5+ a day (agree)			0.75					0.60
Other people like me eat 5+ a day (likely)			0.63					0.47

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel I was overeating if I ate more				0.71				0.52
Time consuming				0.64				0.50
Give up other foods				0.64				0.46
Difficult to find F&Vs I like				0.59				0.40
Bad reaction				0.59				0.41
Meal planning would be difficult				0.59				0.44
Eating more would be expensive				0.55				0.40
Others would think I was fussy				0.50				0.40
Worry about pesticides				0.49				0.31
Other people decide how much F&Vs I eat					0.81			0.70
Whether or not I eat F&Vs each day is up to other people					0.81			0.68
Other people determine the amount of F&Vs I eat					0.78			0.63
Not much I can do about the amount of F&Vs I eat					0.67			0.54
When I don't eat enough F&Vs, I am to blame					0.58			0.43
I am in control of the amount of F&Vs I eat					0.52			0.50
Likely I'll have a heart attack						0.76		0.59
Candidate for high blood pressure						0.71		0.55
High cholesterol level sometime in my life						0.71		0.52
Overweight some point in my life						0.67		0.49
Type of person who will get diabetes						0.65		0.45
I believe I will get cancer						0.55		0.34
Concerned with healthy eating							0.81	0.76
Concerned with health consequences of what I eat							0.79	0.72
I think of myself as a healthy eater							0.62	0.60
Percentage of variance	11.50	11.02	9.07	7.14	6.73	6.12	4.58	

The mean, standard deviation, and intercorrelations among items are presented in Table 6.7. Bartlett's test of sphericity (χ^2 = 11106.41, p <.001), the KMO statistic (.87) and individual measures of sampling adequacy (>.70) supported the factorability of the correlation matrix. Seven components were extracted based on the scree plot of eigenvalues and parallel analysis (attached in Appendix F). The component loadings, communalities, and percentage of variance explained by each component following varimax rotation are summarised in Table 6.8. Component loadings under .40 have been suppressed to aid interpretation. In addition, all items have been ordered and grouped by size of component loading. The rotated factor solution is approaching simple structure (Thurstone, 1947) with each component showing a number of strong loadings, and items loading onto only one component. An examination of the communality values (proportion of variance in each item accounted for by the set of components) in Table 6.8 suggests the cons items are not as well represented in the factor solution.

Most items loaded onto their anticipated component. Components 1, 4, and 2 reflect the Pros, Cons and Self Efficacy respectively. Component 3 was interpreted as Perceived Norms given subjective and descriptive norm items loaded onto the same component. Component 5 was interpreted as Control as it contains internal and external control items. Components 6 and 7 reflect Susceptibility to Disease and Self Identity respectively. The total variance explained by the 7-component solution was 56.15%. Following rotation, the pros component explained the largest amount of variance (11.50%), followed by self efficacy (11.02%), perceived norms (9.07%), cons (7.14%), control (6.73%), perceived susceptibility to disease (6.12%), and self identity (4.58%).

The results of the PCA for the pros, cons, and self efficacy items were also compared to those of Ling (1999; Ling & Horwath, 1999, 2001) found during original scale development. There was a high degree of similarity in component loadings for the pros and cons items. The coefficient of congruence value was .99 for salient pros and cons items that were used in the current study and contained on Ling's scales. However, in contrast to the results of Ling (1999; Ling & Horwath, 1999), the self efficacy items represented a single component following the deletion of three items contained on the original scale.

Summated scales were developed for the psychosocial factors based on the average score of salient items loading onto each component. The range, mean, standard deviation, and intercorrelations on each scale are summarised in Table 6.9. The intercorrelations among scales were small to moderate and therefore provide further evidence to suggest the psychosocial factors are relatively distinct constructs. Factor scores were also generated based directly upon component loadings. The relationship between factor scores and summated scale scores was very high with correlations ranging from .87 (self identity) to .98 (perceived norms). The reliability of each summated scale was also assessed using Cronbach's alpha. As summarised in Table 6.9, each scale had an acceptable level of internal consistency with alpha coefficients ranging from .77 (susceptibility to disease) to .92 (pros).

Table 6.9. *Intercorrelations, Means, Standard Deviations, and Cronbach's Alpha Reliability Coefficients for the Psychosocial Summated Scales*

Scale		Range	α	*M*	*SD*	1	2	3	4	5	6
1	Pros	1–5[a]	.92	3.12	0.92	-					
2	Cons‡	.0-.6[a]	.80	0.14	0.13	.30 **	-				
3	Self efficacy	1–5[b]	.90	3.74	0.88	.15 **	-.22 **	-			
4	Control†	1.4-2.5[c]	.82	2.25	0.21	-.02	-.34 **	.28 **	-		
5	Norms	1–7[c]	.89	4.14	1.38	.19 **	-.10 *	.24 **	.05	-	
6	Self identity	1–5[c]	.78	3.72	0.75	.21 **	-.18 **	.37 **	.20 **	.16 **	-
7	Susceptibility	1–5[c]	.77	2.69	0.73	.07	.19 **	-.16 **	-.17 **	.04	-.26 **

† Log ‡ Square root. [a] 1 = not important – 5 = extremely important. [b] 1 = not at all confident – 5 = totally confident.

[c] 1 = strongly disagree – 7 = strongly agree.

* p <.05, ** p <.01.

Stages of Change and Psychosocial & Contextual Factors

The next objective of the study was to examine the psychosocial and contextual factors across the stages of change. Mean differences in factors across the stages of change were assessed with one way ANOVAs, and evaluated with *F* and Welch (*W*) tests. In addition, Games Howell post hoc tests were used to determine which means were significantly different. The results were then used to determine which factors discriminated between adjacent stages of change (i.e., precontemplation and contemplation, contemplation and preparation, preparation and action/maintenance). The magnitude of standardised mean differences was assessed with Cohen's *d*. The mean scores on factors were also plotted across the stages of change to examine the overall pattern of scores. Finally, trend analysis using polynomial contrasts were used to assess whether the relationship between each factor and the stages of change was best explained by a linear or non-linear (quadratic or cubic) component of trend.

Psychosocial & Contextual Factors across the Stages of Change

Contextual factors examined across the stages of change included age, education, income, food insecurity, and awareness of F&V guidelines. The psychosocial factors included the perceived pros, cons, self efficacy, control, norms, self identity, and susceptibility to disease. Mean scores on all factors were expected to significantly differ across the stages of change. ANOVA results are presented in Table 6.10, along with mean scores and standard deviations on factors in each stage of change. The results presented in Table 6.10 indicate there were significant mean differences on all factors across the stages of change. The largest amount of variance in the stages of change due to differences in group means (η^2) was accounted for by perceived norms and self efficacy. Moderate-large amounts of variance in the stages of change were also explained by the pros and self identity. The cons, food insecurity, awareness of F&V guidelines, and age accounted for a moderate amount of variance. All other factors accounted for a small proportion of variance.

Table 6.10. *Mean Scores and Standard Deviations, ANOVA Results, and Effect Sizes for each Factor across the Stages of Change for Fruit & Vegetable Intake*

			Stage of Change						
		N	PC	C	P	A/M	*F**	*W**	η²
Age									
	M	512	52.55 [a]	46.79	39.40 [ab]	52.87 [b]	9.74	14.32	.05
	SD		16.49	15.57	12.06	15.99			
Education									
	M	508	2.54 [a]	2.81	2.61	2.86 [a]	3.09	3.03	.02
	SD		1.13	1.21	1.10	1.05			
Income									
	M	504	2.36 [a]	2.40	2.32	2.69 [a]	4.31	4.35	.03
	SD		1.07	1.01	0.88	1.03			
Food insecurity									
	M	509	0.94 [a]	1.28 [c]	1.82 [ab]	.81 [bc]	11.34	9.69	.06
	SD		1.06	1.20	1.18	1.05			
Aware of guidelines									
	M	509	1.94 [ab]	2.37	2.41 [a]	2.49 [b]	10.91	10.77	.06
	SD		0.99	1.16	0.87	0.92			
Pros									
	M	512	46.23 [abc]	52.77 [a]	56.31 [bd]	50.90 [cd]	16.03	22.61	.09
	SD		9.22	8.37	6.61	10.42			
Cons									
	M	507	50.00 [c]	55.71 [ac]	55.22 [b]	48.06 [ab]	13.23	10.07	.07
	SD		9.45	12.09	11.36	8.97			
Self efficacy									
	M	508	47.14 [ad]	42.36 [bde]	48.03 [ce]	53.75 [abc]	32.30	30.74	.16
	SD		9.86	10.12	9.41	8.46			
Control									
	M	506	48.92	47.80	50.24	51.16	2.63	2.70	.02
	SD		11.40	9.31	8.27	9.36			
Norms									
	M	513	44.11 [ac]	46.80 [b]	51.53 [c]	54.05 [ab]	43.92	40.93	.21
	SD		9.82	9.33	7.92	8.41			
Self identity									
	M	512	47.15 [a]	46.39 [b]	45.95 [c]	53.03 [abc]	18.42	18.54	.10
	SD		10.30	9.81	9.00	9.00			
Susceptibility									
	M	513	50.33	52.04	53.95 [a]	48.82 [a]	4.02	3.99	.02
	SD		9.84	9.72	9.92	10.04			

Note. Means that share the same subscript are significantly different from each other based on Games Howell post hoc tests. PC = Precontemplation, C = Contemplation, P = Preparation, A/M = Action/Maintenance. *All *F* and W tests significant p <.05

Factors Discriminating Between Adjacent Stages of Change

The results presented in Table 6.10 were used to determine which factors discriminated between adjacent stages of change. Mean differences in factors in adjacent stages were examined given the transtheoretical model (TTM) claims successful behaviour change is achieved by moving through the stages of change, from one stage of change to the next. As the ability to detect small-moderate mean differences on factors in adjacent stages has been limited in the current study by the small number of men in the contemplation and preparation stages, both significant and non-significant differences have been reported in Table 6.11.

Precontemplation-Contemplation. Based on the results presented in Table 6.11, the pros, cons and self efficacy differed significantly between the precontemplation and contemplation stages. The magnitude of mean differences on the pros between the precontemplation and contemplation stages were large, while moderate mean differences were detected for the cons and self efficacy. Although not significantly different, there were also small-moderate mean differences in awareness of F&V guidelines, age, food insecurity, and perceived norms.

Table 6.11. *Factors Discriminating among Adjacent Stages of Change for Fruit & Vegetable Intake and Standardised Mean Differences*

Precontemplation & contemplation			Contemplation & preparation			Preparation & action/maintenance		
Factors	*d*		Factors	*d*		Factors	*d*	
Age	.36		Age	.53		Age	.95	*
Pros	.74	*	Pros	.47		Pros	.62	*
Norms	.28		Norms	.55		Norms	.31	
Self efficacy	.48	*	Self efficacy	.58	*	Self efficacy	.64	*
Food insecurity	.30		Food insecurity	.45		Food insecurity	.90	*
Aware of guidelines	.40		Control	.28		Income	.39	
Cons	.53	*				Cons	.70	*
						Self identity	.79	*
						Susceptibility	.51	*

* Means were significantly different when evaluated with Games Howell post hoc tests following ANOVA, $p < .05$.
Mean differences less than $d = .20$ have not been reported.

Contemplation-Preparation. Self efficacy significantly differentiated between the contemplation and preparation stages. Although not significantly different, there were also moderate mean differences in perceived norms, age, pros, and food insecurity in the contemplation and preparation stages. Small increases in control were also found.

Preparation-Action/Maintenance. Between the preparation and action/maintenance stages there were significant and large mean differences in age, food insecurity, and self identity. In addition, significant and moderate mean differences were found in the cons, self efficacy, pros, and susceptibility to disease. Although not significantly different, there were also small-moderate mean differences in income and perceived norms in the preparation and action/maintenance stages.

Linear or Non-Linear Relationships across the Stages of Change?

The nature of the relationship between each factor and the stages of change was also examined. An underlying assumption of the TTM and stage models is that different factors are important in different stages. Therefore consistent increases or decreases in factors across the stages are not expected. In other words, linear relationships between key theoretical variables and the stages of change should *not* be found. To examine the overall pattern of scores across the stages of change, mean scores on each factor were plotted and are illustrated in Figures 6.4 to 6.14. Non-linear trends were expected to be found on age, income, food insecurity, and susceptibility to disease across the stages of change. Linear trends were expected for awareness of F&V guidelines, self efficacy, control, subjective and descriptive norms, and self identity.

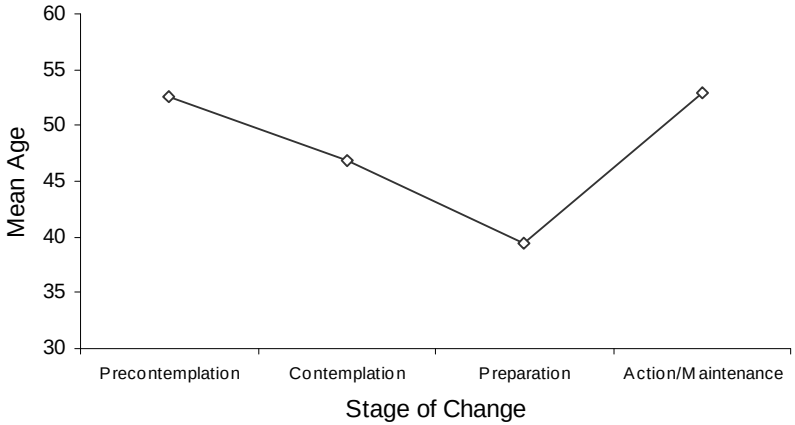

Figure 6.3. Age across the stages of change.

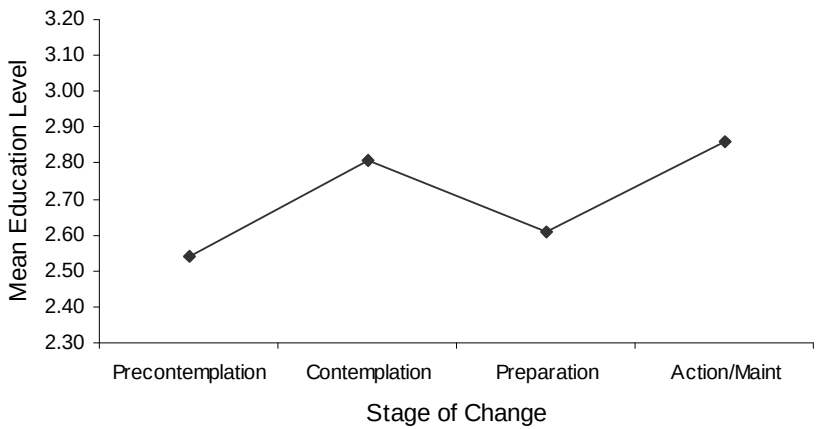

Figure 6.4. Education across the stages of change.

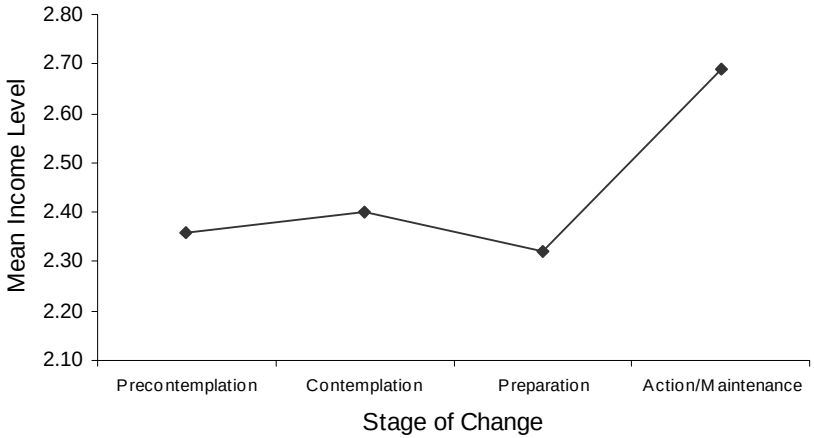

Figure 6.6. Income across the stages of change.

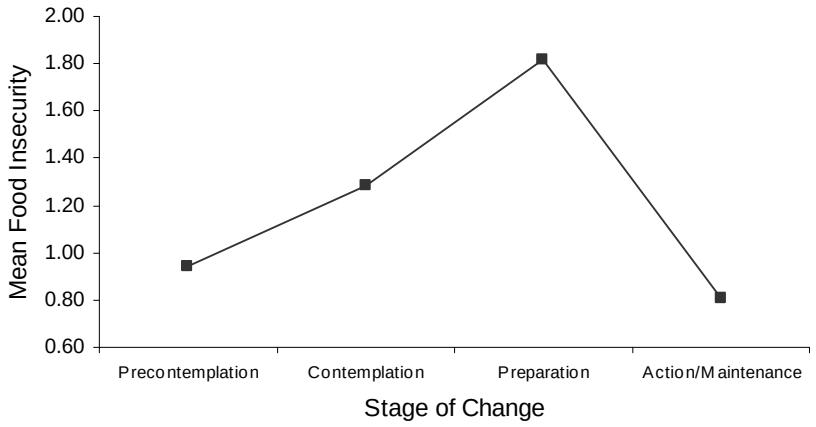

Figure 6.5. Food insecurity across the stages of change.

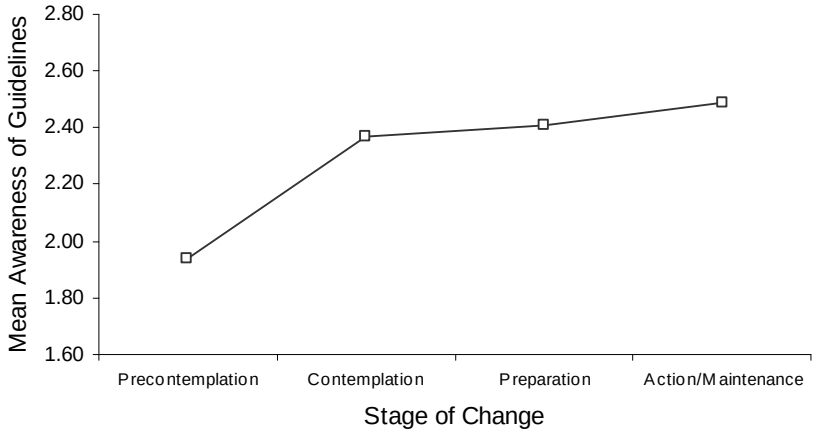

Figure 6.7. Awareness of guidelines across the stages of change.

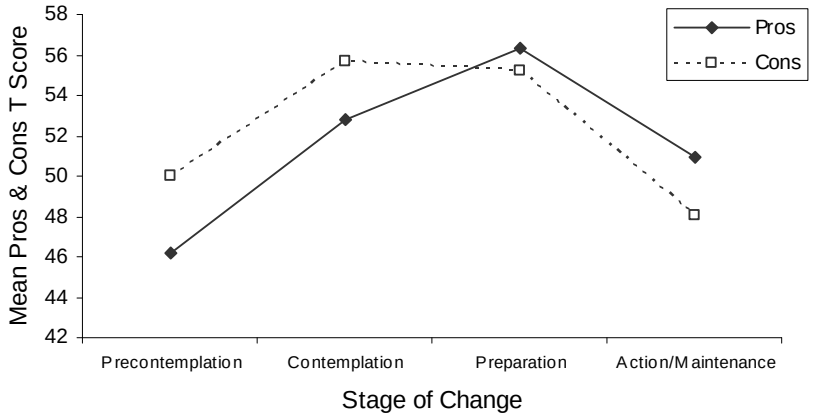

Figure 6.8. Pros and cons across the stages of change.

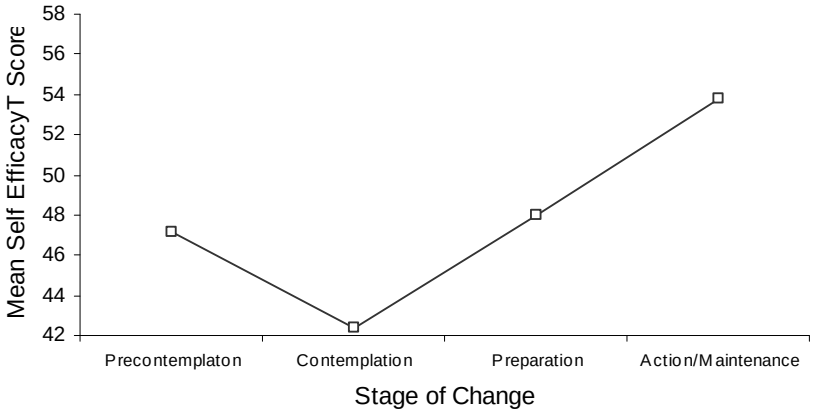

Figure 6.10. Self efficacy across the stages of change.

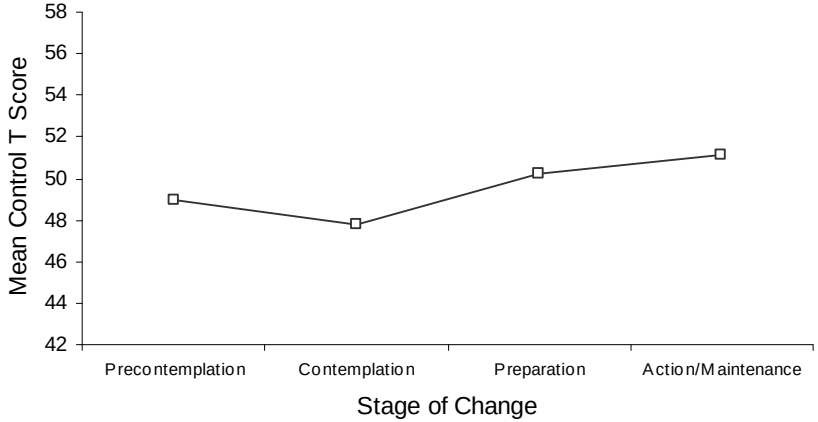

Figure 6.9. Control across the stages of change.

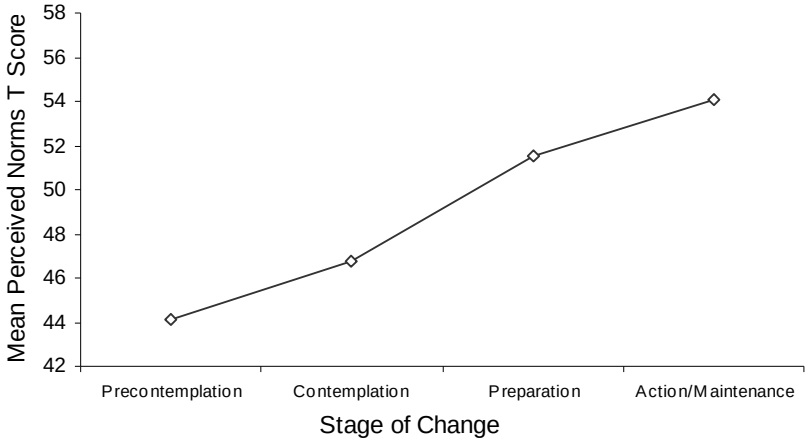

Figure 6.11. Perceived norms across the stages of change.

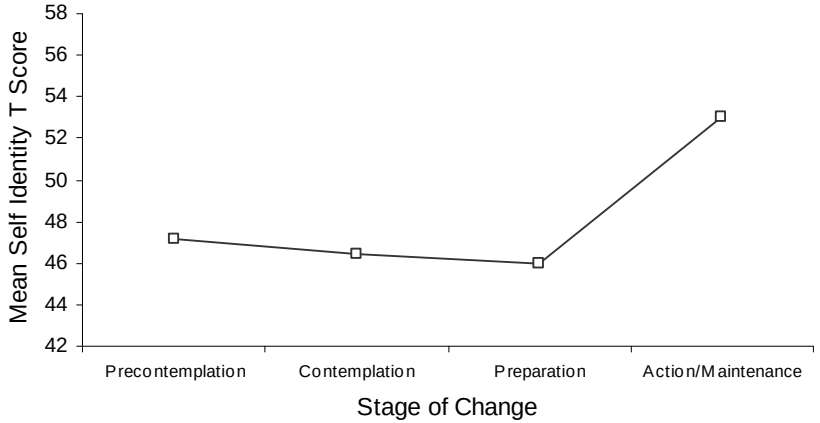

Figure 6.12. Self identity across the stages of change.

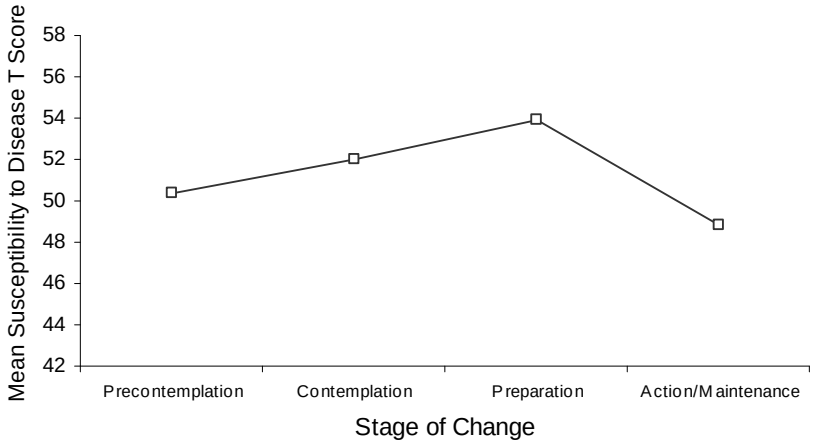

Figure 6.13. Susceptibility to disease across the stages of change.

Figures 6.4 to 6.14 suggest several factors are more important in the earlier stages of change including awareness of F&V guidelines, cons and self efficacy. In addition, mean scores on food insecurity, the pros, and perceived susceptibility to disease appear to increase in a linear fashion between the precontemplation and preparation stages, while age similarly decreases. Mean scores on these factors then decrease (or increase) in the latter stages of change, in the opposite direction. For income and self identity there were only small mean differences in the preaction stages but scores on these factors increased in the postaction stages. Finally, self efficacy increased in a linear fashion from contemplation to action/maintenance, and perceived norms increased in a similar manner from precontemplation to action/maintenance.

To determine whether the relationship between the factors and stages of change was best explained by a linear or non-linear (quadratic or cubic) component of trend, trend analyses were performed using orthogonal polynomial contrasts. The findings presented in Table 6.12 indicate the relationship between the stages of change and pros, self efficacy and self identity reflected both linear and quadratic components of trend. In addition, the relationship between the stages of change and age, as well as food insecurity, reflected both quadratic and cubic components of trend. Nevertheless, based on the strength of the η^2 measure of association, a linear relationship best explained the relationship between the stages of change and perceived norms, self efficacy, self identity, awareness of F&V guidelines, control, education and income. The linear component of trend accounted for the largest amount of variance in perceived norms and self efficacy. On the other hand, a quadratic component of trend best explained the relationship between the stages of change and the cons, food insecurity, pros, age and susceptibility to disease. The quadratic component of trend accounted for the largest amount of variance in the cons and food insecurity.

Table 6.12. *Linear, Quadratic & Cubic Components of Trend between Factors and the Stages of Change for Fruit & Vegetable Intake*

	Linear		Quadratic		Cubic	
	F	η^2	*F*	η^2	*F*	η^2
Age			26.63	.05	4.84	.01
Education	6.30	.01				
Income	5.78	.01				
Food insecurity			28.63	.05	7.19	.01
Aware of guidelines	22.21	.04				
Pros	24.60	.04	28.02	.05		
Cons			31.98	.06		
Self efficacy	56.84	.09	23.69	.04		
Control	6.14	.01				
Norms	110.50	.17				
Self identity	24.14	.04	12.32	.02		
Susceptibility			8.60	.02		

Note. df =1 and p <.05 for each component of trend analysis reported.

In summary, the results presented in this section indicate the psychosocial and contextual factors all differed significantly across the stages of change for F&V intake. Perceived norms, self efficacy, self identity and the pros accounted for the largest amount of variance in the stages of change. Furthermore, post hoc tests and the magnitude of standardised mean differences indicated a number of factors discriminated between adjacent stages of change. Between the precontemplation and contemplation stages the pros and cons were the most important factors, while self efficacy and perceived norms discriminated between the contemplation and preparation stages. Between the preparation and action/maintenance stages, age, food insecurity and self identity were the most important discriminating factors. Different factors were therefore important between adjacent stages of change. Nevertheless, plots of mean scores on factors across the stages of change revealed several patterns. Several factors consistently increased (or decreased) across the preaction stages, then decreased (or increased) in the postaction stages in the opposite manner. On other factors there were only small differences in the preaction stages but large increases in the postaction stages. For the remaining factors, mean scores tended to increase across both the pre- and post-action stages of change. The nature of relationship between the factors and the stages of change was also specifically tested using trend

analysis. Both linear and non-linear relationships were found between the factors and the stages of change. Consequently, the stages of change for F&V intake do not represent a single underlying continuum. Nevertheless, the magnitude of mean differences, pattern of mean scores, and results of trend analyses provide some evidence to suggest the preaction stages (i.e., precontemplation, contemplation, and preparation) represent an underlying continuum. In other words, those factors which were important in the preaction stages were similar regardless of whether one was classified in the precontemplation, contemplation or preparation stage.

Fruit & Vegetable Intake and Psychosocial & Contextual Factors

The remaining objectives of the study were to evaluate the impact of the psychosocial and contextual factors on F&V intake, and to determine whether intentions were the mechanism by which the psychosocial factors influenced behaviour. Moderating effects in predicting behaviour were also examined. The bivariate relationship among factors is reported first. A series of hierarchical multiple regression (HMR) analyses are then presented which examine the relationship between the predictor variables and intentions, and F&V intake, and the mediating effects of intentions.

Bivariate Relationship

The bivariate relationship between the factors and intentions, as well as F&V intake are presented in Table 6.13. Mean scores, standard deviations and the range on each variable are also presented.

Intentions. The results in Table 6.13 indicate intentions were significantly and positively related to income and education. That is, men who had a higher level of income and education on average had more intentions of eating adequate servings of F&Vs in the future. Awareness of F&V guidelines was also positively related to intentions. Men with a higher level of awareness of guidelines had stronger intentions on average. Among the psychosocial factors examined, Table 6.13 indicates intentions were significantly associated with all factors, except susceptibility to disease. That is, men who rated the benefits of eating F&Vs higher, believed they were more capable and in control of their F&V intake, had higher perceived norms,

and considered themselves healthy eaters had higher intentions on average. On the other hand, men who perceived more cons and barriers to eating F&Vs tended to have lower intentions. The magnitude of each of these relationships with intentions indicates perceived norms were explaining the largest amount of variance (32%), followed by self efficacy (12%) and self identity (9%).

Fruit & Vegetable Intake. Table 6.13 indicates F&V intake was positively associated with age, education and income. That is, men who were older, earned more, and had a higher level of education ate more F&Vs on average. Awareness of F&V guidelines and food insecurity were also significantly related to F&V intake. That is, men with a higher level of awareness of guidelines tended to eat more F&Vs. On the other hand, men who were experiencing higher levels of household food insecurity ate fewer F&Vs on average. Among the psychosocial factors examined, F&V intake was significantly related to all factors, except the pros. Findings indicate men who considered themselves capable of eating F&Vs in challenging situations, were more in control of their intake, rated norms higher, and considered themselves healthy eaters ate more F&Vs on average. On the other hand, men who rated the cons higher and considered themselves susceptible to chronic health conditions tended to eat fewer F&Vs. In addition, men who had stronger intentions had a higher F&V consumption on average. The magnitude of each of these relationships with F&V intake indicates self efficacy was explaining the largest amount of variance (26%), followed by intentions (19%), self identity (14%), and perceived norms (10%).

Mediating Effects. For a variable to function as a mediator, an independent variable needs to be related to both the dependent and mediating variable. Table 6.13 indicates the cons, self efficacy, control, perceived norms and self identity were significantly related to both intentions and F&V intake. It is therefore possible the main effects of these psychosocial factors on F&V intake may be partially mediated by intentions.

Table 6.13. *Range, Mean, Standard Deviation and Bivariate Correlations for Independent and Dependent Variables, N = 514*

	Factor	Range	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age	18-97	51.20	16.16	-													
2	Education	1-4[a]	2.68	1.05	-.10 *	-												
3	Income	1-4[b]	2.53	1.04	-.12 **	.21 **	-											
4	Food insecurity	0-3[c]	0.97	1.11	-.25 **	-.10 *	-.38 **	-										
5	Aware of guidelines	1-4[d]	2.30	0.99	-.09 *	.05	.04	-.05	-									
6	Pros	1 -5[e]	3.12	0.92	-.16 **	-.03	-.02	.16 **	.01	-								
7	Cons†	.0-.6[e]	0.14	0.13	-.15 **	-.08	-.23 **	.46 **	-.08	.30 **	-							
8	Self efficacy	1 -5[f]	3.74	0.88	.12 **	.12 **	.19 **	-.27 **	.14 **	.15 **	-.22 **	-						
9	Control‡	1.4-2.5[g]	2.25	0.21	-.04	.11 *	.14 **	-.19 **	.06	-.02	-.34 **	.28 **	-					
10	Norms	1-7[g]	4.14	1.38	-.01	.04	.16 **	-.15 **	.21 **	.19 **	-.10 *	.24 **	.05	-				
11	Self identity	1-5[g]	3.72	0.75	.30 **	.11 *	.10 *	-.16 **	.05	.21 **	-.18 **	.37 **	.20 **	.16 **	-			
12	Susceptibility	1-5[g]	2.69	0.73	-.00	-.08	-.05	.10 *	.01	.07	.19 **	-.16 **	-.17 **	.04	-.26 **	-		
13	Intentions	1-7[g]	4.92	1.82	.00	.12 **	.15 **	-.09	.22 **	.21 **	-.15 **	.35 **	.21 **	.57 **	.30 **	-.08	-	
14	F&V intake‡	0.5-3.3	1.92	0.52	.17 **	.15 **	.15 **	-.24 **	.17 **	.09	-.21 **	.51 **	.16 **	.31 **	.37 **	-.16 **	.44 **	-

† Log. ‡ Square root.

[a] 1 = no school qualifications, 2 = secondary school qualification, 3 = trade or professional qualification, 4 = university qualification. [b] 1 = Loss/Zero-$20,000, 2 = 20,001-$40,000, 3 = 40,001–70,000, 4 = 70,001 + [c] 0 = food secure – 3 = food insecure. [d] 1 = low - 4 = high. [e] 1 = not important – 5 = extremely important. [f] 1 = not at all confident – 5 = totally confident. [g] Strongly disagree – strongly agree.

* p <.05, ** p <.01.

Hierarchical Multiple Regression (HMR) of Intentions

A HMR was conducted to examine the collective and independent impact of the predictor variables in explaining intentions. The psychosocial factors were expected to make a unique and significant contribution to the variance explained in intentions. On step 1, the sociodemographic factors that were significantly associated with F&V intake were entered into the analysis. On step 2, awareness of F&V guidelines was entered. On step 3, the psychosocial factors that were significantly associated with intentions were entered into the model. The results of the HMR are presented in Table 6.14.

Table 6.14. *Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Intentions, N = 463*

	Step 1			Step 2			Step 3		
	B	β		*B*	β		*B*	β	
Income	.23	.13	**	.22	.13	**	-.01	-.00	
Education	.18	.10	*	.17	.10	*	.14	.08	*
Aware of guidelines				.35	.19	**	.15	.08	*
Pros							.27	.13	**
Cons							-.76	-.05	
Self efficacy							.30	.14	**
Control							.84	.10	*
Norms							.62	.47	**
Self identity							.21	.09	*
R		.19	**		.27	**		.66	**
R^2		.03			.07			.43	
Adjusted R^2	.	.03			.07			.42	
R^2 Change					.04	**		.36	**

** p <.01, * p <.05

After step 1, the *R* for the regression was significantly different from zero, $F(2, 460) = 8.19$, p <.001. Income and education each contributed significantly to the prediction of intentions. Altogether, 3% (3% adjusted) of the variability in intentions was predicted by knowing the scores on these variables. After step 2 with the addition of awareness of F&V guidelines to the equation, $F(3, 459) = 11.85$, p <.001, there was a

significant increment in R^2 (R^2 change = .04, p <.001). Awareness of F&V guidelines contributed significantly to the prediction of intentions. Altogether, 7% (7% adjusted) of the variability in intentions was predicted by knowing the scores on these variables. After step 3, the R for the regression was significantly different from zero, $F(9, 453) = 38.34$, p <.001. The pros, self efficacy, control, perceived norms, and self identity each contributed significantly to the prediction of intentions. Once the intercorrelations among the predictor variables had been taken into account however, income was no longer significantly related to intentions. Altogether, 43% (42% adjusted) of the variability in intentions was predicted by knowing scores on these variables. The beta values reported in Table 6.14 indicate the most important independent predictor of intentions were perceived norms, followed by self efficacy and the pros.

Hierarchical Multiple Regression (HMR) of Fruit & Vegetable Intake

A HMR was also conducted to examine the collective and independent impact of the predictor variables in explaining F&V intake. The contextual factors were expected to make a unique and significant contribution to the variance accounted for in F&V intake. The psychosocial factors were also expected to make a unique and significant contribution to the variance explained in F&V intake, over and above the contextual factors. On step 1, the sociodemographic factors that were significantly associated with F&V intake were entered into the analysis. On the following step, food insecurity and awareness of F&V guidelines were entered. The psychosocial factors that were significantly related to F&V intake were entered in on step 3. Presented in Table 6.15 are the results of the HMR.

After step 1, the R for the regression was significantly different from zero, $F(3, 449) = 12.80$, p <.001. Age, education and income each contributed significantly to the prediction of F&V intake. Altogether, 8% (7% adjusted) of the variability in F&V intake was predicted by knowing scores on these variables. After step 2 with the addition of food insecurity and awareness of guidelines to the equation, $F(5, 447) = 14.21$, p <.001, there was a significant increment in R^2 (R^2 change = .06, p <.001). Food insecurity and awareness of F&V guidelines each contributed significantly to

the prediction of F&V intake. Altogether, 14% (13% adjusted) of the variability in F&V intake was predicted by knowing scores on these variables.

Table 6.15. *Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Fruit & Vegetable Intake, N = 453*

	Step 1			Step 2			Step 3		
	B	β		*B*	β		*B*	β	
Age	.01	.18	**	.01	.14	**	.00	.04	
Education	.05	.10	*	.05	.10	*	.02	.05	
Income	.10	.19	**	.06	.11	*	.02	.04	
Food insecurity				-.09	-.19	**	-.04	-.09	*
Aware of guidelines				.09	.17	**	.04	.08	*
Cons							-.01	-.00	
Self efficacy							.22	.36	**
Control							-.07	-.03	
Norms							.07	.19	**
Self identity							.11	.16	**
Susceptibility							-.06	-.08	*
R		.28	**		.37	**		.62	**
R^2		.08			.14			.38	
Adjusted R^2		.07			.13			.37	
R^2 Change					.06	**		.24	**

** $p < .01$, * $p < .05$

After step 3 with the addition of the psychosocial factors to the equation, $F(11, 441) = 24.65$, $p < .001$, there was a significant increment in R^2 (R^2 change = .24, $p < .001$). Self efficacy, perceived norms, self identity and susceptibility to disease each contributed significantly to the prediction of F&V intake. Once the intercorrelations among the predictor variables had been taken into account however, age, education, income, and food insecurity were no longer significantly related. Based on the beta values reported in Table 6.15, self efficacy was the most important independent contributor to the prediction of F&V intake, followed by perceived norms and self identity.

Mediating Effects

The mediating effects of intentions were examined by including the variable in on step 3 of the HMR examining F&V intake. Intentions were expected to partially mediate the impact of the psychosocial factors on F&V intake. With intentions included in the model $F(12, 440) = 24.33$, $p < .001$, there was a significant increment in R^2 (R^2 change = .26, $p < .001$). Intentions contributed significantly to the prediction of F&V intake along with self efficacy, perceived norms, self identity, and susceptibility to disease. Food insecurity also contributed significantly to the prediction of F&V intake with intentions in the model. Altogether, 40% (38% adjusted) of the variability in F&V intake was predicted by knowing the scores on these variables. Based on the beta values reported in Table 6.16, self efficacy remained the most important unique predictor of F&V intake, followed by intentions, self identity, and food insecurity.

Table 6.16. *Summary of Hierarchical Multiple Regression Analysis for Mediating Effects of Intentions in Predicting Fruit & Vegetable Intake, N = 453*

	Step 1			Step 2			Step 3		
	B	β		*B*	β		*B*	β	
Age	.01	.18	**	.01	.14	**	.00	.05	
Education	.05	.10	*	.05	.10	*	.02	.03	
Income	.10	.19	**	.06	.11	*	.02	.03	
Food insecurity				-.09	-.19	**	-.05	-.11	*
Aware of guidelines				.09	.17	**	.04	.07	
Cons							-.01	-.00	
Self efficacy							.20	.32	**
Control							-.11	-.04	
Norms							.04	.10	*
Self identity							.10	.14	**
Susceptibility							-.06	-.08	*
Intentions							.05	.18	**
R		.28	**		.37	**		.63	**
R^2		.08			.14			.40	
Adjusted R^2	.	.07			.13			.38	
R^2 Change					.06	**		.26	**

** $p < .01$, * $p < .05$

To determine whether intentions were mediating the main effects of the psychosocial factors on F&V intake, the regression coefficients in Tables 6.15 and 6.16 were compared. When intentions were included in the HMR examining F&V intake there was a reduction in the regression coefficient associated with perceived norms. The results therefore suggest the main effect of perceived norms on F&V intake were partially mediated by intentions.

Moderating Effects

Possible moderating effects were also tested using HMR. Self efficacy was expected to moderate the impact of intentions in predicting F&V intake. A small and not statistically significant interaction was found between self efficacy and intentions.

Table 6.17. *Summary of Hierarchical Multiple Regression Analysis for Moderating Effects Predicting Fruit & Vegetable Intake, N = 444*

	Step 1			Step 2			Step 3			Step 4		
	B	β		*B*	β		*B*	β		*B*	β	
Age	.01	.19	**	.01	.15	**	.00	.05		.00	.06	
Education	.06	.12	*	.06	.11	*	.02	.05		.02	.05	
Income	.08	.16	**	.05	.10		.01	.02		.01	.03	
Food insecurity				.08	.16	**	.04	.09		.03	.07	
Aware of guidelines				-.09	-.16	**	-.03	-.06		-.03	-.06	
Cons							-.09	-.02		-.09	-.02	
Self efficacy							-.18	-.30	**	-.20	-.32	**
Control							-.10	-.04		-.08	-.03	
Norms							-.03	-.08		-.03	-.08	
Self identity							-.10	-.14	**	-.10	-.14	**
Susceptibility							.06	.08	*	.06	.09	*
Intentions							-.06	-.21	**	-.06	-.19	**
Intentions x insecurity										-.03	-.10	*
Self efficacy x insecurity										.05	.09	*
R		.27	**		.35	**		.63	**		.64	**
R^2		.07			.12			.40			.40	
Adjusted R^2		.07			.11			.38			.39	
R^2 Change					.05	**		.27	**		.01	*

** p <.01, * p <.05

Post hoc analyses were nevertheless performed to determine whether any of the psychosocial and contextual factors interacted with intentions or self efficacy in predicting F&V intake as summarised in Table 6.17. The variables were centred prior to analysis and interaction terms were entered into the HMR after the main effects. As summarised in Table 6.17, the interaction terms between food insecurity and intentions, as well as food insecurity and self efficacy contributed significantly to the prediction of F&V intake[66]. With the interaction terms included in the equation, R^2 = $F(14, 429) = 20.78$, $p < .001$, there was a significant increment in R^2 (R^2 change = .01, $p < .05$). Altogether, 40% (39% adjusted) of the variability in F&V intake was predicted by knowing the scores on these variables. Findings therefore indicate the impact of self efficacy and intentions on F&V intake depends in part on household food insecurity.

Fruit & Vegetable Intake by Household Food Insecurity Status

Descriptive Characteristics of Participants by Household Food Insecurity

To evaluate how the impact of intentions and self efficacy differed in relation to food insecurity status, separate analyses were performed on men with *low* (different aspects of food insecurity were never or only seldom a problem) and *high* food insecurity (experienced 1 or more aspects of food insecurity at least once in awhile). Presented in Table 6.18 are the descriptive characteristics of participants based on household food insecurity level. A greater proportion of Maori, Pacific Island and Asian men reported high food insecurity compared to N.Z. European/Others. Men with high food insecurity also tended to be younger and have a lower level of education and income. However, the BMI of men experiencing low (M = 26.59, SD 3.73) and high food insecurity (M = 26.28, SD = 3.77) did not differ. Nevertheless, those experiencing low food insecurity were more likely to be overweight, while those with high food insecurity were more likely to be obese. Although men experiencing high food insecurity reported fewer chronic health problems on average, they were less likely to rate their health as excellent and more likely to rate their health as good, compared to men with low food insecurity.

[66] A small but not statistically significant was also found between age and self efficacy.

Table 6.18. *Descriptive Characteristics of Participants by Household Food Insecurity*

	Low food insecurity		High food insecurity	
	n	%	*n*	%
Ethnicity				
NZ Maori	14	4.0	21	13.0
NZ European/Other	327	94.0	124	77.0
Pacific Islander	4	1.1	8	5.0
Asian	12	3.4	20	12.4
Age (years)				
18 – 24	17	4.9	15	9.4
25 – 44	76	21.8	62	38.8
45 – 64	168	48.3	65	40.6
65+	87	25.0	18	11.3
Education				
No school qualification	58	16.8	30	19.1
Secondary school qualification	65	18.8	42	26.7
Trade or professional qualification	122	35.2	45	28.7
University qualification	94	27.2	33	21.0
Qualification gained overseas	7	2.0	7	4.5
Income				
Loss/Zero - $20,000	47	13.8	51	32.7
$20,001 - $40,000	83	24.3	54	34.6
$40,001 - $70,000	115	33.7	41	26.3
$70,000 or more	96	28.2	10	6.4
Overweight & obese				
Normal weight	112	32.9	63	39.9
Overweight	178	52.4	68	43.0
Obese	50	14.7	27	17.1
Chronic health problems				
None	119	34.2	70	44.0
1–2 chronic health problems	168	48.3	64	40.3
3 or more chronic health problems	61	17.5	25	15.7
Self rated health				
Excellent	44	12.7	9	5.7
Very good	130	37.4	58	36.5
Good	136	39.2	72	45.3
Fair	33	9.5	18	11.3
Poor	4	1.2	2	1.2

F&V intake also differed in relation to household food insecurity level. Low food insecure men consumed 0.93 more servings of F&Vs a day on average (*M* = 4.22, *SD* = 2.13) compared to high food insecure men (*M* = 3.29, *SD* = 1.86)[67]. In addition, twice as many low food insecure men were eating 5 or more servings of F&Vs a day compared to high food insecure men (19% vs. 36%)[68]. Men with a lower level of food insecurity were also more likely to be classified in the action/maintenance stage for F&V intake, while men experiencing higher levels of food insecurity were more likely to be in the contemplation and preparation stages as illustrated in Table 6.19.[69]

Table 6.19. *Stage of Change Distribution for Fruit & Vegetable Intake by Household Food Insecurity*

	Low food insecurity		High food insecurity	
Stage of change	*n*	%	*n*	%
Precontemplation	110	31.9	49	30.4
Contemplation	28	8.1	25	15.5
Preparation	14	4.1	24	14.9
Action/maintenance	193	55.9	63	39.2

Summarised in Tables 6.20 and 6.21 are the mean scores, standard deviations and range on each variable for low and high food insecure men. Men experiencing high levels of household food insecurity rated the cons twice as high as those with low food insecurity. The pros were also rated slightly higher by men experiencing high food insecurity, but self efficacy and self identity were on average lower. The level of intentions among those with high (*M* = 4.82, *SD* = 1.76) and low food insecurity (*M* = 4.97, *SD* = 1.85) were however similar.

[67] On average, men who never experienced food insecurity (*M* = 4.40, *SD* = 2.12) ate 1.54 more servings of F&Vs a day on average compared to men who experienced 3 or more aspects of food insecurity at least once in awhile (*M* = 2.86, *SD* = 1.54).
[68] In total, 39% of men who never experienced food insecurity were eating 5 or more servings of F&Vs a day, compared to 17% of those who experienced 3 or more aspects of household food insecurity at least once in awhile.
[69] Low food insecure men in the action/maintenance stage had a higher level of F&V intake on average (*M* = 5.19, *SD* = 2.08) than high food insecure men (*M* = 4.22, *SD* = 1.98).

Table 6.20. *Range, Mean, Standard Deviation and Bivariate Correlations for Independent and Dependent Variables among Low Food Insecure Men, n = 348*

	Factor	Range	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Age	18-97	53.79	15.85	-												
2	Education	1-4[a]	2.74	1.04	-.12 *	-											
3	Income	1-4[b]	2.76	1.01	-.24 **	.17 **	-										
4	Aware of guidelines	1-4[c]	2.34	1.00	-.11 *	.10	.01	-									
5	Pros	1 -5[d]	3.03	0.95	-.12 *	-.02	.05	.07	-								
6	Cons†	.0-.6[d]	0.10	0.11	-.06	-.05	-.21 **	.00	.25 **	-							
7	Self efficacy	1 -5[e]	3.87	0.86	.07	.12 *	.13 *	.14 *	.23 **	-.14 *	-						
8	Control‡	1.4-2.5[f]	2.27	0.21	-.06	.09	.13 *	.07	.03	-.35 **	.26 **	-					
9	Norms	1-7[f]	4.26	1.39	-.04	.04	.15 **	.21 **	.26 **	-.09	.27 **	.00	-				
10	Self identity	1-5[f]	3.80	0.75	.29 **	.09	.07	.05	.27 **	-.07	.33 **	.21 **	.13 *	-			
11	Susceptibility	1-5[f]	2.65	0.73	-.00	-.02	-.04	.03	.04	.15 **	-.17 **	-.15 **	.07	-.27 **	-		
12	Intentions	1-7[f]	4.97	1.85	-.05	.15 **	.14 **	.28 **	.25 **	-.14 **	.37 **	.21 **	.59 **	.31 **	-.09	-	
13	F&V intake‡	0.8-3.3	1.99	0.52	.10	.15 **	.09	.20 **	.18 **	-.11 *	.46 **	.16 **	.33 **	.38 **	-.15 **	.48 **	-

† Log. ‡ Square root.

[a] 1 = no school qualifications, 2 = secondary school qualification, 3 = trade or professional qualification, 4 = university qualification. [b] 1 = Loss/Zero-$20,000, 2 = 20,001-$40,000, 3 = 40,001–70,000, 4 = 70,001 or more. [c] 1 = low - 4 = high. [d] 1 = not important – 5 = extremely important. [e] 1 = not at all confident – 5 = totally confident. [f] Strongly disagree – strongly agree.

* $p < .05$, ** $p < .01$.

Table 6.21. *Range, Mean, Standard Deviation and Bivariate Correlations for Independent and Dependent Variables among High Food Insecure Men, n = 161*

	Factor	Range	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Age	19-84	45.24	15.23	-												
2	Education	1-4[a]	2.54	1.05	-.13	-											
3	Income	1-4[b]	2.06	0.92	-.14	.26 **	-										
4	Aware of guidelines	1-4[c]	2.25	0.99	-.08	-.08	.06	-									
5	Pros	1 -5[d]	3.31	0.82	-.13	.03	-.04	-.13	-								
6	Cons†	.0-.6[d]	0.21	0.13	-.06	-.03	.03	-.21 **	.29 **	-							
7	Self efficacy	1 -5[e]	3.46	0.84	.12	.07	.11	.11	.07	-.21 **	-						
8	Control‡	1.6-2.5[f]	2.20	0.21	-.13	.12	.03	.03	-09	-.24 **	.23 **	-					
9	Norms	1-7[f]	3.91	1.32	-.03	.03	.08	.16 *	.07	-.01	.11	.12	-				
10	Self identity	1-5[f]	3.56	0.74	.23 **	.11	.01	.04	.14	-.24 **	.40 **	.14	.18 *	-			
11	Susceptibility	1-5[f]	2.77	0.72	.05	-.16	.02	-.02	.11	.21 **	-.07	-.18 *	.01	-.22 **	-		
12	Intentions	1-7[f]	4.82	1.76	.08	.05	.14	.05	.13	-.18 *	.30 **	.22 **	.50 **	.27 **	-.06	-	
13	F&V intake‡	0.5-3.1	1.74	0.52	.17 *	.07	.17 *	.11	-.08	-.19 *	.55 **	.04	.21 **	.27 **	-.17 *	.27 **	-

† Log. ‡ Square root.

[a] 1 = no school qualifications, 2 = secondary school qualification, 3 = trade or professional qualification, 4 = university qualification. [b] 1 = Loss/Zero-$20,000, 2 = 20,001-$40,000, 3 = 40,001–70,000, 4 = 70,001 or more. [c] 1 = low - 4 = high. [d] 1 = not important – 5 = extremely important. [e] 1 = not at all confident – 5 = totally confident. [f] Strongly disagree – strongly agree.

* $p < .05$, ** $p < .01$.

Factors Related to Fruit & Vegetable Intake for Low Food Insecure Men

The bivariate relationship among variables for low food insecure men are presented in Table 6.20. Findings indicate intentions were significantly and positively related to education, income, awareness of guidelines, pros, self efficacy, control, norms, and self identity. The cons were also significantly and negatively related to intentions. Perceived norms accounted for the largest amount of variance in intentions (35%), followed by self efficacy (14%) and self identity (10%). Table 6.20 also indicates F&V consumption was significantly and positively associated with education, awareness of guidelines, pros, self efficacy, control, norms, self identity and intentions. The cons and susceptibility to disease were also significantly and negatively related to F&V intake. The largest amount of variance in F&V intake was accounted for by intentions (23%), followed by self efficacy (21%), self identity (14%), and perceived norms (11%).

Factors Related to Fruit & Vegetable Intake for High Food Insecure Men

For high food insecure men, Table 6.21 indicates intentions were significantly and positively related to self efficacy, control, perceived norms, and self identity. The cons were also significantly and negatively related to intentions. Perceived norms accounted for the largest amount of variance in intentions (25%), followed by self efficacy (9%) and self identity (7%). Table 6.21 also indicates F&V intake was significantly and positively related to age, income, self efficacy, norms, self identity, and intentions. The cons and perceived susceptibility to disease were also significantly and negatively related to F&V intake. The largest amount of variance in F&V intake was accounted for by self efficacy (30%), followed by intentions (7%), self identity (7%), perceived norms (4%) and cons (4%).

Hierarchical Multiple Regression of Fruit & Vegetable Intake by Food Insecurity

Separate HMRs were conducted to examine the collective and independent impact of the contextual and psychosocial factors on F&V intake among men experiencing low and high food insecurity. On step 1, the sociodemographic factors that were significantly associated with F&V intake were entered into the analysis. Psychosocial factors significantly related to F&V intake were entered in on step 2.

Low Food Insecurity. Presented in Table 6.22 are the results of the HMR analysis examining F&V intake among low food insecure men. After step 1, the *R* for the regression was significantly different from zero, $F(1, 316) = 8.04$, $p < .01$. Education contributed significantly to the prediction of F&V intake. Altogether, 3% (2% adjusted) of the variability in F&V intake was predicted by scores on this variable.

Table 6.22. *Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Fruit & Vegetable Intake among Low Food Insecure Men, n = 318*

	Step 1			Step 2		
	B	β		*B*	β	
Education	.08	.16	**	.03	.06	
Aware of guidelines				.04	.07	
Pros				-.00	-.01	
Cons				.02	.00	
Self efficacy				.15	.24	**
Control				.03	.01	
Norms				.04	.11	
Self identity				.14	.21	**
Susceptibility				-.03	-.04	
Intentions				.07	.23	**
R		.16	**		.62	**
R^2		.03			.38	
Adjusted R^2		.02			.36	
R^2 Change					.35	**

** $p < .01$, * $p < .05$

After step 2, with the addition of psychosocial factors to the equation, $R^2 = F(10, 307) = 18.65$, $p < .001$, there was a significant increment in R^2 (R^2 change = .35, $p < .001$). Self efficacy, self identity, and intentions each contributed significantly to the prediction of F&V intake. Once the intercorrelations among the predictor variables had been taken into account however, education was no longer significantly related to F&V intake. Altogether, 38% (36% adjusted) of the variability in F&V intake was predicted by knowing scores on these variables. The beta values reported in Table 6.22 indicate self efficacy and intentions were the most important independent predictors of F&V intake, followed by self identity.

High Food Insecurity. The results of the second HMR examining men with high food insecurity are presented in Table 6.23. After step 1, the *R* for the regression was significantly different from zero, $F(2, 150) = 4.59$, $p < .05$. Age and income each contributed significantly to the prediction of F&V intake and altogether accounted for 6% (5% adjusted) of the variability.

Table 6.23. *Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Fruit & Vegetable Intake among High Food Insecure Men, n = 153*

	Step 1			Step 2		
	B	β		*B*	β	
Age	.01	.18	*	.00	.11	
Income	.10	.18	*	.06	.11	
Cons				-.31	-.08	
Self efficacy				.35	.56	**
Norms				.07	.16	*
Self identity				-.01	-.02	
Susceptibility				-.10	-.13	*
Intentions				-.02	-.05	
R		.24	*		.66	**
R^2		.06			.44	
Adjusted R^2		.05			.41	
R^2 Change					.38	**

** $p < .01$, * $p < .05$

After step 2, with the addition of the psychosocial factors to the equation, $R^2 = F(8, 144) = 14.03$, $p < .001$, there was a significant increment in R^2 (R^2 change = .38, $p < .001$). Self efficacy, perceived norms and susceptibility to disease each contributed significantly to the prediction of F&V intake. Altogether, 44% (41% adjusted) of the variability in F&V intake was predicted by knowing scores on these variables. The beta values in Table 6.23 indicate self efficacy was the most important independent predictor of F&V intake, followed by perceived norms and susceptibility to disease.

In summary, similar factors were important in predicting intentions among men experiencing high and low levels of household food insecurity. The factors associated with F&V intake differed however depending on household food insecurity status. For men experiencing low household food insecurity, intentions and self efficacy were both moderately associated with F&V intake. Among men experiencing high household food insecurity only self efficacy was moderately related to F&V intake. Furthermore, once the intercorrelations among the predictor variables had been taken into account, similar results were found in HMR analyses. For men experiencing low food insecurity, self identity was also significantly and independently related to F&V intake. For men experiencing higher levels of food insecurity, perceived norms and susceptibility to disease were significantly and independently related to F&V intake. Intentions were therefore not independently related to behaviour among high food insecure men.

7. Discussion

The aim of the study was to develop a better understanding of the process of behaviour change, and the psychosocial and contextual factors associated with fruit and vegetable (F&V) intake among men in New Zealand (N.Z.). The study assessed F&V consumption, food insecurity, and awareness of F&V guidelines. The proportion of men in each stage of change for F&V intake was also examined, along with the validity of the stage of change measure, and the minimum number of components required to account for the items used to assess psychosocial factors. The psychosocial and contextual factors were also examined across the stages of change to identify those factors which differentiated between adjacent stages of change, as well as the overall nature of relationships. The impact of the psychosocial and contextual factors on F&V intake was also assessed, as well as the mechanism by which the psychosocial factors influenced behaviour, and possible interactions among factors in predicting behaviour. Findings are discussed in relation to each research objective. Theoretical, methodological and practical implications are also discussed as well as possible avenues for future research.

Fruit & Vegetable Intake, Food Insecurity & Guideline Awareness

Fruit & Vegetable Intake

Average F&V intake was 3.92 (*SD* = 2.08) servings a day based on fruit, juice, potatoes (excluding hot potato chips), other cooked vegetables, and salad. A comparable level of F&V intake was reported in the U.S. Behavioral Risk Factor Surveillance System (BRFSS) and 5+ A Day surveys using similar measures (Li, Serdula, Bland, Mokdad, Bowman & Nelson, 2000; Serdula, Coates, Byers, Simoes, Mokdad & Subar, 1995; Stables et al., 2002)[70]. Estimates of F&V intake are more conservative however than in other N.Z. surveys. In the 1997 National Nutrition Survey (NNS97), F&V consumption was on average approximately 5 servings a day (Ministry of Health [MOH] & University of Auckland, 2003). Nevertheless, intake assessed with 24 hour recalls similar to that used in the NNS97, as well as longer food

[70] Average intakes range from 3.60-3.72 for men and 3.90-4.33 for women. Serdula, Gillespie, Kettel-Khan, Farris, Seymour & Denny (2004) also provide estimates of geometric mean consumption from 1994 – 2000.

frequency questionnaires (FFQs) tend to yield higher estimates of F&V intake compared to brief FFQs (similar to that used in the current study [e.g., Field et al., 1998; Kristal, Glanz, Tilley & Li, 2000; Resnicow et al., 2000, 2001; Thompson et al., 2000]). The main difference appears to be in vegetable intake which is lower on brief FFQs (Field et al., 1998; Kristal et al., 2000). Hot potato chips were also excluded from estimates of F&V intake which were consumed by 3 in 5 men one or more times a week, similar to the findings of the NNS97[71].

Approximately 1 in 3 men were eating 5 or more servings of F&Vs a day in line with dietary guidelines. The proportion of men consuming 3 or more servings of vegetables a day was similar to the 2005 BRFSS (22%), but more men in the current study were eating 2 or more servings of fruit (45% vs. 29% [Blanck et al., 2007]). Fruit intake nevertheless corroborates with the 2002/03 NZ Health Survey (NZHS [43%]), but vegetable consumption in the current study was somewhat lower (22% vs. 63%)[72]. Findings are not directly comparable however given F&V consumption was assessed with different items (e.g., frequency vs. servings), response formats (e.g., per month/week/day vs. per day), times frames (e.g., previous month vs. usual intake), and also excluded hot potato chips. Previous studies have also obtained higher estimates of F&V intake based on 2-item measures similar to that used in the 2002/03 NZHS compared to 7-item brief FFQs (e.g., Resnicow et al., 2000, 2001). The proportion of men eating 5 or more servings of F&Vs a day was therefore lower (30% vs. 44%) than in the 2002/03 NZHS (Tobias, Jackson, Yeh & Huang, 2007). Findings corroborate with previous surveys however in suggesting a large proportion of N.Z. men do not eat sufficient amounts of F&Vs each day.

[71] 54% of men and 42% of women ate hot potato chips or kumara chips/french fries/wedges at least once per week in the NNS97 (Russell, Parnell & Wilson et al., 1999).
[72] Results from the 2007 NZHS (MOH, 2008) indicate 49.6% of men were eating 2 servings of fruit and 56.1% were eating 3 servings of vegetables.

Food Insecurity

The level of household food insecurity was comparable to the NNS97 (Russell, Parnell, Wilson et al., 1999). For example, 12% of men had run out of food due to a lack of money at least once in awhile, compared to 11% of men who sometimes or often did in the NNS97. As the NNS97 did not assess overall food insecurity the method used was based on that in the U.S. and Canada. In total, 14% of men experienced 3 or more aspects of food insecurity at least once in awhile. Findings from the NNS97 suggest the proportion of females experiencing food insecurity is likely to be higher. In the U.S. and Canada, 11% and 9% of households respectively reported 3 or more food insecure conditions (Health Canada, 2007; Nord, Andrews & Carlson, 2007). Although the measures used are not directly comparable, food insecurity appears to be higher in N.Z.[73] Nevertheless findings from the 2002 National Nutrition Children's Survey (Parnell, Scragg, Wilson, Schaaf & Fitzgerald, 2003) suggest food insecurity is likely to be even higher in households containing children[74].

Awareness of Fruit & Vegetable Guidelines

The study provides new insights with respect to the proportion of men aware of the guidelines for F&V intake in N.Z. Awareness of the guideline to eat 5 or more servings of F&Vs a day was high (77%). Awareness also appears to be higher than in the U.K., but in line with the proportion of N.Z. supermarket shoppers aware of the 5+ A Day programme (Ashfield-Watt, Stewart & Scheffer, 2004; Food Standards Agency, 2007). However, only a small percentage of men (16%) were able to correctly identify specific guidelines for vegetables and fruit. In line with previous research (Green & Boyle, 2001), there appears to be better awareness of general rather than specific recommendations. There may also be some confusion over the 5+ A Day message with 22% of men thinking they should be eating 5 servings of fruit *and* 5 servings of vegetables. The use of specific recommendations in health promotion messages may therefore help facilitate a greater understanding.

[73] Results from the latest U.S. survey estimated that on any given day between 0.5-0.8% of households experienced hunger (Nord et al., 2007).

[74] For example, the 2002 National Nutrition Children's Survey (Parnell et al., 2003) found 22% of households containing children had run out of food because of a lack of money sometimes or often compared to 14% of men in the current study who did once in awhile or more.

Stages of Change

Stage of Change Distribution

The proportion of men in each stage of change for F&V intake was examined. Nearly 1 in 3 men were in the precontemplation stage and had no intentions of changing their F&V intake within the foreseeable future. On the other hand, 10% of men in the contemplation stage and 7% in the preparation stage were thinking about increasing their F&V intake over the next 6 months and 30 days respectively. In line with previous research examining dietary behaviours (e.g., de Graaf, van der Gaag, Kafatos, Lennernas & Kearney, 1997; Laforge, Greene & Prochaska, 1994, Laforge, Velicer, Richmond & Owen, 1999; Ma, Betts, Horacek, Georgiou & White, 2003; Steptoe, Wijetunge, Doherty & Wardle, 1996), only a small proportion of men (3%) were in the action stage and therefore currently trying to modify their behaviour. As a result, the action and maintenance stages were combined and half of the men (51%) were classified in this stage.

Stage assignment was based on a specific action criterion of 5 or more servings of F&Vs a day. Other studies have examined the direction of intake (e.g., high/low) and found a larger proportion of participants in the postaction stages for F&V intake (e.g., Kloek, van Lenthe, van Nierop & Mackenbach, 2004; Lechner, Brug, De Vries, van Assema & Mudde, 1998; Trudeau, Kristal, Li & Patterson, 1998; Van Duyn et al., 1998). On the other hand, studies in the U.K., U.S. and the Netherlands (e.g., Armitage, Povey & Arden, 2003; De Vet, De Nooijer, De Vries & Brug, 2005b; Ma, Betts, Horacek, Georgiou, White & Nitzke, 2002; Ma et al., 2003; Povey, Conner, Sparks, James & Shepherd, 1999) which have used similar action criteria (e.g., 5 servings of F&Vs a day) have found a slightly smaller proportion of participants in the postaction stages[75]. International comparisons nevertheless suggest F&V intake may be slightly higher in N.Z. (Aguado et al. 2002; Blanck et al., 2005; Krebs-Smith & Kantor, 2001; MOH & University of Auckland, 2003). Findings from national surveys also indicate F&V intake increased slightly in N.Z. between 1997 and 2002/03 (Russell, Parnell & Wilson et al., 1999, Ministry of Health, 2004b). Recent surveys may therefore find more participants in the postaction stages. Given age is

[75] *M* = approximately 40%

positively associated with F&V intake (see for example Guenther, Dodd, Reedy & Krebs-Smith, 2006; MOH, 2004b), the slightly older age of participants may have also contributed to research findings. In addition, a wide variety of fresh produce was available at the time of the year the study was conducted (see www.vegetables.co.nz). The proportion of men in the postaction stages is nevertheless lower than that found by the Cancer Society and SPARC (Sullivan, Oakden, Young, Lau & Lawson, 2004) for vegetable and fruit intake (73% and 67% respectively). However, the level of F&V consumption among females may partly explain these findings. For example, the study found 59% of females compared to 41% of males were eating 2 servings of fruit and 3 servings of vegetables a day. That is, a slightly smaller proportion of men than that found in the postaction stages for F&V intake in the current study, and in line with the results of the 2002/03 NZHS (44% [Tobias et al., 2007]).

Mean Fruit & Vegetable Intake in each Stage

Previous research and reviews of the transtheoretical model (TTM) have called for greater attention to the psychometric properties of stage of change measures (e.g., Adams & White, 2003, 2005; Armitage & Conner, 2000; Bridle et al., 2005; Brug, Conner, Harre, Kremers, McKellar & Whitelaw, 2005; Bunton, Baldwin, Flynn & Whitelaw, 2000; Riemsma et al., 2003). The validity of the stage measure was therefore examined in relation to F&V intake. On average men in the action/maintenance stage were consuming 5.08 (*SD* = 2.21) servings of F&Vs each day in line with dietary guidelines. On the other hand, men in the precontemplation, contemplation and preparation stages had a similar level of F&V consumption, which was below the recommended level. Findings are therefore consistent with stage model predictions and previous research (i.e.; Campbell et al., 1998; De Vet et al., 2005a; Greene, Fey-Yensan, Padula, Rossi, Rossi & Clark, 2004; Ling & Horwath, 2000; Ma et al., 2002, 2003). In addition, findings indicate men in the action/maintenance stage had the highest level of F&V intake on average. Hypothesis 1 was therefore supported.

Proportion Classified Correctly in each Stage

The validity of the stage measure was also assessed in relation to the proportion of men classified correctly based on their consumption of 5 servings of F&Vs a day. In total, 88% of men in the preaction stages were consuming *less* than 5 servings of F&Vs each day. The negative predictive value[76] is higher than in earlier studies examining the stages of change for F&V intake (e.g., De Vet et al., 2005a; Ling & Horwath, 2000; Ma et al., 2003). The current study therefore classified more participants correctly into the preaction stages compared to previous research. On the other hand, the positive predictive value or the proportion of men consuming 5 or more servings of F&Vs a day was 51% in the postaction stages. A greater proportion of men in the postaction stages were therefore consuming 5 or more servings of F&Vs a day than in the preaction stages (1-.88 = 22%). Hypothesis 2 was therefore supported.

The proportion of men in the postaction stages classified correctly is however lower than in previous studies examining F&V intake (e.g., De Vet et al., 2005a; Ling & Horwath, 2000; Ma et al., 2003)[77]. The higher level of classification accuracy in earlier studies may be due to the separate examination of vegetable and fruit intake (e.g., De Vet et al., 2005a; Ma et al., 2003). The use of a FFQ and trained telephone interviewer to clarify F&V consumption, as well as a lower action criterion (3.75 servings) also likely improved the positive predictive value in another study (e.g., Ling & Horwath, 2000). Nevertheless, the accuracy of classification also depends in part on the method of dietary assessment used. That is, the higher positive predictive values found in previous research may be attributed in part to higher estimates of F&V intake. Several studies (i.e., De Vet et al., 2005a; Ma et al., 2002) assessed intake with brief FFQs which weighted frequency of consumption by serving size information. Another study (i.e., Ling & Horwath, 2000) used multiple 24 hour recalls which also tend to yield higher estimates of F&V consumption compared to brief FFQs (see for example Field et al., 1998; Kristal et al., 2000; Thompson et al., 2000). The lower positive predictive value in the current study may therefore be due

[76] Proportion classified in the *preaction* stages eating *less* than 5 servings of F&Vs a day.
[77] De Vet et al. (2005a) classified 78% correctly in the postaction stages for fruit intake, Ma et al. (2003) classified 84% and 69% correctly in the postaction stages for F&V intake respectively, and Ling and Horwath (2000) classified 76% correctly into the postaction stages for F&V intake.

in part to the lower estimates of F&V intake obtained. In other words, a greater proportion of men in the postaction stages may have been eating 5 or more servings of F&Vs each day if another method of dietary assessment had been used. Nevertheless, accurate stage assignment is important for the delivery of appropriate stage matched interventions. Further analyses were therefore performed to determine how men in the action/maintenance stage who were *not* eating at least 5 servings of F&Vs each day should be treated.

Classification of Pseudo-Maintainers

Pseudo-action/maintainers was the term used to refer to men in the postaction stages who were *not* eating 5 or more servings of F&Vs each day. Several earlier studies have reclassified pseudo-maintainers into an earlier stage based on their intentions (i.e., Greene, Rossi, Reed, Willey & Prochaska, 1994; Lechner et al., 1998; Ma et al., 2003; Rossi, 1993). Stage matched interventions should however be based on the characteristics people share in particular stages. As a result, others have argued (e.g., Ounpuu, Woolcott & Greene, 2000) reclassification may be unnecessary if pseudo-maintainers have cognitive profiles similar to true-maintainers (i.e., those meeting the action criterion) than those in earlier stages of change. Pseudo-action/maintainers were therefore compared to true-action/maintainers and those in the preaction stages based on their intentions and self identity as a healthy eater. Overall, pseudo-action/maintainers appeared to be more similar to true-action/maintainers than those in the preaction stages of change based on their intentions, self identity, and level of F&V intake. Previous research (Ma et al., 2003) also suggests the pros and cons among those in the maintenance stage who do not meet the action criterion for vegetable and fruit intake are similar to those who do when the magnitude of mean differences are taken into account. Likewise, pseudo-maintainers for dietary fat intake appear to be more similar to those in the maintenance stage than precontemplators based on their use of processes of change (Ounpuu et al., 2000). Given the results of the current study and previous research, the reclassification of pseudo-maintainers into an earlier stage of change was therefore considered unnecessary. Findings therefore suggest a parsimonious method that involves the simple selection of one statement from several, which avoids the use of skip patterns, is valid for classifying people into different stages of change for F&V intake.

Psychosocial Scales

The discriminant validity of the psychosocial factors was also assessed. A principal components analysis (PCA) was performed to determine the minimum number of components required to account for the intercorrelations among the items used to assess the psychosocial factors. Items were developed to assess perceived control and descriptive norms, while previous measures were adapted and used to assess the perceived pros, cons, self efficacy, subjective norms, self identity, and susceptibility to disease. The PCA solution was replicated in two randomly selected split half samples. The items reflected seven components and all loaded onto their anticipated components, except the subjective norm and descriptive norm items which formed a single component.

Self identity and normative beliefs (e.g., Terry, Hogg & White, 1999), as well as control and self efficacy items have been found to represent different factors in previous research (e.g, Armitage & Conner, 1999ab; Manstead & Van Eekelen, 1998; Povey, Conner, Sparks, James & Shepherd, 2000a; Sparks, Guthrie & Shepherd, 1997; Terry & O'Leary, 1995). The distinction between control and self efficacy in the theory of planned behaviour (TPB) therefore appears to be warranted. Although there is a paucity of research examining the discriminant validity between subjective and descriptive norm items for dietary behaviours, they have been found to represent different factors in relation to exercise, condom use, and lottery playing (e.g. Courneya, Conner & Rhodes, 2006; Sheeran & Orbell, 1999; White, Terry & Hogg, 1994). The results from these studies along with a meta-analysis (Rivis & Sheeran, 2003) nevertheless suggest subjective and descriptive norms tend to be moderately-highly correlated. Descriptive and subjective norms have also been found to represent global higher-order constructs in the domains of dieting and exercise (Hagger & Chatzisarantis, 2005). Furthermore, an acceptable level of internal consistency was reported for measures that included both subjective and descriptive norm items for dietary fat and F&V intake (e.g., Povey et al., 2000a). Given the positive and public nature of dietary behaviours, a high level of congruence may be expected between what people say and do (see Lapinski & Rimal, 2005). People may differ more however with respect to their own behaviour and expectations of others for negative health behaviours. I may smoke for example but not approve of others doing so.

Behaviours which are performed in private (e.g., condom use) are also less open to inspection by others.

The pros and cons were found to reflect two components in line with the results of Ling and Horwath (2001) during original scale development. In addition, a high degree of similarity in component loadings was found for items used in both studies. The variance accounted for by the pros and cons items was also similar to that reported by Ling and Horwath (2001) in post hoc analyses[78]. Self efficacy was also assessed with a scale developed by Ling and Horwath (1999). In contrast to their findings however, self efficacy items were found to represent a single component. Ling and Horwath (1999) nevertheless found the two self efficacy subscales (difficult situations and being able to remember F&Vs) were highly correlated and reflected a global construct. In addition, only two of the five items included on the being able to remember F&Vs subscale were retained for use in the current study. According to Gorsuch (1983), if a sufficient number of identifying variables are deleted, a factor may not occur in subsequent analyses. Based on the components which were found in the current study, mean summated scales were developed and each scale had an acceptable level of internal consistency.

The Stages of Change and Psychosocial & Contextual Factors

Psychosocial & Contextual Factors across the Stages of Change

Mean scores on the psychosocial and contextual factors were also examined across the stages of change. All factors differed significantly and therefore Hypothesis 3 was supported. Perceived norms accounted for the largest amount of variance across the stages of change due to differences in group means (21%). Self efficacy was also important in line with previous research, accounting for 16% of the variance (e.g., Greene et al., 2004; Ling & Horwath, 1999; Maddock, Marshall, Nigg & Barnett, 2003; Tassell & Flett, 2005). In addition, the pros and self identity accounted for a moderate-large amount of variance, while the cons, food insecurity, awareness of F&V guidelines, and age accounted for a moderate amount. The larger proportion of

[78] The variance accounted for by the pros and cons in was 34% and 16% respectively in a separate PCA of these two factors. The pros accounted for 31% of the variance in the analysis conducted by Ling and Horwath (2001) while the cons accounted for 19% of the variance

variance accounted for by the pros compared to the cons also corroborates with previous research (Greene et al., 2004; Gulliver, & Horwath, 2001b; Ling & Horwath, 2001; Rossi et al., 2001; Tassell & Flett, 2005).

Factors Discriminating Between Adjacent Stages of Change

The development of stage matched interventions requires a clear understanding of the factors which discriminate between adjacent stages of change. The magnitude and significance of mean differences in factors between the precontemplation and contemplation stages, contemplation and preparation stages, and preparation and action/ maintenance stages were therefore examined.

Precontemplation-Contemplation. Between the precontemplation and contemplation stages there were significant and large increases in perceived pros. That is, men in the contemplation stage perceived more benefits of eating F&Vs in line with earlier studies (e.g., Greene et al., 2004; Horacek et al., 2002; Ma et al., 2003; Rapley & Coulson, 2005). The pros have also been found to predict progression from the precontemplation stage for fruit intake and the consumption of a low fat diet in longitudinal and experimental studies (Armitage, Sheeran, Conner & Arden, 2004; De Vet et al., 2005b). Nevertheless, the study found those in the contemplation stage also perceived the cons to be moderately higher. While small-moderate increases in the cons for vegetable and fruit intake have been detected between these stages in previous research (e.g., Ma et al., 2002, 2003), others have found no differences or decreases (e.g., De Vet et al., 2005b; Greene et al., 2004; Ling & Horwath, 2001; Rapley & Coulson, 2005). The pattern of scores is more consistent however when decisional balance or the relative weighing of the pros and cons is considered (i.e., pros-cons). In line with previous research (e.g., Ling, 1999; Ma et al., 2003), men in the contemplation stage had a more positive decisional balance on average compared to the precontemplation stage in post hoc analyses (see Appendix G).

Moderate decreases in self efficacy were also found between the precontemplation and contemplation stages in line with the findings of Ling and Horwath (1999). Other studies however have found few differences or small increases in self efficacy between these stages (e.g., Armitage et al., 2003; Henry, Reimer, Smith & Reicks,

2006; Ma et al., 2003; Maddock et al., 2003). Nevertheless, findings suggest those in the precontemplation stage varied more in their self efficacy compared to other stages of change in line with earlier studies (e.g., Armitage et al., 2003; Henry et al., 2006; Ma et al., 2003; Maddock et al., 2003). That is, ratings of self efficacy in the precontemplation stage are less consistent and may explain the different patterns found. Although not significantly different, there were also moderate-small differences in awareness of F&V guidelines, age, food insecurity, and perceived norms between the precontemplation and contemplation stages consistent with earlier research (e.g., Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003; 2004, Brug, Glanz & Kok, 1997; Campbell et al., 1998; De Vet et al., 2005a; Kloek et al., 2004; Perkins-Porras, Cappuccio, Rink, Hilton, McKay & Steptoe, 2005; Resnicow, McCarty & Baranowski, 2003; Tassell & Flett, 2005; Van Duyn et al., 1998).

Contemplation-Preparation. Self efficacy differed significantly between the contemplation and preparation stages. That is, in line with earlier research examining F&V intake (e.g., Armitage et al., 2003; Ling & Horwath, 2001; Maddock et al., 2003), those in the preparation stage tended to have a moderately higher level of self efficacy. Although two studies of African American women and adolescents found few differences in self efficacy between these stages (e.g., Henry et al., 2006; Ma et al., 2003). The ability to detect significant mean differences in other factors between the contemplation and preparation stages was however limited by sample size. Although not significantly different, the study found moderate increases in perceived pros, norms, and food insecurity between the contemplation and preparation stages in line with earlier studies examining dietary fat and F&V intake (Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003, 2004; Brug, Glanz et al., 1997; Brug, Hospers & Kok, 1997; De Vet et al., 2005b; Henry et al., 2006; Ling & Horwath, 2001; Rapley & Coulson, 2005; Tassell & Flett, 2005). Men in the preparation stage were also moderately younger on average compared to the contemplation stage. While age has previously been found to decrease between the contemplation and preparation stages (Perkins-Porras et al., 2005), others have found few differences (e.g., De Vet et al., 2005b; Resnicow et el., 2003).

Preparation-Action/Maintenance. Factors which differed between the preparation and action/maintenance stages were examined due to the small number of men

classified in the action stage. Between the preparation and action/maintenance stage there were large and significant mean differences in age, food insecurity, and self identity. That is, men in the postaction stages were older, more likely to consider themselves a healthy eater, and experienced less food insecurity on average. Previous research examining F&V intake among Maori women also found moderate decreases in food insecurity between the preparation/action and maintenance stages (Tassell & Flett, 2005). Although earlier studies have found few differences in age and self identity in relation to dietary behaviours between the preparation and action stages, small-moderate increases in age have been found between the preparation and maintenance stages for F&V intake (e.g., De Vet et al., 2005a; Resnicow et al., 2003). In addition, large increases in self identity have been found between the preparation and maintenance stages for the consumption of a low fat diet (Armitage & Arden, 2002). Previous research also suggests overall health concern (e.g., staying healthy is worth everything to me) increases between the contemplation and maintenance stages for dietary fat intake (Sporny & Contento, 1995). There is however a lack of previous research examining self identity across the stages of change for F&V intake.

Between the preparation and action/maintenance stages, significant and moderate-large decreases in the pros and cons were found. That is, men in the action/maintenance stage tended to perceive fewer pros and cons compared to those in the preparation stage. A lower level of cons in the maintenance stage compared to the preparation stage has also been found in earlier studies (e.g., De Vet et al., 2005b; Ling & Horwath, 2001; Ma et al., 2003; Rapley & Coulson, 2005). In addition, previous research has tended to find small and non-significant decreases in the pros between the preparation and maintenance stages (e.g., De Vet et al., 2005b; Ling & Horwath, 2001; Ma et al., 2003). Nevertheless, in line with previous research (e.g., De Vet et al., 2005b; Ling & Horwath, 2001; Rapley & Coulson, 2005), decisional balance was found to increase on average between the preparation and action/maintenance stages in post hoc analyses (see Appendix G).

A moderately lower level of perceived susceptibility to disease was also found among men in the action/maintenance stage compared to the preparation stage, in line with previous research examining dietary fat intake and other health behaviours (e.g., Reid et al., 2007; Rhodes & Hergenrather, 2003; Sniehotta, Luszczynska, Scholz & Lippke,

2005; Sporny & Contento, 1995). The moderately higher level of self efficacy in the postaction stages also corroborates with earlier studies examining F&V intake (e.g., Armitage et al., 2003; Henry et al., 2006; Horacek et al., 2002; Ling & Horwath, 1999; Ma et al., 2003; Maddock et al., 2003; Tassell & Flett, 2005). Although not significantly different, small-moderate mean differences were also found in income and perceived norms between the preparation and action/maintenance stages. Finding those in the action/maintenance stage had a higher level of perceived norms on average is also in line with previous research examining subjective and descriptive norms across the stages for F&V and dietary fat intake (e.g., Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003, 2004; Brug, Glanz et al., 1997; Sporny & Contento, 1995)[79], as well as studies examining encouragement and social support from others (e.g., Campbell et al., 1998; Van Duyn et al., 2001). The baseline 5+ A Day study (Van Duyn et al., 1998) also found those with a higher poverty-income-ratio were more likely to be in the maintenance stage for F&V intake. In summary, those in the action/maintenance stage compared to the preparation stage were on average older, experienced less food insecurity and had a higher level of self identity, self efficacy, perceived norms, and income. They also perceived the pros and cons associated with F&V intake as being lower, and their susceptibility to disease.

Linear or Non-Linear Relationships across the Stages of Change?

An underlying assumption of stage models is that different factors are important in different stages of change. As a result, non-linear patterns are expected to be found on most variables. The pattern of scores on factors across the stages of change was therefore examined. Trend analyses indicated a non-linear component of trend best described the relationship between the stages of change and age, food insecurity, and perceived susceptibility to disease as expected. In line with earlier studies examining dietary behaviours (e.g., Sniehotta et al., 2005; Sporny & Contento, 1995; Tassell & Flett, 2005), food insecurity, and risk perceptions increased across the preaction stages, then decreased in the postaction stages. An opposite pattern was found for age

[79] Although some studies have found small decreases between action and maintenance in perceived norms, they tended to find increases in the action and maintenance stages compared to the preparation stage (e.g., Armitage & Arden, 2002; Armitage et al., 2004; Brug, Hospers et al., 1997)

and corroborates with earlier studies (e.g., De Vet et al., 2005a; Perkins-Porras et al., 2005; Resnicow et al., 2003). As anticipated, there were few differences in income across the preaction stages and increases in the postaction stages. Contrary to expectations however, the pattern of scores on income was best described by a linear trend. As a result, Hypothesis 4 was largely supported. Findings therefore provide some evidence to suggest different factors are important in different stages of change, in line with stage model assumptions.

Linear patterns were expected to be found across the stages of change on the measures of education, awareness of F&V guidelines, self efficacy, control, normative beliefs, and self identity. Results were in line with expectations and Hypothesis 5 was supported. That is, perceived norms, self efficacy, and self identity increased on average across the stages of change in line with previous trend analyses (e.g., Armitage, 2006; Armitage & Arden, 2002; Armitage et al., 2003; Sporny & Contento, 1995; V. Stroebl, personal communication 14 August 2007). Finding awareness of F&V guidelines, perceived control and education increased on average across the stages of change also corroborates with the pattern found in earlier studies (e.g., Armitage & Arden, 2002; Campbell et al., 1998; De Vet et al., 2005a; Kloek et al., 2004; Resnicow et al., 2003; Van Duyn et al., 1998, 2001). In contrast to stage model assumptions however, results indicate a number of factors are important in all stages of change for F&V intake.

The pattern of pros and cons across the stages of change for F&V intake is not consistent in previous research. Nevertheless, the current study found scores on perceived cons were best described by a non-linear trend. While the pros reflected both linear and non-linear components of trend, the latter accounted for a larger proportion of variance. While few specific tests of the relationship between the pros and cons with the stages of change have been conducted to date, previous research has found both linear and non-linear patterns (e.g., Horacek et al., 2002; Ling & Horwath, 2001; Ma et al., 2002; Rapley & Coulson, 2005; V. Stroebl, personal communication 14 August 2007). A more consistent pattern emerged however when decisional balance was examined in post hoc analyses (see Appendix G). Decisional balance scores increased on average across the stages of change in line with earlier research

(e.g., Horacek et al., 2002; Ling, 1999; Ma et al., 2003). Consequently, the relative weighing of the pros and cons appears to be important in all stages of change.

In summary, the study found both linear and non-linear patterns on psychosocial and contextual variables across the stages of change for F&V intake. That is, in line with stage model assumptions several factors were important in different stages of change. However results also showed other factors were important in all stages of change. Consequently, the stages of change do not appear to reflect a single underlying continuum of behaviour change. The pattern of scores and magnitude of mean differences in factors between adjacent stages of change does suggest however similar factors are important in the preaction stages. In other words, regardless of whether one was classified in the precontemplation, contemplation or preparation stage, perceived norms, self efficacy, decisional balance, and awareness of F&V guidelines appear to help facilitate forward stage progression. Those who have more intentions of changing in the future also appear to be younger and experiencing higher levels of food insecurity. Findings therefore suggest the preaction stages of change may reflect a continuum rather than qualitatively distinct stages. This may be attributed in part to the somewhat arbitrary time frames used to define the stages of change. Critiques of the TTM have also questioned whether the stages or subsets of them reflect pseudo-stages rather than genuine stages based on an underlying continuum (e.g., Bandura, 2000; Etter & Sutton, 2002; Littell & Girvin, 2002; Shepherd, 2002; West, 2005). A single intervention may therefore be sufficient for increasing intentions among those with an inadequate level of F&V intake. In other words, a standardised programme aimed at modifying those factors which were important in the preaction stages of change may be just as effective in facilitating change as interventions matched to the precontemplation, contemplation, and preparation stages.

An examination of factors which discriminated between the preparation and action stages, as well as the action and maintenance stages was precluded in the current study due to the small number of participants found in the action stage. That is, the majority of men with a high level of F&V intake had been doing so for more than six months. Based on Cohen's (1992) guidelines, the sample frame of 1200 used in the current study would need to be about four times larger to detect moderate mean

differences in factors between the action and maintenance stages[80]. Financial resources however place limits on sample sizes and although there is increasing interest in identifying factors which facilitate the long term maintenance of behaviour change (e.g., Kumanyika et al., 2000), it may be impractical to examine the action and maintenance stages separately in the general population. While the stages of change no doubt have utility in describing and monitoring individual readiness to change, findings suggest the behaviour change process may be better conceptualised as reflecting two key stages – intentions and behaviour. A more parsimonious continuous model based on intentions and behaviour may therefore be sufficient for understanding F&V intake.

Fruit & Vegetable Intake and Psychosocial & Contextual Factors

Intentions and Psychosocial Factors

A continuous model of behaviour was outlined which extended the theory of planned behaviour (TPB) to integrate the psychosocial and contextual factors. Based on the TPB, intentions were expected to be the most important proximal determinant of behaviour. The impact of the psychosocial factors on behaviour was also largely expected to be indirect and mediated by intentions. Although, self efficacy was expected to have a direct impact on behaviour. In order to determine whether intentions was the mechanism by which the psychosocial factors influenced F&V intake, a series of hierarchical multiple regression analyses were performed. For intentions to function as a mediator the psychosocial factors need to be related to both intentions and behaviour. In addition, the impact of the psychosocial factors on behaviour needs to be reduced when intentions are included in the same model. The impact of the psychosocial factors on intentions, as well as their relationship with behaviour was therefore examined. Intentions were subsequently included into the model examining F&V intake to determine whether the psychosocial factors directly or indirectly influenced behaviour.

[80] According to Cohen (1992) $n = 64$ people are required in each stage to detect moderate mean differences using an alpha level of $p = .05$ and .80 power. Based on 3% of men being classified in the action stage and a response rate of 50%, the original sample would need to have been comprised of approximately 4,800 men. That is, 4 times larger than financial resources permitted in the current study.

As expected the psychosocial factors contributed significantly to the variance explained in intentions. Perceived norms were the most important unique predictor of intentions. Although there is a lack of research examining perceived norms, subjective norms have been independently related to intentions for F&V intake when other TPB variables have been controlled for (e.g., attitudes, self efficacy and/or control, as well as self identity, past behaviour, habit and perceived need [Bogers, Brug, van Assema & Dagnelie, 2004; Brug, De Vet, De Nooijer & Verplanken, 2006; Cox, Anderson, Lean & Mela, 1998; Paisley, Lloyd, Sparks & Mela, 1995; Povey et al., 2000a; Sparks & Shepherd, 1992]). However, subjective norms tend to have a smaller impact on intentions compared to other TPB variables (e.g., Bogers et al., 2004; Brug et al., 2006; Cox et al., 1998; Povey et al., 2000a; Sparks & Shepherd, 1992). Nevertheless, subjective norms are often assessed with single item measures with unknown reliability. The greater impact of perceived norms on intentions in the current study may therefore be attributed to the use of a multi-item scale that included subjective and descriptive norm items. However, perceived norms may have less of an impact on intentions when attitudes as opposed to perceived pros and cons are included in the same model. Attitudes tend to be moderately correlated with subjective and descriptive norms (e.g., Bogers et al., 2004; Povey et al., 2000a; Sparks & Shepherd, 1992), but perceived norms were only weakly correlated to the pros and cons in the current study. The impact of decisional balance was examined in post hoc analyses but did not alter the results. Further research is therefore required to evaluate the impact of perceived norms on intentions while taking into account attitudes.

In line with earlier studies examining dietary behaviours (e.g., Armitage & Conner, 1999a; Astrom & Rise, 2001; Dennison & Shepherd, 1995; Povey et al., 2000a; Sparks & Shepherd, 1992), self efficacy and self identity were independently related to intentions. Self identity however tends to have a larger impact on intentions. The measurement of self identity on a 5-point rather than 7-point scale may have reduced the variability in this factor and underestimated its impact in the current study. In line with previous research, perceived control also had a small and positive impact on intentions at the bivariate level (e.g., Armitage & Conner, 1999ab; Chatzisarantis, Hagger, Smith & Phoenix, 2004; Povey et al., 2000a). Nevertheless, the independent impact of perceived control in previous studies has been negative (e.g., Armitage &

Conner, 1999ab; Povey et al., 2000a). That is, a suppressing variable[81] has removed unwanted variance in perceived control and enhanced its relationship with intentions (see Cohen, Cohen, West & Aiken, 2003; Tabachnick & Fidell, 2007). Armitage and Conner (1999b) suggested the suppression effect was due to self efficacy. Earlier studies (i.e., Armitage & Conner, 1999a; Povey et al., 2000a) have measured perceived control and self efficacy on semantic differential scales[82] (e.g., very capable/very incapable). The positive and independent impact of perceived control may therefore be attributed to the different measures and weaker relationship found among these factors.

While the cons were not independently related to intentions they were associated with self efficacy and perceived control. The pros were however independently related to intentions. Nevertheless, previous research suggests attitudes have a larger impact on intentions in relation to F&V intake (e.g., Bogers et al., 2004; Chatzisarantis et al., 2004; Cox et al., 1998; Paisley et al., 1995; Povey et al., 2000a; Sparks & Shepherd, 1992). A larger proportion of variance may therefore be accounted for in intentions by examining attitudes rather than pros and cons in future research. In the current study perceived susceptibility to disease was not significantly related to intentions. While findings corroborate with earlier research (e.g., Humphries & Krummel, 1999; Umeh, 2003), it is possible the use of a measure of risk perceptions conditional on dietary behaviour (e.g., If I don't eat plenty of F&Vs each day, I'm likely develop diabetes) may have been associated with intentions. The utility of measures of perceived susceptibility to disease conditional on behaviour should therefore be examined in future research.

Findings indicate most of the psychosocial factors were independently related to intentions as expected. Hypothesis 6 was therefore largely supported. Results indicate those with lower intentions of eating 5 or more servings of F&Vs a day in the future had lower perceived norms (i.e., less people around them who eat plenty of F&Vs and expect others to do so), less confidence in their ability and control over their intake, rated the benefits of eating F&Vs lower, and were less likely to consider

[81] As Tabachnick and Fidell (2007, p. 154) point out "a suppressor variable is defined not by its own regression weight, but by its enhancement of the effects of other variables in the set of independent variables".
[82] Similar measures were also used by Armitage and Conner (1999a) and Povey et al. (2000a).

themselves a healthy eater. Other independent risk factors included low awareness of F&V guidelines and education. Nevertheless, the impact of awareness of F&V guidelines appeared to be in part through perceived norms based on the bivariate and multivariate relationship among these factors. The impact of education on intentions may be partly through access to and comprehension of diet and nutrition related information (see Turrell & Kavanagh, 2006). Confusion over dietary guidelines and advice appears to be higher among those with a lower level of education (Cotugna, Subar, Heimendinger & Kahle, 1992; Glanz, Kristal, Sorenson, Palombo, Heimendinger & Probart, 1993). In total, the contextual factors accounted for 7% (7% adjusted) of the variance in intentions, while the psychosocial factors explained an additional 36%. The model containing both contextual and psychosocial factors therefore accounted for 43% (42% adjusted) of the variance in intentions in line with several meta-analyses of the TPB (e.g., Armitage & Conner, 2001; Rivis & Sheeran, 2003).

Fruit & Vegetable Intake and Contextual Factors

The impact of the contextual factors on F&V intake was also examined. As expected age, education, income, food insecurity, and awareness of F&V guidelines were independently related to behaviour. Hypothesis 7 was therefore supported. The most important unique predictors of F&V intake were food insecurity and awareness of F&V guidelines. That is, men who had a higher level of F&V consumption tended to have a lower level of food insecurity and were more likely to be aware of the guidelines for F&V intake. Food insecurity and food insufficiency have also been related to F&V intake in previous research (e.g., Dixon , Winkleby & Radimer, 2001; Gulliford, Mahabir & Rocke, 2003; Kendall, Olson & Frongillo, 1996; Quine & Morrell, 2005; Radminer, Allsopp, Harvey, Firman & Watson, 1997), as well as awareness of F&V guidelines (e.g., Baker & Wardle, 2003; Food Standards Agency, 2007; Krebs-Smith, Heimendinger, Patterson, Subar, Kessler & Pivonka, 1995; Stables et al., 2002; Steptoe, Perkins-Porras, McKay, Rink, Hilton & Cappuccio, 2003; Van Duyn et al., 2001; Watters, Satia & Galanko, 2007). Finding F&V consumption was higher on average among men who were older, more educated and earned more also corroborates with earlier studies (Deshmukh-Taskar, Nicklas, Yang & Berenson, 2007; Guenther et al., 2006; Henderson, Gregory & Swan, 2002; Irala-

Estevez, Groth, Johansson, Oltersdorf, Prattala & Martinez-Gonzalez, 2000; Johanson, Thelle, Solvoll, Bjorneboe & Drevon, 1999; Kamphuis, Giskes, de Bruijn, Wendel-Vos, Brug and van Lenthe, 2006; Krebs-Smith & Kantor, 2001; Metcalf, Scragg & Davis, 2006; Shepherd, Paisley, Sparks, Anderson, Eley & Lean, 1996; Stables et al., 2002; Trudeau et al., 1998; Wardle, Parmenter & Waller, 2000). Findings therefore indicate risk factors for low F&V intake include younger age, a lower level of education, income, and awareness of F&V guidelines, as well as a higher level of food insecurity.

Fruit & Vegetable Intake and Psychosocial Factors

The impact of the psychosocial factors on F&V intake was also examined once the contextual factors had been controlled for. Self efficacy, perceived norms, and self identity were the most important independent predictors of F&V intake. A small proportion of variance in behaviour was also accounted for by perceived susceptibility to disease. Although the cons had a small bivariate relationship with F&V intake they did not independently impact on behaviour. A large relationship was however found between perceived cons and food insecurity. Previous research also suggests the pros only tend to have a small and inconsistent relationship with F&V intake (e.g., Brug et al., 2006; Ling & Horwath, 2001; Steptoe et al., 2003; Van Duyn et al., 2001). Similarly, attitudes do not tend to independently predict F&V intake when other TPB variables and intentions are controlled for (e.g., Bogers et al., 2004; Brug et al., 1995; Chatzisarantis et al., 2004). Furthermore, the inclusion of decisional balance in post hoc analyses did not alter the results of the study. Finding perceived control was not independently related to F&V intake when intentions and self efficacy were included in the same model also corroborates with previous research examining dietary behaviours (e.g., Armitage & Conner, 1999ab; Povey et al., 2000a). Hypothesis 8 was therefore largely supported as expected.

Awareness of F&V guidelines was also independently related to F&V intake when the psychosocial factors were included in the same model. Awareness of F&V guidelines has also been associated with F&V consumption in previous research when other psychosocial factors (e.g., self efficacy, positive and negative outcome expectations, perceived norms, and perceived threat), knowledge of the diet-disease relationship,

and habit have been controlled for (e.g., Baker & Wardle, 2003; Krebs-Smith et al., 1995; Steptoe et al., 2003). However, the main difference in the current study appears to be whether one believes the recommendations are to eat less than *or* more than 5 servings of F&Vs a day. Men who thought the guidelines were to eat at least 5 servings of F&Vs a day had an approximately 30% higher level of consumption, in line with previous studies (Steptoe et al., 2003; Van Duyn et al., 2001; Watters et al., 2007)[83].

Food insecurity was also independently related to behaviour once the psychosocial factors were included in the same model. The impact of income on F&V intake also appeared to be in part through food insecurity. Previous research indicates food insecurity is higher among those with lower incomes (e.g., Edwards, Weber & Bernell, 2007; Laraia, Siega-Riz & Evenson, 2004; Nord et al., 2004, 2007; Parnell et al., 2003; Radimer et al., 1997; Rose & Oliveira, 1997; Russell, Parnell & Wilson et al., 1999; Vozoris & Tarasuk, 2003). Therefore, the impact of income on F&V intake was reduced when food insecurity was included in the model. However, income was also related to self efficacy and perceived norms. The impact of age on F&V intake appeared to be partially through self identity as a healthy eater. Previous research suggests older people tend to consume more traditional diets, are more likely to have made eating F&Vs a habit since childhood, and to consider the health consequences of diet as important (e.g., Horwath, Birbeck, Wilson, Russell & Herbison, 1991; Krebs-Smith et al., 1995; Satia, Kristal, Curry & Trudeau, 2001; Zunft et al., 1997).

Mediating Effects

The mechanism by which the psychosocial factors influenced behaviour was also examined. In line with earlier research (e.g., Bogers et al., 2004; Brug et al., 1995; Chatzisarantis et al., 2004; Lechner et al., 1997; Povey et al., 2000a), intentions had a moderate-large relationship with behaviour at the bivariate level and were independently associated with F&V intake. Furthermore, with intentions included in the model perceived norms had a smaller impact on behaviour. Findings therefore

[83] Those who believed recommendations were to eat less than 5 a day ate on average 3.13 servings a day (*SD* = 1.76), while those who believed they should be eating 5 or more ate on average 4.16 servings (*SD* = 2.11).

indicate perceived norms impact on behaviour in part through intentions, in line with the assumptions of the TPB. Although there is a paucity of previous research examining the mediating effects of intentions in relation to dietary behaviours, the findings corroborate with Bentler and Speckart's (1979) study of negative health behaviours. Nevertheless, the impact of perceived norms on behaviour was not fully accounted for by intentions. It is possible however the mediating effects of intentions were not totally controlled for due to measurement error in intentions (see Baron & Kenny, 1986). That is, more variance in behaviour may have been accounted for if intentions were measured using a multi-item scale and thereby reducing the unique contribution of the psychosocial factors. Nevertheless, other people are recognised as one factor in the TPB which may limit actual control over behavioural performance (see Ajzen & Fishbein, 1973).

In line with previous research and the assumptions of the TPB (e.g., Bogers et al., 2004; Brug et al., 1995; Lechner et al., 1997; Povey et al., 2000a), self efficacy also directly influenced behaviour when intentions were controlled for. Self identity was also independently related to F&V intake. Previous research suggests self identity is moderately associated with the consumption of a low fat diet at the bivariate level (e.g., Armitage & Conner, 1999a), as well as past behaviour for a healthy diet (e.g., Astrom & Rise, 2001). There is nevertheless a lack of research examining the independent impact of self identity on F&V intake. Studies examining household recycling, blood donation and cannabis use however suggest self identity does not independently predict behaviour once intentions and past behaviour are taken into account (e.g., Charng, Piliavin & Callero, 1998; Conner & McMillan, 1999; Terry, et al., 1999). The observed association between self identity and F&V intake may therefore be due to past behaviour[84]. Nevertheless, Granberg and Holmberg (1990) found self identity had a small impact on subsequent voting behaviour in national elections when past behaviour was controlled for. It is therefore possible those with a stronger self identity are more committed to future behavioural performance.

[84] See Ouellette & Wood (1998) and Conner & Armitage (1998) for meta-analyses examining the relationship between past behaviour and current behaviour.

Perceived susceptibility to disease was also independently and negatively related to F&V intake. That is, men who ate more F&Vs perceived their risk of chronic health problems as being lower. Findings differ however from earlier studies in which those who consume a diet more in line with dietary guidelines have been found to perceive their risk of disease as higher (e.g., Contento & Murphy, 1990; Dittus, Hillers & Beerman, 1995; Schafer, Keith & Schafer, 1995). Previous studies have nevertheless tended to use measures of risk perceptions conditional on behavioural performance (e.g., threat of ill health from eating a diet high in fat). On the other hand, the items used in the current study were not dependent on behaviour (e.g., likelihood of a heart attack in the future). Consequently, the results of the study are more likely to reflect the impact of behaviour on perceived susceptibility to disease (see Abraham & Sheeran, 2000; Weinstein & Nicolich, 1993). Control for past behaviour and the use of measures of risk perceptions conditional on behaviour have therefore been recommended in the literature (see Abraham & Sheeran, 2000; Ronis, 1992).

In summary, self efficacy, self identity, and perceived susceptibility to disease were directly related to behaviour once intentions were controlled for. Perceived norms on the other hand appeared to influence behaviour indirectly through intentions. While the TPB also assumes the impact of attitudes on behaviour is mediated by intentions, the pros in the current study were only significantly related to intentions. Further research is nevertheless required to determine whether intentions is the mechanism by which attitudes influence F&V intake. Hypothesis 9 which postulated the main effects of the psychosocial factors on behaviour would be mediated by intentions was therefore only partially supported. However, with intentions included in the model, awareness of F&V guidelines was no longer significantly related to F&V intake. Food insecurity on the other hand remained a small but significant predictor of behaviour. In the TPB perceived behavioural control has been conceptualised as having requisite opportunities and resources (see Ajzen, 1991). Although perceived behavioural control tends to be assessed with self efficacy and/or control items, more external factors may warrant greater consideration.

The impact of income on F&V intake appeared to be partly through food insecurity. In addition, self identity appears to be one mechanism by which age influences behaviour. The total variance accounted for by the contextual factors in F&V intake

was 14% (13% adjusted). This is in line with expectations given the more distal nature of the variables and corroborates with earlier research (e.g., Baker & Wardle, 2003; Johansson et al., 1999; Turrell, 1998; Wardle et al., 2000). With the psychosocial factors and intentions included in the same model, 40% (38% adjusted) of the variance in F&V intake was accounted for. The variance accounted for in behaviour is therefore greater than that explained by intentions and perceived behavioural control in a meta-analysis of a range of health behaviours (27% [Armitage & Conner, 2001]). Furthermore, previous research using objective measures of consumption (e.g., FFQs rather than self rated intake) have accounted for between 10-39% of the variance in vegetable, fruit and F&V intake (e.g., Bogers et al., 2004; Brug et al., 2006; Lechner et al., 1997; Povey et al., 2000a).

Moderating Effects

The final objective of the study was to examine whether self efficacy interacted with intentions to predict F&V intake. In the TPB, perceived behavioural control is assumed to moderate the relationship between intentions and behaviour (Ajzen, 1991). While the current study found a small interaction between self efficacy and intentions, it was not statistically significant and Hypothesis 10 was not supported. In line with previous research examining perceived behavioural control (see Ajzen, 1991), intentions and self efficacy appear to largely have additive effects in predicting behaviour. On the other hand, food insecurity significantly interacted with intentions and self efficacy in post hoc analyses. That is, the impact of intentions and self efficacy on F&V intake depended in part on household food insecurity status. No studies to date appear to have explored the interaction among these factors and therefore the findings provide a new contribution to the literature. To determine how the impact of intentions and self efficacy differed in relation to household food insecurity status, separate analyses were performed on men experiencing low (i.e., food insecurity was never or seldom a problem) and high levels of food insecurity (i.e., food insecurity experienced at least once in awhile).

Among low food insecure men, intentions, self efficacy, and self identity were significantly and independently related to F&V intake. In addition, education appeared to indirectly influence behaviour through intentions and self efficacy. On

the other hand, the main factor associated with F&V intake among high food insecure men was self efficacy. Although intentions among low and high food insecure men were similar on average, intentions were not significantly related to behaviour among high food insecure men. Perceived norms nevertheless had a small independent impact on behaviour among high food insecure men. These findings therefore lend support to Ajzen and Fishbein's (1973) claim that "an individual may not be able to perform a given behavior, despite his intention to do so, if he lacks the required ability or if he is prevented from doing so by circumstances or by people" (p. 44). The association between perceived susceptibility to disease and behaviour among high food insecure men nevertheless highlights the importance of eating adequate amounts of F&Vs each day.

Research Implications

The study examined an extended stage and continuous model of F&V intake. The stages of change appear to be a useful heuristic device for describing behaviour and intentions associated with F&V intake. While precontemplation is often considered synonymous with resistance to change, the study however found men in this stage only mildly intended not to eat 5 or more servings of F&Vs a day in the future. The proportion of men in each stage of change nevertheless provides valuable information for planning interventions aimed at increasing F&V intake. In line with the assumptions of the TTM (see for example Greene, Rossi, Rossi, Velicer, Fava & Prochaska, 1999), findings indicate only a small proportion of men are likely to benefit from action oriented programmes. Interventions aimed at facilitating change among those in the preaction stages on the other hand are likely to benefit a large number of people. According to the TTM, interventions which are matched to each of the preaction stages should be more effective in facilitating successful behaviour change than standardised intervention programmes. Nevertheless, findings indicate those factors which are potentially amenable to change and important in the preaction stages are similar regardless of whether one is classified in the precontemplation, contemplation or preparation stage.

Factors important in the preaction stages of change included perceived norms, self efficacy, the pros and cons, and awareness of F&V guidelines. In addition, those who

were younger and had a higher level of food insecurity were more likely to be thinking about changing their behaviour in the future. While it is difficult to directly compare results from the stage and continuous model, the study found similar factors were also important in relation to intentions as summarised in Table 7.1. That is, intentions were also positively associated with perceived norms, self efficacy, and the pros. Awareness of F&V guidelines also appeared to influence intentions in part through perceived norms. To a lesser extent, self identity as a healthy eater, perceived control and education were also associated with intentions. Therefore findings suggest interventions should aim to modify similar factors regardless of whether behaviour change is conceptualised as involving a series of stages of change, or small gradual changes along a continuum. In other words, both models reach similar conclusions about key factors which should be modified in order to increase intentions among those with an inadequate level of F&V intake.

Table 7.1. *Factors Important in the Preaction and Postaction Stages of Change for Fruit and Vegetable Intake, and Related to Intentions and Behaviour.*

	Pre-Action	Post-action	Pre- & post-action	Intentions	F&V intake	Intentions & intake
Perceived norms			+			+
Self efficacy			+			+
Self identity			+			+
Pros	+	-		+		
Cons	+	-			-	
Decisional balance			+			+
F&V guidelines			+			+
Food insecurity	+	-			-	
Age	-	+			+	
Income			+			+
Education			+			+
Control			+			+
Susceptibility		-			-	

Note. +/- = scores on factors increase or decrease respectively. F&V = fruit and vegetable. The importance of factors is ranked based on the proportion of variance accounted for across the stages of change due to differences in group means. Factors which had a linear relationship with the stages of change were considered to be important in both the pre- and post-action stages of change. Those factors which had a non-linear relationship with the stages of change were considered to be important in the preaction or postaction stages based on the pattern and magnitude of mean differences found between adjacent stages of change. In order to compare findings at a similar level, the bivariate relationship between factors and intentions, as well as fruit and vegetable intake was used. Results pertaining to decisional balance have also been reported.

Between the preparation and action/maintenance stages of change a number of contextual and psychosocial factors appeared to be important including age, food insecurity, self identity, perceived pros and cons, self efficacy, susceptibility to disease and income. Similar factors were also associated with F&V intake. Nevertheless, once the relationship among predictor variables had been taken into account results indicated the most important and proximal determinants of F&V intake included self efficacy and intentions. Self identity, food insecurity, and perceived norms also had a small impact on behaviour. The other psychosocial and contextual factors appeared to largely influence intentions. Nevertheless, the impact of self efficacy and intentions on F&V intake was found to differ with respect household food insecurity status.

Results therefore have practical implications for the design of interventions aimed at increasing F&V intake. The modification of perceived norms, pros and cons, confidence or ability in eating F&Vs in difficult situations, and awareness of F&V guidelines appear to be important for increasing intentions. Findings indicate perceived norms were the most important factor across the stages of change and also in relation to intentions. That is, whether others are perceived as eating adequate amounts of F&Vs each day and their approval (or disapproval) of others doing so. Therefore, the modification of perceived norms and feedback about one's own behaviour compared to similar others (e.g., comparative norms) may be beneficial in individual intervention efforts, along with the involvement of family or whanau. Several reviews suggest interventions which include family members, social support and small groups are associated with more positive outcomes for dietary behaviours (e.g., Adamson & Mathers, 2004; Ammerman, Lindquist, Lohr & Hersey, 2002). The implementation of programmes in larger group settings (e.g., worksites and community organisations) may also be valuable for increasing perceived norms, as well as media and public health campaigns. Although Cialdini (2003) warns against sending "muddled messages" or different depictions of what people say and do (i.e., subjective and descriptive norms). In other words, campaigns which encourage people to eat 5 or more servings of F&Vs a day should draw attention to the fact many people do eat a healthy diet high in F&Vs, rather than those who do not. Cafeteria and catering policies which increase the availability of F&Vs (as well as

possible restrictions on unhealthy food items) may also be beneficial in altering perceived norms (see Glanz & Hoelscher, 2004).

Perceived norms also appear to be influenced by awareness of F&V guidelines. Given 1 in 4 men seemed to be unaware of the guidelines for F&V intake, findings suggest the continued promotion of the 5+ A Day message would be valuable. There nevertheless appears to be some confusion over the guidelines with 1 in 5 men thinking recommendations were to eat 5 servings of fruit *and* vegetables a day. Previous research suggests people are less willing to act if they believe dietary advice is conflicting or confusing (e.g., Balch, Loughrey, Weinberg, Lurie & Eisner, 1997; Harnack, Block & Lane, 1997). Guidelines should therefore be communicated in a manner which is simple, clear, and easy to understand. The promotion of separate guidelines for vegetables and fruit may help facilitate greater understanding. Further avenues for guideline promotion should however be explored to better reach males.

Nutrition and health information is often directed towards females (see Courtenay, 2000; Lyons & Willott, 1999) and may partly explain their higher level of dietary knowledge. For example, the guidelines for F&V consumption are often promoted in supermarkets but women are more likely to do the household shopping than men (Steptoe & Wardle, 1999; Food Standards Agency, 2007)[85]. While other point-of-sale promotions may be beneficial for increasing awareness among men (e.g., worksite cafeterias), television, magazines, and newspapers are more commonly used sources of nutrition information by both men and women (American Dietetic Association, 2002). While the internet may be a promising avenue for future health promotion effots, a survey of U.S. households found only 16% used the internet to access health information, and those who did tended to have a higher level of education and income (Tu & Hargraves, 2003). Furthermore, only 61% of households in N.Z. currently have internet access and use elsewhere tends to be lower among those who are more socioeconomically disadvantaged and older (Couper, 2000; Scriven & Smith-Ferrier, 2003; Statistics N.Z., 2007c; Stanton & Rogelberg, 2001; Tu & Hargraves, 2003). At the present time, internet campaigns would appear to primarily benefit those who already have a higher level of F&V intake.

[85] The fruit and veggies more matters campaign in the U.S. also appears to be more directed towards moms (see http://www.fruitsandveggiesmorematters.org)

Modifying perceived pros and cons associated with F&V intake also appears to be important for increasing intentions. Decisional balance sheets (e.g., listing the pros and cons) may be useful in getting people to generate their own arguments for change (see also Miller & Rollnick, 2002). Evidence also suggests people are motivated by more immediate outcomes and internal rewards (e.g., Balch et al., 1997; Satia et al., 2002; Trudeau et al., 1998). In line with this, post hoc analyses revealed feeling good about looking after one's health, keeping regular (avoiding constipation), and adding variety to meals were benefits perceived as important by men. Previous research also suggests simple messages about the benefits of consuming a low fat diet (i.e., maintaining fitness, controlling weight, and enhanced feelings of health) are useful in facilitating progression from the precontemplation stage (Armitage et al., 2004). Furthermore, positively framed messages appear to be more beneficial in the promotion of preventative health behaviours (see Rothman, Bartels, Wlaschin & Salovey, 2006).

The most important cons in post hoc analyses included cost, time, difficulty in planning meals, and finding F&Vs that one liked in line with previous research (e.g., Balch et al., 1997; James, 2004; Krummel, Humphries & Tessaro, 2002; Pollard, Kirk & Cade, 2002). Greater promotion of F&Vs which are high in essential nutrients but relatively inexpensive such as in-season or frozen F&Vs may therefore be warranted. Previous research also suggests those least motivated about changing their behaviour were interested in receiving tips on preventing spoilage, along with quick and easy recipes made from common ingredients (see Rudd, Betts, Kritch, Nitzke, Lohse & Boechner, 2005). Opportunities for taste testing may help people try new F&Vs. Reviews of point-of-sale interventions (Brownson, Haire-Joshu & Luke, 2006; Glanz & Hoelscher, 2004; Seymour, Yaroch, Serdula, Blanck & Khan, 2004) also suggest price incentives, increased availability, and the labelling of healthy foods may be promising means of increasing F&V consumption.

Confidence in being able to eat F&Vs in difficult situations appears to be important for increasing both intentions and behaviour. According to Bandura (2000), self efficacy is influenced by a number of factors including social persuasion, emotional and physiological reactions associated with behavioural performance, observational learning of others, and previous successes or mastery experiences. Consequently, the

modelling of healthy dietary behaviours by similar others is expected to increase perceptions of one's own ability (see Bandura, 2000). Other strategies used in motivational interviewing include eliciting people's own ideas about how they might go about changing and overcoming foreseeable obstacles, as well as drawing on their own past successes (see Miller & Rollnick, 2002). Small manageable steps should also be incorporated into programmes to increase opportunities for success. The inclusion of an additional serving of vegetables to meals, a glass of juice at breakfast, or a piece of fruit at lunch may be some easy ways of increasing the amount of F&Vs in one's diet. For those who believe their behaviour is beyond their control, Bandura (2004) however claims more personal guidance and structured mastery programs are required to bolster individual staying power in the face of difficulties and setbacks.

Among those experiencing higher levels of food insecurity, self efficacy appears to be particularly important for translating intentions into action. Interventions specifically targeting those with high levels of food insecurity may therefore be required. A recent report on food security among Maori in Aotearoa by Te Hotu Manawa Maori (2007) summarises a number of community initiatives aimed at improving food access and supply (see also NSW Centre for Public Health Nutrition, 2003 for Australian policy and practice interventions). Interventions include advice on purchasing and the preparation of healthy meals within a limited budget, cooking demonstrations, and supermarket tours. While home gardening is another strategy which has also been used, it may be less practical for those who do not own their own homes. Another lifestyle intervention programme aimed at preventing Type 2 diabetes among Maori found the potentially higher costs associated with the consumption of a healthy diet could be limited by restricting the amount of unhealthy food items bought regularly (Murphy et al., 2003). This study also found participants perceived the regular contact and monitoring as one of the most useful aspects of the programme. Support for community initiatives aimed at increasing the ability of individuals to make positive dietary changes, especially among those experiencing higher levels of food insecurity therefore appears to be warranted (see also Voyle & Simmons, 1999). School intervention programmes aimed at increasing F&V intake among children may be usefully extended to include family components.

In order to make the consumption of fresh F&Vs an easier choice, local food markets could also be supported and encouraged. However, fiscal policies may also be required. Food in N.Z. is subject to a goods and services tax (GST), while in other countries including Australia healthy food items are exempt (Australian Taxation Office, 2007; Inland Revenue, 2007). A N.Z. study is currently examining whether the discounting of healthy foods by about the same amount as GST promotes healthier food choices (Ni Mhurchu, 2007; MOH, 2006). However, food cost appears to be more important among those experiencing higher levels of household food insecurity[86] and more socioeconomically disadvantaged (Dibsdall, Lambert, Bobbin & Fewer, 2003; Eikenberry & Smith, 2004; Giskes, Turrell, Patterson & Newman, 2002; Pollard et al., 2002; Shepherd et al., 1996; Turrell & Kavanagh, 2006). The implementation of such programmes in lower socioeconomic areas may therefore merit higher priority to encourage the consumption of a healthy rather than energy dense diet which can currently satisfy hunger at a relatively cheaper cost (see also Drewnowski & Darmon, 2005).

Income and housing may also need addressing for some food insecure families. Since the late 1980s the level of disposable income in the top and bottom 20% of households in N.Z. has been widening and is currently 2.8 times lower in the poorest group (Ministry of Social Development, 2007[87]; Tobias & Howden-Chapman, 1999)[88]. Housing and household utilities are relatively fixed and account for the largest amount of household expenditure[89] (Statistics N.Z., 2004). Food on the other hand is a more discretionary item (Booth & Smith, 2001). Evidence suggests when money needs to be used to pay for other essential services, accumulated debt, and unexpected bills, food shortages have been precipitated in some households (McPherson, 2006; N.Z. Fight Against Food Poverty, 1999; Tarasuk, 2001; Uttley,

[86] On average, low food insecure men indicated the expense associated with eating more fruit was not important-slightly important (M = 1.53, SD = .89), while it was moderately important for high food insecure men (M = 2.88, SD = 1.30). Men experiencing 3 or more aspects of food insecurity rated cost as being more important (M = 3.37, SD = 1.26).

[87] The 2008 Ministry of Social Development report indicates the gap has reduced for the first time to 2.6 times lower in the poorest group.

[88] Taking into account the number of household members. Over the last 2 decades N.Z. experienced the fastest increase in income inequality of any country for which data is available (Hills, 1995; cited in Wise & Signal, 2000). See also O'Dea and Howden-Chapman, 2000).

[89] In 2003/04 expenditure on housing and household operation equated to 28% of the average household income of $60,433 per annum and 37% of the average household expenditure of $888 per week (Statistics N.Z., 2004).

1997, Wynd, 2005). Although food bank use may arouse negative feelings such as shame and embarrassment, it nevertheless appears necessary for some. A 1994 review by the Social Policy Agency Research Unit estimated there were 365 food banks in N.Z. giving out about 40,000 food parcels a year (N.Z. Fight Against Food Poverty, 1999; Uttley, 1997). Further data available from the Auckland City Mission shows the number of food parcels distributed between 1996 and 2005 has continued to rise (Robertson, 2006; Wynd, 2005). Although food bank use only represents a small portion of the problem, the use of food banks and special food grants is twice as high in households containing children (9.4% [Parnell et al., 2003]). A review of income and tax policies, especially for families with children may therefore be required (see N.Z. Fight Against Food Poverty, 1999; Uttley, 1997)[90].

A multiple level and comprehensive approach maybe needed to help facilitate increased F&V consumption. Individual interventions may be supported and complemented by those at the environmental level including organisational and community programmes, as well as policy changes (Kumanyika, 2001; Swinburn, Egger & Raza, 1999). Environmental interventions also have the potential to have a more permanent impact on behaviour and reach a larger proportion of the population including those who are typically hard to reach (Brownson et al., 2006; Booth et al., 2001; Cohen, Scribner & Farley, 2000; Sallis & Owen, 2002; Swinburn et al., 1999). Although environmental interventions are likely to have a smaller impact on behaviour, they nevertheless have the potential to bring about population shifts in the distribution of F&V intake (see Cohen et al., 2000; McKinlay, 1995). In contrast, individual interventions may have a larger impact on individual behaviour but only benefit a minority of the population. Consequently, multiple level approaches based on ecological frameworks are increasingly being recognised as promising means of modifying individual risk behaviours (McKinlay, 1995; Sallis & Owen, 2002; Swinburn et al., 1999). That is, interventions which combine downstream individual approaches, midstream organisational and community based programmes, and upstream public policy changes (McKinlay, 1995; see also Orleans, 2000; Smith, Orleans & Jenkins, 2004).

[90] The 2008 budget on 22 May proposed personal tax cuts particularly aimed at families with children by reducing the lowest tax rate and lifting the threshold for middle and higher incomes.

Future Research

Future research should consider using social ecological models which include both psychosocial and contextual factors. A number of models have been outlined in the literature which incorporate a broader range of environmental factors (e.g., Booth et al., 2001; Kamphuis, van Lenthe, Giskes, Brug & Mackenbach, 2007; Swinburn et al., 1999; Wetter et al., 2001; see also French, Story & Jeffery, 2001). Culture is one factor that appears important to explore in future research given its impact on food acceptability, taboos and preferences, as well as the meaning and value of different foods, and health beliefs (Ashcraft, 1985; Crotty, 2002; Evans, Sinclair, Fusimalohi, Laiva'a & Freeman, 2003; Fieldhouse, 1995; Kirkwood, Simmons, Weblemoe, Voyle & Richards, 1997; Rozin, 1996; Vainikolo, Vivili & Guthrie, 1993; Voyle & Simmons, 1999). A recent review of environmental factors associated with F&V intake only found two studies however which had evaluated the impact of culture (Kamphuis et al., 2006). Future research should also consider the marital status and the number of people living in a household as they may directly or indirectly influence F&V intake through food insecurity (see Kamphuis et al., 2006). Consideration of the impact of being "prescribed" a healthy diet by health professionals may also be beneficial.

Future research should consider whether local access and availability of fresh produce are barriers to F&V consumption. While several recent N.Z. studies have investigated access to supermarkets and shops selling healthy food items (Pearce, Blakely, Witten & Bartie, 2007; Pearce, Witten, Hiscock & Blakely, 2007), there is paucity of research examining the quality of fresh produce available. Access to transport should also be examined especially among older people and those more socioeconomically disadvantaged. Storage facilities (e.g., fridges and freezers) may also be a barrier to increased F&V intake, especially in low income households (see Giskes et al., 2002; Reicks, Randall & Haynes, 1994). Other aspects of dietary knowledge should also be considered including nutrition labelling and knowledge of diet-disease relationships, as well as perceptions of dietary advice as confusing or difficult to comprehend (see Cotungna et al., 1992; Glanz et al., 1993; Turrell & Kavanagh, 2006). The identification of factors which promote self efficacy and lower food insecurity would

also be a valuable avenue for future research. Whether age alters the impact of psychosocial factors on F&V intake should also be explored further.

The impact of self identity, as well as the value and meaning of food may also be a valuable avenue for future research. Identities describe relatively enduring aspects of the self which are derived in part from social interactions with others and the labels pervasively applied to people over time (Biddle et al., 1985; Bisogni, Connors, Devine & Sobal, 2002; Snyder & Stukas, 1999)[91]. Consequently, others hold expectations about one's behaviour and behavioural performance may serve to validate one's identity (Biddle et al., 1995; Callero, 1985). Furthermore, people may be motivated to maintain their self identity if it provides them with a sense of self esteem and accomplishment (see Biddle et al., 1985; Bisogni et al., 2002; Conner & Armitage, 1998). The meaning and values symbolised by a behaviour may therefore be used to express one's identity. In addition to health consciousness, food may be used to communicate one's cultural or ethnic identity, masculinity or femininity, spirituality, morality, or social status (Allen & Baines, 2002; Bove, Sobal & Rauschenbach, 2002; Fieldhouse, 1995; Furst, Connors, Bisogni, Sobal & Falk, 1996; Gedrich, 2003; Vainikolo et al., 1993; Vartanian, Herman & Polivy, 2007; see also Mick, 1986; Sparks, 2000). That is, what one eats may convey aspects of self to others. Furthermore, the offering of food by others may also be used to convey respect, hospitality or aroha in Maori culture (Ashcraft, 1985; Fieldhouse, 1995; Vainikolo et al., 1993). Future research should therefore explore whether F&V intake is influenced by attitudes towards the symbolic meaning of food, along with their utilitarian value.

The use of longitudinal research designs in future research would also provide stronger tests of stage model assumptions. That is, whether behaviour change involves progressing through a series of stages of change over time, and whether different factors predict movement from one stage of change to the next (Weinstein, Rothman & Sutton, 1998). If behaviour change follows a temporal sequence then the probability of moving to a non-adjacent stage would be low (Sutton, 2001). That is, movement is expected to primarily occur between adjacent stages. A measurement

[91] Although self identities may change over time with different life transitions (e.g., as roles, responsibilities and relationships change [Bisogni et al., 2002; Furst et al., 1996]).

schedule which gives a complete picture of the stage transitions that occur is therefore required (Sutton, 2001; Weinstein, Rothman et al., 1998). If stage transitions are missed then people may appear to have skipped stages. Sutton (2001) suggests careful retrospective questioning may be useful for "filling in" gaps in the measurement schedule. Nevertheless, if behaviour change involves movement along a continuum rather than a sequence of stages then small naturally occurring shifts would also be expected to be more common than larger ones (Weinstein, Rothman et al., 1998). Therefore, Weinstein and colleagues (Weinstein, Rothman et al., 1998) claim deciphering whether change involves gradual changes along a continuum or transition to an adjacent stage may be somewhat subjective and sequence data might not be very conclusive. Longitudinal research designs would nevertheless allow stronger inferences to be drawn about the causal direction of relationships. For example, whether self identity and perceived susceptibility to disease impact on behaviour or vice versa. While longitudinal research designs would also enable control for past behaviour, they cannot definitively rule out the possibility that an observed association is due wholly or partly to other unmeasured variables (Sutton, 2000). The paucity of longitudinal research conducted to date also likely reflects the larger demand placed on resources and funding required to repeatedly assess participants over extended periods of time, as well as the problems associated with participant drop-out and retaining representative samples[92].

Experimental studies which examine stage matched interventions provide the ultimate test of stage models (see Weinstein, Rothman et al., 1998). That is, studies which examine the utility of interventions matched to each stage of change (i.e., one intervention for each stage) based on the characteristics which they share. Finding stage matched interventions are more effective in facilitating progression from one stage of change to the next than standardised interventions would provide stronger support for the TTM. There is however a lack of studies which have been conducted to date which compare stage matched and standardised interventions. Nevertheless, a recent study examined the utility of stage matched feedback but found it had no superior value in relation to mismatched feedback for fruit intake (De Vet, De

[92] To examine the complete sequence of stage movements, participants would need to be followed for at least 2 years. In addition, Armitage (2006) estimated several thousand participants would be required to properly assess the TTM given there are 25 possible stage movements and over 60% of participants tend to remain in the stage in follow-up assessments

Nooijer, De Vries & Brug, 2006). In addition, Perkins-Porras and colleagues (2005) compared nutrition education with a nutrition information and behavioural counselling intervention based on stage of change. Although the study lacked a control condition, results indicated the behavioural counselling intervention had a greater impact on F&V consumption in the contemplation stage. Few differences were found however in the precontemplation and preparation stages. Another study (Resnicow et al., 2003) found the inclusion of three motivational interviewing telephone calls had a greater impact on behaviour than an intervention only condition compared to the control group. The inclusion of behavioural counselling or motivational interviewing in interventions aimed at increasing F&V intake is not limited however to those based on the TTM.

Most TTM interventions have compared intervention and control conditions and have found positive increases in F&V intake[93] (e.g., Beresford, Curry, Kristal, Lazovich, Feng & Wagner., 2001; Campbell et al., 1999; Delichatsios, Hunt, Lobb, Emmons & Gillman 2001; John, Yudkin, Neil & Ziebland, 2003; Kristal, Henderson, Patterson & Neuhauser, 2001; Marcus et al., 1998; Richards, Kattlemann & Ren, 2006), in line with the results of a review of randomised controlled trials (0.60 servings a day [Ammerman et al., 2002]). A number of interventions have also included personalised feedback and tailored advice to individuals (e.g., Brug, Glanz, van Assema, Kok & Breukelen, 1998; Campbell, DeVellis, Strecher, Ammerman, DeVellis & Sandler, 1994; Campbell et al., 1999; Delichatsios et al., 2001; De Vet et al., 2006; Kristal et al., 2000; Marcus et al., 1998). While individually tailored feedback (i.e., those based on individual assessments) and health messages have been found to have a small but positive impact on behaviour in several recent reviews (Kroeze, Werkman & Brug, 2006; Noar, Benac & Harris, 2007), they are also not limited to the TTM[94].

The results of the current study therefore suggest more research is required to compare the utility of interventions matched to the precontemplation, contemplation and preparation stages with standardised interventions aimed at increasing intentions.

[93] *M* = .20 to .60 servings a day depending on follow-up period.
[94] Noar and colleagues (2007) found tailored print messages which included theoretical, behaviour and demographic information had the greatest impact on behaviour.

Interventions should however contain a similar level of personalisation and intervention intensity. The impact of interventions should also be reported in relation to baseline stage to determine the efficacy of interventions in different stages. It has also been argued that interventions need to be ultimately judged on behavioural outcomes (e.g., Adams & White, 2005; Bridle et al., 2005; Whitelaw, Baldwin, Bunton & Flynn, 2000). Therefore, outcomes should be assessed with respect to both stage and behaviour. However it may be more beneficial to evaluate standardised interventions with respect to baseline stage (e.g., see Bauman, Sallis, Dzewaltowski & Owen, 2002; Schwarzer, 2008). That is, whether the impact of a single intervention has a differential impact on those in the precontemplation, contemplation or preparation stages of change. Nevertheless, there have also been calls to examine why interventions are efficacious in modifying behaviour (e.g., Baranowski, Anderson & Carmack, 1998; Bauman et al., 2002; Kristal et al., 2000). The hypothesised mechanisms (i.e., mediators) by which an intervention is expected to have an impact on behaviour should therefore also be examined. For example, whether an intervention designed to increase self efficacy influenced behaviour in part by increasing individual confidence in performing the behaviour. Results would not only help determine whether an intervention had an impact as intended, but also in model refinement and the development of future interventions (Bauman et al., 2002; Baranowski et al., 1998; Kristal et al., 2000).

Strengths & Limitations

A number of limitations need to be taken into account when interpreting the results of the current study. Firstly, usual intake of F&Vs was evaluated with a brief FFQ given its relative ease of administration and low respondent burden. Brief FFQs are however more suitable for assessing mean intake and ranking levels of consumption than absolute intake (Horwath, 1990). Although, an assessment of portion size or adjustment based on external portion size information may have led to higher estimates of F&V intake being obtained (see Thompson et al., 2002; Thompson, Midthune, Subar, Kahle, Schatzkin & Kipnis, 2004; Thompson, Midthune, Subar, McNeel, Berrigan & Kipnis, 2005)[95]. Nevertheless, some evidence suggests the

[95] Thompson et al., (2004) used the median portion size for each food group by gender and age group from the CSFII 94-96 survey in scoring algorithms.

weighting of consumption by portion size leads to an overestimation of F&V intake among women but an underestimation of intake among men compared to multiple 24 hour recalls (Thompson et al., 2002). On the other hand, when portion size information is excluded, the level of F&V intake among men appears to be underestimated to a larger degree than women (Thompson et al., 2002). This may be due to the larger servings of vegetables which men tend to eat (see Ashfield-Watt, Welch, Day & Bingham, 2003). Gender differences in F&V intake may therefore partly reflect the differential validity of dietary assessment methods.

While other studies have also used brief FFQs to assess F&V intake (i.e., De Vet et al., 2005a; Ma et al., 2003), alternative methods are available such as diet records and multiple 24 hour recalls collected on non-consecutive days. They are not suitable however for inclusion in mail surveys given they require a trained interviewer, a higher level of cooperation by respondents, and are also more time consuming and expensive to administer (see Biro, Hulshof, Ovesen & Cruz, 2002; Block et al., 1986; Field et al., 1998; Guenther et al., 2006; Kristal, Peters & Potter, 2005). Furthermore, F&V intake tends to be slightly underestimated on food records compared to observed behaviour (e.g., Di Noia, Contento & Schinke, 2007[96]; Domel, Baranowski, Leonard, Davis, Riley & Baranowski, 1994; Forli, Oppedal, Skjelle & Vatn, 1998), but the degree and direction of misreporting on 24 hour recalls is less clear (Thompson et al., 2002). Although evidence consistently indicates total energy intake is underreported on 24 hour recalls and records, it is possible the consumption of healthy foods is overestimated (Aguado et al., 2002; Briefel, Sempos, McDowell, Chien & Alaimo, 1997; Nelson & Bingham, 2001; Rennie, Coward & Jebb, 2007; Subar et al., 2001). With no dietary assessment method currently available for determining true F&V intake (Horwath, 1990; Nelson & Bingham, 2001), some researchers have used multiple measures to provide converging or triangulated estimates of consumption (e.g., Andersen, Veierod, Johansson, Sakhi, Solvoll & Drevon, 2005; Resnicow et al., 2003).

The study was also limited by the number of men classified in the contemplation, preparation, and action stages of change as it reduced the power of the study to detect

[96] Di Noia and colleagues (2007) found F&V intake was underestimated by approximately 15% in comparison to observed behaviour in a sample of adolescents.

significant mean differences in factors between adjacent stages of change. Nevertheless, previous research may have had insufficient power due to the small number of participants also classified in these stages (e.g., Armitage & Arden, 2002; Brug, Glanz et al., 1997; Brug, Hospers et al., 1997; De Vet et al., 2005b; Henry et al., 2006; Rapley & Coulson, 2005; Resnicow et al., 2003). According to Cohen (1992), at least n = 64 participants need to be classified in each category to detect moderate mean differences with an alpha level of p =.05 and power of .80. Consequently, some studies have combined the contemplation and preparation stages (e.g., Greene et al., 2004; Horacek et al., 2002), preparation and action stages (Tassell & Flett, 2005), or action and maintenance stages as was done in the current study (e.g., Auld et al., 1998; Ling & Horwath, 2001; Lechner et al., 1998). While this method helps increase power, it nevertheless precludes an examination of factors which discriminate between these stages of change. On the other hand, the ability to obtain larger sample sizes which are sufficient to detect significant mean differences is likely to be restricted in most studies by access to resources.

The results of the study may have been influenced by the measures used and sample characteristics. The use of a single item measure of intentions is likely to have led to an underestimation of the relationship with psychosocial and contextual factors. On the other hand, measurement error in intentions may have led to an overestimation of the impact of the psychosocial factors on F&V intake. Multiple item measures should therefore be used in future research. Participant characteristics may have also led to an underestimation of the incidence of food insecurity given younger men and those from socioeconomically disadvantaged backgrounds were under represented in the study. It is also likely study participants were more interested in diet and nutrition, and health conscious than non-participants. Consequently, the impact of food insecurity and sociodemographic factors on behaviour may have been underestimated due to restricted range and variability (see Sutton, 1998; Turrell & Kavanagh, 2006). In addition, household rather than personal income may have been more important to consider, given income is often shared among household members (see O'Dea & Howden-Chapman, 2001). Given the majority of participants who took part in the study were N.Z. Europeans the impact of ethnicity on behaviour was also precluded and places limits on the generalisability of research findings. An over-sampling of lower socioeconomic groups, Maori, and younger people should therefore be

considered in future research. Finally, given the cross sectional nature of the research design, causation cannot be assumed. For example, while the psychosocial factors are expected to influence behaviour, it is possible behaviour impacts on these factors. It is also possible some third unmeasured variable is responsible for the observed relationship.

The study nevertheless contributes to a better understanding of the process of behaviour change and those factors related to higher levels of F&V consumption. Results indicate a large proportion of men in N.Z. may benefit from increased F&V intake. At least one third of men with an inadequate level of F&V intake appeared to be thinking about changing their behaviour. Findings also indicate those in the precontemplation stage who are often viewed as resistant to change only mildly intended not to eat 5 or more servings of F&Vs a day in the future. The study also contributes to a better understanding of factors important in different stages of change for F&V intake. Finding similar factors were important in the preaction stages however challenges the stage model assumption that different factors are important in different stages of change. Consequently, results provide some evidence to suggest the preaction stages may reflect an underlying continuum based on intentions rather than qualitatively distinct stages. Therefore, standardised intervention programmes targeted towards those in the preaction stages of change may be just as effective in facilitating change as stage matched interventions. Furthermore, those factors which were important in the preaction stages of change were also largely related to intentions. These factors included perceived norms, pros and cons, self efficacy and awareness of F&V guidelines. Factors which discriminated between the precontemplation and action/maintenance stages of change were also similar to those associated with F&V intake. However, once the relationship among factors had been taken into account the most important proximal determinants of behaviour appeared to be self efficacy and intentions.

Findings therefore indicate the TTM may have no superior value in understanding F&V intake than a more parsimonious continuous model. The TTM also appears to be less practical to examine given the demand on larger sample sizes due to the proportion of people normally found in the contemplation, preparation and action stages. The complexity of the TTM also makes it more difficult and challenging to

assess. An extended continuous model on the other hand reached similar conclusions about the process of behaviour change and those factors which contribute to higher levels of F&V consumption. Based on the same sample size however the continuous model was able to take into account the relationship among predictor variables, facilitated a better understanding of the mechanism by which different factors influenced F&V intake, and provided new insights into how the impact of self efficacy and intentions differ in relation to household food insecurity status.

The incorporation of both psychosocial and contextual factors in the current study contributes to a more comprehensive understanding of factors related to F&V intake. Efforts to increase F&V consumption may require a comprehensive multiple level approach which incorporates environmental interventions to complement and support individual level behaviour change efforts. Interventions targeting those with higher levels of household food insecurity may also be required to help translate their intentions into action. A comprehensive approach may have greater capacity for reaching those most in need and bringing about population shifts in F&V consumption. Moreover, such an approach combined with those aimed at increasing physical activity may help reduce the risk of overweight and obesity, as well as chronic diseases including coronary heart disease, diabetes, and some cancers, which place a large demand on the health care system. Ultimately however, the consumption of a nutrient dense diet high in F&Vs may have both short-term and long-term benefits for individual health and wellbeing.

Appendix A: New Zealand Dietary Guidelines

The New Zealand (N.Z.) food and nutrition guidelines for healthy adults (Ministry of Health [MOH], 2003) recommend maintaining a healthy body weight by eating well and being physically active each day. Adults should eat a variety of nutritious foods from each of the four major food groups each day including vegetables and fruits, breads and cereals, milk and milk products, and lean meat, poultry, seafood, eggs or alternatives. Specific advice for each of the four major food groups and the nutrients they provide are summarised in Table A.1. The guidelines also recommend preparing or selecting pre-prepared foods, drinks and snacks with minimal added fat (especially saturated fat), that are low in salt, and with little added sugar. The guidelines also suggest drinking plenty of liquids each day (especially water), limiting alcohol intake, and purchasing, preparing, cooking, and storing food to ensure food safety.

Table A.1. *Food and Nutrition Guideline Advice for the Four Major Food Groups and the Nutrients they provide for New Zealand Adults.*

Advice	Food group	Nutrients provided
Eat at least five servings per day; at least three servings of vegetables and at least two servings of fruits	**Vegetables and fruits** (includes fresh, frozen, canned and dried) (only one serving of vegetable or fruit juice or dried fruit counts) If trying to control energy intake, do no eat too much dried fruit and drain syrup from canned fruit	Carbohydrates Dietary fibre Vitamins: especially A (yellow and green vegetables), C (dark green vegetables and most fruits, potatoes) and folate Minerals: magnesium, potassium
Eat at least six servings per day (try to choose wholegrain)	**Breads and cereals** (includes all breads, grains, rice, and pasta)	Protein Carbohydrates Dietary fibre Vitamins: all B group (except B_{12}), E (rich in wheat germ) Minerals: magnesium, calcium, iron, zinc and selenium (wholegrain products)

Eat at least two servings per day (choose low or reduced fat options)	**Milk and milk products** (includes cheese, yoghurt and ice cream)	Protein Fats: higher proportion of saturated than poly- or mono-unsaturated fats especially in full fat products Vitamins: riboflavin, B_{12}, A Minerals: especially calcium, phosphorous, zinc and iodine
Eat at least one serving per day	**Lean meat, poultry, chicken, seafood, eggs, nuts and seeds and legumes**	Protein Fats: both visible and marbled in meat (mostly saturated fat, cholesterol); mostly unsaturated fats in seafood, nuts and seeds Carbohydrates: mainly legumes (dried peas and beans) Vitamins: B_{12}, niacin, thiamine Minerals: iron, zinc, magnesium, copper, potassium, phosphorous and selenium

Note. From *Food and Nutrition Guidelines for Healthy Adults: A Background Paper* (p. 5), by Ministry of Health, 2003, Wellington, New Zealand: Ministry of Health.

Appendix B: Survey Questionnaire

Massey University

Health, Diet, and Fruit & Vegetable Intake



A survey of men in New Zealand

School of Psychology
Te Kura Hinengaro Tangata
Massey University
Private Bag 102 904
North Shore Mail Centre, Auckland

«ID_Number»

Identification Number

How to complete this survey

Instructions:

- Please use a pen to complete this survey
- Clearly mark your answer with a tick
- Please print clearly when asked to write a response
- If you make a mistake, please put a cross over the mistake and put a tick in the box that best reflects your answer
- Below is an example of the kinds of questions in this survey

Example:	
In general, would you say your health is: (Please tick one box)	
Excellent	☐
Very Good	☐
For example, if you thought your health was good in general, you would tick this box — Good	☑
Fair	☐
Poor	☐

Please read the following carefully:

- All the information you give us is in confidence and will only be used for the purposes of this study
- There are no right or wrong answers; we would like the response that is best for you
- It is important that you give your own answers to each of the questions
- Do not take too much time to answer each question; usually your first response is best
- Completion and return of this survey implies consent to take part in this study

Thank you for taking the time to fill out this survey

You may now begin

If you have any questions please contact us either by Phone (0800) 100 309 or email Angela.Jury.3@uni.massey.ac.nz

Health, Diet, and
Fruit & Vegetable Intake

Health & Diet

Firstly, we would like to ask you some questions about your health and diet. For each of the following questions please tick the box that best describes your answer.

Q1 **In general, would you say your health is:**
(Please tick one box)

Excellent	☐
Very Good	☐
Good	☐
Fair	☐
Poor	☐

Q2 **The following items are health conditions that you may have. For each question please tick 'Yes' if a doctor, nurse or other health care worker has told you that you have this health condition. Otherwise please tick 'No'.**

(Please do not skip any questions)

		Yes ▼	No ▼
(a)	Asthma	☐	☐
(b)	Other respiratory diseases (e.g. bronchitis or emphysema)	☐	☐
(c)	Diabetes	☐	☐
(d)	High blood pressure or hypertension	☐	☐
(e)	Heart disease (e.g. heart attack or angina)	☐	☐
(f)	Stroke	☐	☐
(g)	Arthritis or rheumatism	☐	☐
(h)	Stomach ulcer or duodenal ulcer	☐	☐
(i)	Chronic liver trouble (e.g. cirrhosis)	☐	☐
(j)	Bowel disorders (e.g. irritable bowel, colitis or polyps)	☐	☐
(k)	Hernia or rupture	☐	☐
(l)	Chronic kidney or urinary tract conditions	☐	☐
(m)	Hepatitis	☐	☐
(n)	Chronic skin conditions (e.g. dermatitis or psoriasis)	☐	☐
(o)	Skin cancer	☐	☐
(p)	Other forms of cancer	☐	☐
(q)	Sight impairment (that cannot be corrected with glasses)	☐	☐
(r)	Hearing impairment	☐	☐
(s)	Epilepsy	☐	☐

Q3 Below are statements about medical conditions that you may get in the future. Please tick the box that shows how much you agree or disagree with each statement.

	(Please tick one box on each line)	Strongly disagree ▼	Disagree ▼	Neither agree or disagree ▼	Agree ▼	Strongly agree ▼
(a)	I know I'll have a high cholesterol level sometime in my life	☐	☐	☐	☐	☐
(b)	I would say that I'm a very likely candidate for high blood pressure	☐	☐	☐	☐	☐
(c)	I'll end up being overweight at some point in my life	☐	☐	☐	☐	☐
(d)	I am the type of person who will get diabetes	☐	☐	☐	☐	☐
(e)	I feel it is very likely that I will have a heart attack at some point in my life	☐	☐	☐	☐	☐
(f)	I believe I will get cancer sometime during my lifetime	☐	☐	☐	☐	☐

Q4 Below are statements about health and illness. Please tick the box that shows how much you agree or disagree with each statement.

	(Please tick one box on each line)	Strongly disagree ▼	Moderately disagree ▼	Mildly disagree ▼	Mildly agree ▼	Moderately agree ▼	Strongly agree ▼
(a)	If I get sick, it's my own behaviour which determines how soon I get well again	☐	☐	☐	☐	☐	☐
(b)	No matter what I do, if I am going to get sick, I will get sick	☐	☐	☐	☐	☐	☐
(c)	Having regular contact with my physician is the best way for me to avoid illness	☐	☐	☐	☐	☐	☐
(d)	Most things that affect my health happen to me by accident	☐	☐	☐	☐	☐	☐
(e)	Whenever I don't feel well, I should consult a medically trained professional	☐	☐	☐	☐	☐	☐
(f)	I am in control of my health	☐	☐	☐	☐	☐	☐
(g)	My family has a lot to do with my becoming sick or staying healthy	☐	☐	☐	☐	☐	☐
(h)	When I get sick, I am to blame	☐	☐	☐	☐	☐	☐
(i)	Luck plays a big part in determining how soon I will recover from an illness	☐	☐	☐	☐	☐	☐
(j)	Health professionals control my health	☐	☐	☐	☐	☐	☐

		Strongly disagree ▼	Moderately disagree ▼	Mildly disagree ▼	Mildly agree ▼	Moderately agree ▼	Strongly agree ▼
(k)	My good health is largely a matter of good fortune	☐	☐	☐	☐	☐	☐
(l)	The main thing which affects my health is what I myself do	☐	☐	☐	☐	☐	☐
(m)	If I take care of myself, I can avoid illness	☐	☐	☐	☐	☐	☐
(n)	Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me	☐	☐	☐	☐	☐	☐
(o)	No matter what I do, I'm likely to get sick	☐	☐	☐	☐	☐	☐
(p)	If it's meant to be, I will stay healthy	☐	☐	☐	☐	☐	☐
(q)	If I take the right actions, I can stay healthy	☐	☐	☐	☐	☐	☐
(r)	Regarding my health, I can only do what my doctor tells me to do	☐	☐	☐	☐	☐	☐

Q5 Below are statements about the type of person you think you are. Please tick the box that shows how much you agree or disagree with each statement.

(Please tick <u>one</u> box on each line)		Strongly disagree ▼	Disagree ▼	Neither agree or disagree ▼	Agree ▼	Strongly agree ▼
(a)	I think of myself as a healthy eater	☐	☐	☐	☐	☐
(b)	I think of myself as someone who is concerned with healthy eating	☐	☐	☐	☐	☐
(c)	I think of myself as someone who is concerned with the health consequences of what I eat	☐	☐	☐	☐	☐
(d)	I think of myself as someone who enjoys the pleasures of eating	☐	☐	☐	☐	☐

Q6 Please write your height below.

Q7 Please write your weight below.

Health, Diet, and
Fruit & Vegetable Intake

Fruit & Vegetables

The following questions are about how much fruit and vegetables you eat. Please answer each question below even if you do not normally eat a lot of fruit and vegetables.

Please note: In this section <u>one serving is approximately a handful</u> of (fresh, frozen, canned or stewed) fruit and vegetables. Specific examples of serving sizes are also given below.

Q8 How many servings of *<u>fruit</u>* do doctors recommend each day?

Examples of one serving
- 1 apple, pear, banana or orange
- 2 small apricots or plums
- ½ cup fresh fruit salad or stewed fruit (fresh, frozen or canned)

(Please tick <u>one</u> box)

1 or fewer	☐
At least 2	☐
At least 3	☐
At least 4	☐
5 or more	☐

Q9 How many servings of *<u>vegetables</u>* do doctors recommend each day?

Example of one serving
- 1 medium potato, kumara or similar sized root vegetable such as yam or taro
- ½ cup cooked vegetables such as puha, water cress, parengo or corn
- ½ cup salad or mixed vegetables
- 1 tomato

(Please tick <u>one</u> box)

1 or fewer	☐
At least 2	☐
At least 3	☐
At least 4	☐
5 or more	☐

Q10 **Do you consistently eat at least 5 servings of fruit and vegetables each day?**
(Please tick one box which is most appropriate for you)

NO, and I DO NOT intend to change this within the next 6 months	☐
NO, but I intend to change this within the next 6 months	☐
NO, but I intend to change within the next month	☐
YES, and I started doing this LESS than 6 months ago	☐
YES, and I have done so for MORE than 6 months	☐

Q11 **Below are questions about the types of fruit and vegetables you have eaten over the *last month*. Please indicate *how often* you ate each type of fruit and vegetable.**

	(Please tick one box on each line)	Rarely or never ▼	1-3 per month ▼	Once per week ▼	2-4 per week ▼	5-6 per week ▼	Once per day ▼	2 per day ▼	3 per day ▼	4+ per day ▼
(a)	How often do you drink fruit juice such as orange, apple or tomato?	☐	☐	☐	☐	☐	☐	☐	☐	☐
(b)	Not counting juice, how many servings of fruit (fresh, frozen, canned or stewed) do you eat? (1 serving = 1 medium piece or 2 small pieces of fruit or ½ cup stewed fruit)	☐	☐	☐	☐	☐	☐	☐	☐	☐
(c)	How often do you eat hot potato or kumara chips, french fries or wedges?	☐	☐	☐	☐	☐	☐	☐	☐	☐
(d)	How often do you eat potatoes (not counting chips, fries or wedges)?	☐	☐	☐	☐	☐	☐	☐	☐	☐
(e)	How often do you eat salad (including mixed green salad and other mixtures of raw vegetables)?	☐	☐	☐	☐	☐	☐	☐	☐	☐
(f)	How many servings of any other cooked vegetables do you usually eat (including vegetables in mixed dishes such as casseroles and stir-frys)? (1 serving = ½ cup cooked vegetables)	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q12 The following statements are about some of the benefits and barriers to eating fruit and vegetables.

Please indicate how important each statement would be to you if you were thinking about eating more fruit and vegetables.

	(Please tick one box on each line)	Not important ▼	Slightly important ▼	Moderately important ▼	Very important ▼	Extremely important ▼
(a)	Eating more fruit and vegetables would give me more vitamins and minerals	☐	☐	☐	☐	☐
(b)	I would feel good about looking after my health by eating more fruit and vegetables	☐	☐	☐	☐	☐
(c)	Eating more fruit and vegetables each day would help to keep me regular (avoid constipation)	☐	☐	☐	☐	☐
(d)	Fruit and vegetables would help to control my weight	☐	☐	☐	☐	☐
(e)	Eating more fruit and vegetables would help me look better	☐	☐	☐	☐	☐
(f)	I would feel good about eating more fruit as they are fresh	☐	☐	☐	☐	☐
(g)	Fruit and vegetables would help add variety to my meals	☐	☐	☐	☐	☐
(h)	My family would be pleased if I ate more fruit and vegetables	☐	☐	☐	☐	☐
(i)	I would be following the food and nutrition guidelines if I ate more fruit and vegetables	☐	☐	☐	☐	☐
(j)	Others would think I was fussy if I kept worrying about eating more fruit and vegetables	☐	☐	☐	☐	☐
(k)	Meal planning would be difficult for my family if I asked for more vegetable dishes	☐	☐	☐	☐	☐
(l)	Preparing and cooking vegetables would be time consuming	☐	☐	☐	☐	☐
(m)	Eating more fruit would be expensive	☐	☐	☐	☐	☐
(n)	I would worry about pesticides if I ate more fruit and vegetables	☐	☐	☐	☐	☐
(o)	I would feel I was overeating if I ate more fruit	☐	☐	☐	☐	☐
(p)	I would have to give up other foods to eat more fruit and vegetables	☐	☐	☐	☐	☐
(q)	It would be difficult for me to find fruit and vegetables that I liked	☐	☐	☐	☐	☐
(r)	I would get a bad reaction (e.g. cough, wind, cramps etc) if I ate more of certain fruits and vegetables	☐	☐	☐	☐	☐

Q13 How confident are you that you would be able to have fruit and vegetables in each of the following situations?

	(Please tick one box on each line)	Not at all confident ▼	Mildly confident ▼	Moderately confident ▼	Very confident ▼	Totally confident ▼
(a)	On most days I can have fruit as part of my lunch	☐	☐	☐	☐	☐
(b)	I can have fruit or vegetables even after a long day when I'm feeling tired	☐	☐	☐	☐	☐
(c)	I can eat other fruit and vegetables when my favourite ones are unavailable	☐	☐	☐	☐	☐
(d)	I can eat fruit or vegetables even on days when I'm in a rush	☐	☐	☐	☐	☐
(e)	I can order at least one vegetable dish when I'm eating out	☐	☐	☐	☐	☐
(f)	I can have fruit even when the only type available needs to be peeled and cut	☐	☐	☐	☐	☐
(g)	I can have fruit after a fast food meal	☐	☐	☐	☐	☐
(h)	When I'm preparing a meal for myself I can include some vegetables	☐	☐	☐	☐	☐
(i)	On most days I can have a small plate of vegetables for dinner	☐	☐	☐	☐	☐

Q14 Below are statements about the degree of control you have over the amount of fruit and vegetables you eat. Please indicate how much you agree or disagree with each statement?

	(Please tick one box on each line)	Strongly disagree ▼	Moderately disagree ▼	Mildly disagree ▼	Mildly agree ▼	Moderately agree ▼	Strongly agree ▼
(a)	I am in control of the amount of fruit and vegetables I eat	☐	☐	☐	☐	☐	☐
(b)	When I don't eat enough fruit and vegetables, I am to blame	☐	☐	☐	☐	☐	☐
(c)	No matter what I intend to do, other people usually determine the amount of fruit and vegetables I eat	☐	☐	☐	☐	☐	☐
(d)	There is not much I can do about the amount of fruit and vegetables I eat	☐	☐	☐	☐	☐	☐
(e)	Whether or not I eat fruit and vegetables each day is up to other people	☐	☐	☐	☐	☐	☐
(f)	Other people usually decide how much fruit and vegetables I eat each day	☐	☐	☐	☐	☐	☐

Q15 Below are statements about the behaviour and thoughts of other people. Please indicate how much you agree or disagree with each statement?

	(Please tick one box on each line)	Strongly disagree ▼	Moderately disagree ▼	Mildly disagree ▼	Neither agree or disagree ▼	Mildly agree ▼	Moderately agree ▼	Strongly agree ▼
(a)	People who are important to me think I should eat 5 or more servings of fruit and vegetables every day	☐	☐	☐	☐	☐	☐	☐
(b)	I feel under social pressure to eat 5 or more servings of fruit and vegetables every day	☐	☐	☐	☐	☐	☐	☐
(c)	Most of my family eat 5 or more servings of fruit and vegetables each day	☐	☐	☐	☐	☐	☐	☐
(d)	Most of my friends eat 5 or more servings of fruit and vegetables each day	☐	☐	☐	☐	☐	☐	☐
(e)	Most people who are important to me eat 5 or more servings of fruit and vegetables every day	☐	☐	☐	☐	☐	☐	☐

Q16 How likely is it that other people who are important to you expect you to eat 5 or more servings of fruit and vegetables every day?
(Please tick one box)

Extremely unlikely	☐
Moderately unlikely	☐
Mildly unlikely	☐
Neither likely or unlikely	☐
Mildly likely	☐
Moderately likely	☐
Extremely likely	☐

Q17 How true is it that most people who are important to you eat 5 or more servings of fruit and vegetables each day?
(Please tick one box)

Not at all true	☐
Moderately untrue	☐
Mildly untrue	☐
Neither true or false	☐
Mildly true	☐
Moderately true	☐
Completely true	☐

Q18 **How likely is it that other people like you would eat 5 or more servings of fruit and vegetables each day?**
(Please tick one box)

Extremely unlikely	☐
Moderately unlikely	☐
Mildly unlikely	☐
Neither unlikely or likely	☐
Mildly likely	☐
Moderately likely	☐
Extremely likely	☐

Q19 **Please indicate the extent to which you agree with the following statement. "I intend to eat 5 or more servings of fruit and vegetables each day in the future".**
(Please tick one box)

Strongly disagree	☐
Moderately disagree	☐
Mildly disagree	☐
Neither agree or disagree	☐
Mildly agree	☐
Moderately agree	☐
Strongly agree	☐

Q20 **Below are statements about whether you feel you always have sufficient resources to have the food you need for yourself, and the people you live with. We are not concerned with your budget or how you spend your money.**

In all questions 'we' refers to the household, unless it is a one-person household.

	(Please tick one box on each line)	Never ▼	Seldom ▼	Once in a while ▼	Occasion-ally ▼	Often ▼	Most of the time ▼	All of the time ▼
(a)	We can afford to eat properly	☐	☐	☐	☐	☐	☐	☐
(b)	Food runs out in our household due to a lack of money	☐	☐	☐	☐	☐	☐	☐
(c)	We eat less because of a lack of money	☐	☐	☐	☐	☐	☐	☐
(d)	The variety of foods we are able to eat is limited by a lack of money	☐	☐	☐	☐	☐	☐	☐
(e)	We rely on others to provide food and/or money for food for our household	☐	☐	☐	☐	☐	☐	☐
(f)	We make use of special food grants or food banks when we do not have enough money for food	☐	☐	☐	☐	☐	☐	☐
(g)	I feel stressed because of not having enough money for food	☐	☐	☐	☐	☐	☐	☐
(h)	I feel stressed because I can't provide the food I want for social occasions	☐	☐	☐	☐	☐	☐	☐

Health, Diet, and
Fruit & Vegetable Intake

Background Information

Lastly, we would like to ask you for some general background information. Please tick the box which you believe gives an accurate indication of your <u>current</u> situation, or write details in the space provided.

Q21 In what year were you born?

	1	9		

Q22 Which ethnic group do you belong to?
(please tick the box or boxes which apply to you)

New Zealand European	☐
Māori	☐
Samoan	☐
Cook Island Maori	☐
Tongan	☐
Niuean	☐
Chinese	☐
Indian	☐
Other (such as Dutch, Japanese, Tokelauan). Please state below: _____	☐

Q23 What is your *<u>highest secondary school</u>* qualification?
(Please tick <u>one</u> box)

No school qualifications	☐
NZ School Certificate in one or more subjects *or* National Certificate level 1 *or* NCEA level 1	☐
NZ Sixth Form Certificate in one or more subjects *or* National Certificate level 2 *or* NZ UE before 1986 in one or more subjects *or* NZCEA level 2	☐
NZ Higher School Certificate *or* Higher Leaving Certificate *or* NZ University Bursary/Scholarship *or* National Certificate level 3 *or* NZCEA level 3 *or* NZ Scholarship level 4	☐
Other secondary school qualification **gained in NZ** (Please print the qualification below): _____	☐
Other secondary school qualification **gained overseas**	☐

Q24 Apart from secondary school qualifications, have you completed any other qualifications?

(Please don't count qualifications that take less than 3 months of full-time study to get)

No	☐
Yes (Please print your highest qualification below) _____	☐

Q25 From all sources of income, what was the total income that you yourself received before tax in the last 12 months?

Please tick one box)

Loss/Zero	☐
$1 – $20,000	☐
$20,001 – $30,000	☐
$30,001 – $40,000	☐
$40,001 – $50,000	☐
$50,001 – $70,000	☐
$70,001 – $100,000	☐
$100,001 or more	☐

Thank you for taking the time to complete this survey

If you would like to receive a summary of the research results once they have been completed, please include your name and address below. As it takes some time to analyse research results however, it may be several months after you complete this questionnaire before you receive a copy.

Please note, your name and address will be detached from your questionnaire once it is returned to ensure your responses are kept completely confidential.

Name _____

Address _____

_____

_____

Email Address _____

Before you place your questionnaire in the return FREEPOST envelope provided, please:

- ▶ Check you have not skipped any pages
- ▶ Double check you have entered ALL the information that you intended to

Appendix C: Information for Survey Participants

Attached is a copy of the pre-letter sent to participants advising them that they had been randomly selected to take part in the study, information sheet sent with the survey questionnaire, and thank you/reminder postcard.

School of Psychology

Te Kura Hinengaro Tangata
Massey University
Private Bag 102 904
North Shore Mail Centre, Auckland

31 August 2006

«Mailing_Name»
«Mailing_address_1»
«Mailing_address_2»
«Mailing_address_3» «Post_Code»
«Mailing_address_4»

Dear «Salutation»

A few days from now you will receive an invitation in the mail to fill out a brief questionnaire for an important study we are conducting in the School of Psychology at Massey University.

You have been **randomly chosen** from the New Zealand electoral roll, as one of **1,200** people to take part in this study. The New Zealand electoral roll is a publicly available database which many health researchers use to select people to participate in their studies.

Health is an important issue for all New Zealanders and it has been shown that what we eat can have an impact on our health. The consumption of fruit and vegetables has been identified as one important aspect of what we eat. The purpose of this research is to develop a better understanding of the factors that influence fruit and vegetable intake among New Zealand men.

We are writing to you in advance because we have found that many people like to know ahead of time that they will be contacted. Additional information about the study will be sent to you along with a copy of the questionnaire. However, should you require any further information in the meantime, please do not hesitate to contact us by email at **Angela.Jury.3@uni.massey.ac.nz** or phone **(0800) 100 309**.

Thank you for your time and considering our request.

Yours sincerely

Angela Jury
Doctoral Researcher

School of Psychology
Te Kura Hinengaro Tangata
Massey University
Private Bag 102 904
North Shore Mail Centre, Auckland

MASSEY UNIVERSITY STUDY ON

Health, Diet, and Fruit & Vegetable Intake

Dear «Mailing_Name»

We would like to invite you to take part in a study about health, diet, and fruit and vegetable intake. The purpose of this research is to develop a better understanding of the factors that influence fruit and vegetable intake among New Zealand men. You may take part in this study even if you believe you don't eat a healthy diet or a lot of fruit and vegetables.

How was I chosen to take part in the study?
You have been **randomly chosen**, from the New Zealand electoral roll, as one of **1,200** people to take part in this study. The New Zealand electoral roll is a publicly available database which many health researchers use to select people to participate in their studies.

Who is doing the study?
My name is Angela Jury and this study is being conducted as part of my doctoral research in psychology, which is being supervised by Dr Ross Flett in the School of Psychology at Massey University in Palmerston North, and Dr Paul Hirini from Deakin University in Melbourne, Australia.

What am I being asked to do?
If you would like to participate in this study please complete the enclosed questionnaire and return it in the freepost envelope provided. It should take about 15-20 minutes to complete. Completion and return of the questionnaire will be taken as your consent to take part in the study. However, as someone who has been invited to participate in this study, you are under no obligation to accept our invitation.

What are my rights as a participant in this study?
If you decide to participate, you have the right to decline to answer any particular question; withdraw from the study at anytime; ask any questions about the study at anytime during participation; provide information on the understanding that your name will not be used unless you give permission to the researcher; and be given access to a summary of the project findings when it is concluded.

What can I expect of the researchers?
If you choose to take part in this study, all information you provide will be kept completely confidential, and will only be used for the purposes of this study. All information obtained will be stored securely for 5 years and then destroyed. Also, it will not be possible to identify any individual from the results reported in this study. If you would like to receive a summary of the research results once they have been completed, please write your name and address on the slip provided on the inside back page of the questionnaire. On return of your questionnaire, this slip will be separated to ensure your responses are kept completely confidential.

For your information, a number has been printed on the questionnaire to allow us to delete your name once your questionnaire has been returned and to ensure we don't send you a reminder. If you do not wish to participate in this study or receive a reminder, simply return your questionnaire uncompleted and we will delete your name from the list.

How can you contact us?
If you would like any further information about this study please do not hesitate to contact us by email at **Angela.Jury.3@uni.massey.ac.nz** or phone **(0800) 100 309**. Thank you for your time and considering our request.

Yours sincerely
Angela Jury
Doctoral Researcher

Massey University

School of Psychology
Te Kura Hinengaro Tangata
Massey University
Private Bag 102 904
North Shore Mail Centre, Auckland

Dear «Salutation»

We recently posted a questionnaire to you, which is part of an important study to develop a better understanding of factors that influence fruit and vegetable intake among men in New Zealand.

If you have returned your questionnaire please accept our sincere thanks. If not, we would like you to know we are still keen to receive your reply.

If you did not receive a copy of the questionnaire, or if it has been misplaced, please phone **(0800) 100 309** or email **Angela.Jury.3@uni.massey.ac.nz** and we will post another copy to you today.

Yours sincerely
Angela Jury
Doctoral Researcher

Appendix D: Scree Plot of Eigenvalues

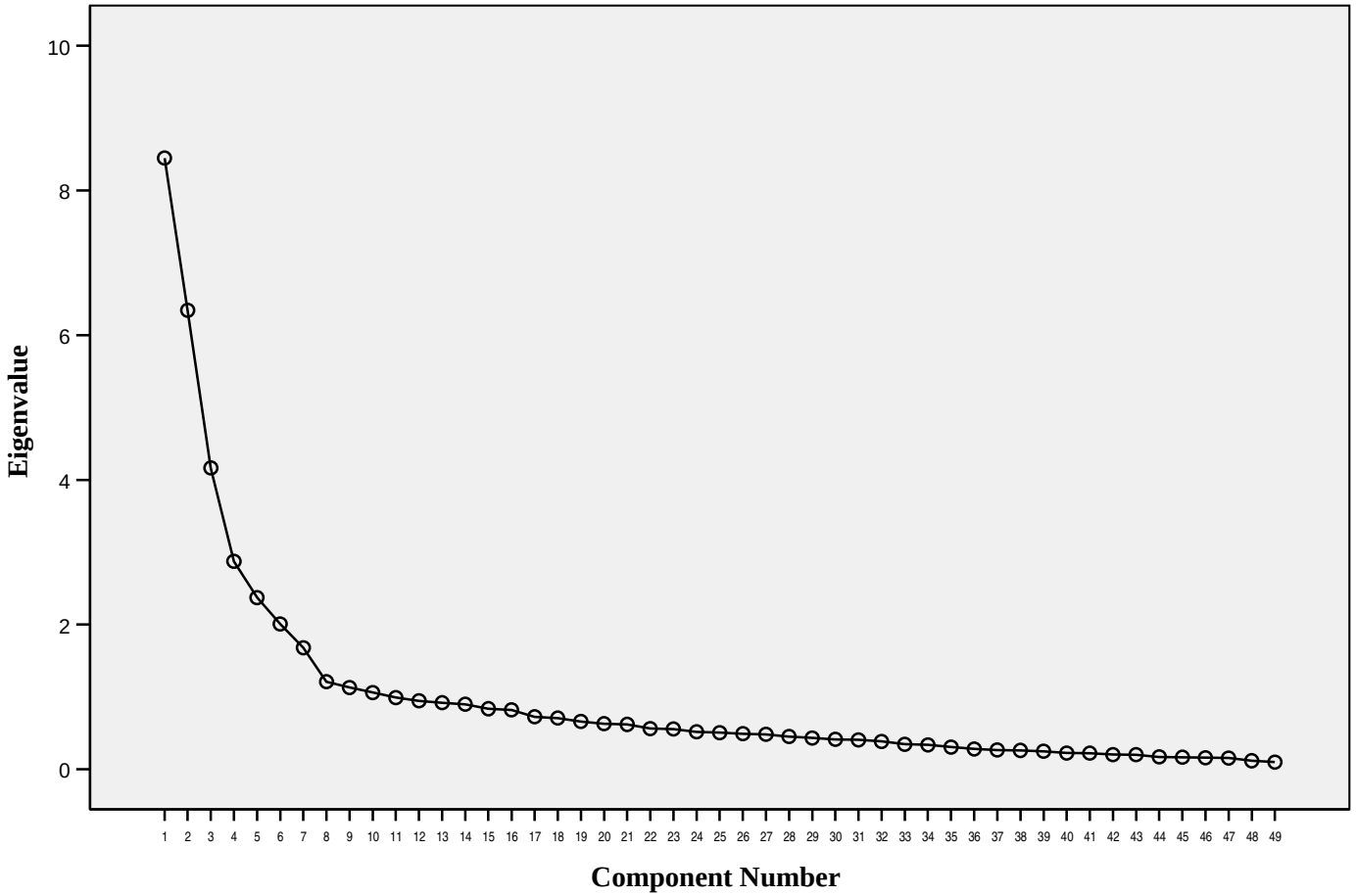

Figure D.1. Scree plot of eigenvalues for first split half sample, *n* = 230**.**

Appendix E: Principal Components Solutions for Split Half Samples

The component loadings, communalities, and percentage of variance accounted for by each component following varimax rotation for split half samples 1 and 2 are presented in Tables E.1 and E.2 respectively.

Table E.1. *Split Half Sample 1: Component Loadings, Communalities (h^2), and Percentage of Variance for Principal Components Extraction and Varimax Rotation, n = 230*

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel good about looking after my health	0.80							0.70
Feel good as F&Vs are fresh	0.79							0.68
Keep me regular (avoid constipation)	0.80							0.66
Help control weight	0.77							0.63
Add variety to meals	0.79							0.66
Help me look better	0.72							0.63
Following food and nutrition guidelines	0.74							0.62
Give me vitamins and minerals	0.72							0.54
Family would be pleased	0.71							0.60
Can eat when in a rush		0.82						0.72
Can have when feeling tired		0.82						0.72
Can eat when favourite ones are unavailable		0.77						0.65
Can order when eating out		0.71						0.54
Can have when needs to be peeled and cut		0.72						0.58
Can have fruit for lunch		0.76						0.64
Can have after fast food meal		0.60						0.40
Can include when preparing meal for myself		0.61						0.52
Can have small plate of vegetables for dinner		0.54						0.45
Most people important to me eat 5+ a day (agree)			0.86					0.77
Most of my family eat 5+ a day (agree)			0.82					0.71
People important to me eat 5+ a day (true)			0.76					0.62
People important to me expect me to eat 5+ a day (likely)			0.75					0.61
Most of my friends eat 5+ a day (agree)			0.76					0.62
People important to me think I should eat 5+ a day (agree)			0.75					0.59
Other people like me eat 5+ a day (likely)			0.59					0.46

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel I was overeating if I ate more				0.77				0.60
Time consuming				0.70				0.58
Give up other foods				0.64				0.46
Difficult to find F&Vs I like				0.54				0.38
Bad reaction				0.55				0.37
Meal planning would be difficult				0.59				0.52
Eating more would be expensive				0.57				0.44
Others would think I was fussy				0.50				0.41
Worry about pesticides				0.49				0.34
Other people decide how much F&Vs I eat					0.78			0.69
Whether or not I eat F&Vs each day is up to other people					0.77			0.69
Other people determine the amount of F&Vs I eat					0.75			0.61
Not much I can do about the amount of F&Vs I eat					0.67			0.54
When I don't eat enough F&Vs, I am to blame					0.62			0.42
I am in control of the amount of F&Vs I eat					0.53			0.54
Likely I'll have a heart attack						0.70		0.52
Candidate for high blood pressure						0.68		0.51
High cholesterol level sometime in my life						0.72		0.58
Overweight some point in my life						0.61		0.47
Type of person who will get diabetes						0.66		0.51
I believe I will get cancer						0.59		0.38
Concerned with healthy eating							0.79	0.73
Concerned with health consequences of what I eat							0.75	0.66
I think of myself as a healthy eater							0.69	0.66
Percentage of variance	11.53	11.00	9.01	7.40	6.83	5.99	5.16	

Table E.2. *Split Half Sample 2: Component Loadings, Communalities (h^2), and Percentage of Variance for Principal Components Extraction and Varimax Rotation, n = 228*

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel good about looking after my health	0.83							0.74
Feel good as F&Vs are fresh	0.81							0.70
Keep me regular (avoid constipation)	0.78							0.65
Help control weight	0.77							0.67
Add variety to meals	0.76							0.64
Help me look better	0.76							0.62
Following food and nutrition guidelines	0.73							0.60
Give me vitamins and minerals	0.75							0.60
Family would be pleased	0.62							0.56
Can eat when in a rush		0.84						0.71
Can have when feeling tired		0.79						0.65
Can eat when favourite ones are unavailable		0.81						0.69
Can order when eating out		0.68						0.50
Can have when needs to be peeled and cut		0.71						0.58
Can have fruit for lunch		0.65						0.49
Can have after fast food meal		0.67						0.48
Can include when preparing meal for myself		0.64						0.48
Can have small plate of vegetables for dinner		0.59						0.53
Most people important to me eat 5+ a day (agree)			0.88					0.79
Most of my family eat 5+ a day (agree)			0.86					0.78
People important to me eat 5+ a day (true)			0.83					0.70
People important to me expect me to eat 5+ a day (likely)			0.80					0.68
Most of my friends eat 5+ a day (agree)			0.77					0.63
People important to me think I should eat 5+ a day (agree)			0.76					0.61
Other people like me eat 5+ a day (likely)			0.59					0.44

	Component							
	1	2	3	4	5	6	7	h^2 after rotation
Feel I was overeating if I ate more				0.69				0.52
Time consuming				0.65				0.52
Give up other foods				0.65				0.49
Difficult to find F&Vs I like				0.57				0.37
Bad reaction				0.54				0.36
Meal planning would be difficult				0.59				0.45
Eating more would be expensive				0.57				0.41
Others would think I was fussy				0.54				0.40
Worry about pesticides				0.46				0.33
Other people decide how much F&Vs I eat					0.81			0.71
Whether or not I eat F&Vs each day is up to other people					0.84			0.73
Other people determine the amount of F&Vs I eat					0.76			0.61
Not much I can do about the amount of F&Vs I eat					0.69			0.60
When I don't eat enough F&Vs, I am to blame					0.50			0.39
I am in control of the amount of F&Vs I eat		-0.42			0.47			0.48
Likely I'll have a heart attack						0.77		0.60
Candidate for high blood pressure						0.68		0.53
High cholesterol level sometime in my life						0.73		0.58
Overweight some point in my life						0.67		0.50
Type of person who will get diabetes						0.66		0.46
I believe I will get cancer						0.56		0.37
Concerned with healthy eating							0.73	0.70
Concerned with health consequences of what I eat							0.75	0.68
I think of myself as a healthy eater		0.44					0.49	0.56
Percentage of variance	11.49	11.23	9.47	7.16	6.68	6.37	4.44	

Appendix F: Parallel Analysis & Scree Plot for the Full Sample

Presented in Table F.1 are the results of the parallel analysis performed on the full sample. The scree plot of eigenvalues for the full sample is illustrated in Figure F.1.

Table F.1. *Comparison of the Eigenvalues obtained from the Principal Components Analysis and Parallel Analysis in the Full Sample, N = 458*

Component number	Actual eigenvalue from PCA	Criterion value from parallel analysis	Decision
1	8.013	1.698	Accept
2	6.341	1.626	Accept
3	4.011	1.574	Accept
4	2.745	1.530	Accept
5	2.640	1.491	Accept
6	2.110	1.450	Accept
7	1.654	1.416	Accept
8	1.165	1.382	Reject

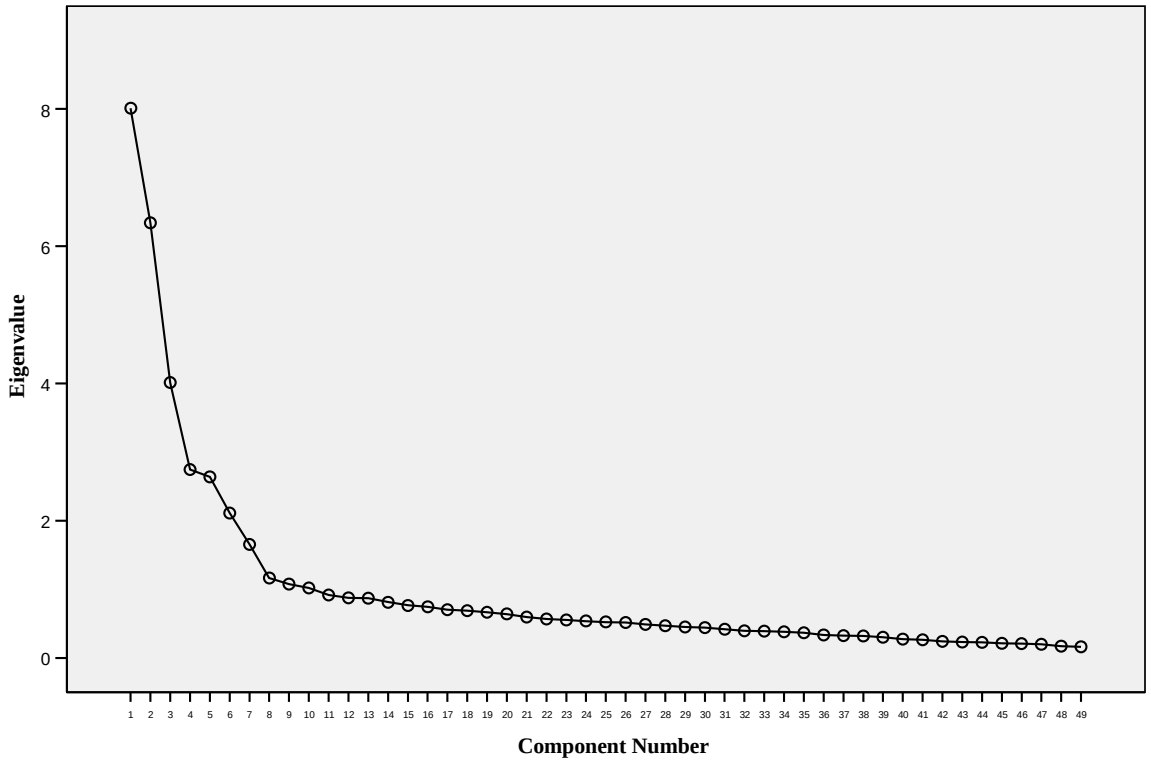

Figure F.1. Scree plot of eigenvalues for full sample, N = 458.

Appendix G: Decisional Balance

Post hoc analyses were performed to examine the pattern of mean scores on decisional balance across the stages of change for F&V intake. Decisional balance was calculated by subtracting cons *T* scores from pros *T* scores. The results of ANOVA using Games Howell post hoc tests indicated there was a statistically significant difference across the stages of change, $F(3, 503) = 11.60$, $p<.001$ ($W = 11.98$, $p<.001$). As illustrated in Figure G.1, those in the action/maintenance stage had the highest decisional balance on average ($M = 2.69$, $SD = 11.59$), which was significantly higher than the precontemplation ($M = -3.85$, $SD = 11.02$) and contemplation ($M = -2.93$, $SD = 12.92$) stages. The decisional balance of those in the preparation stage ($M = 1.09$, $SD = 13.09$) did not significantly differ from the other stages of change. In total, 6.5% of the variance in decisional balance was explained by the stages of change.

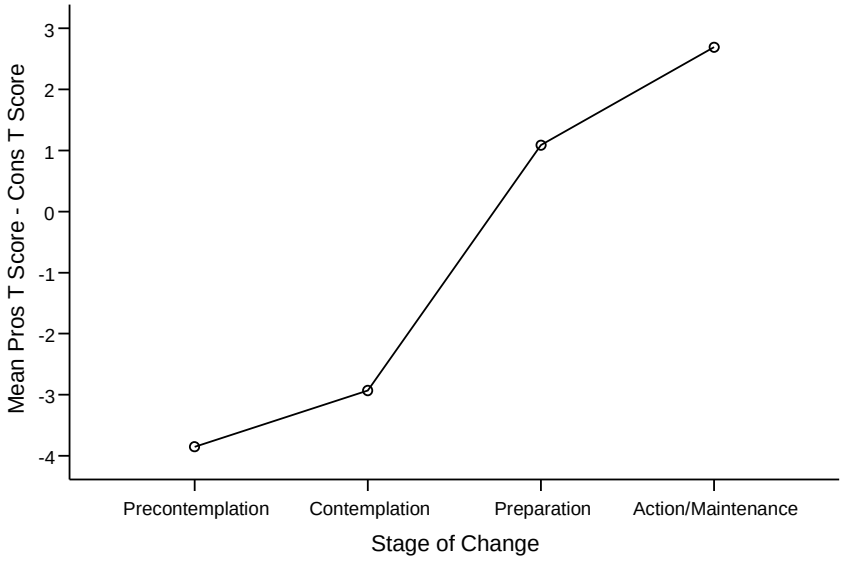

Figure G.1. Decisional balance across the stages of change.

The results of the trend analysis using orthogonal polynomial contrasts indicated the relationship between decisional balance and the stages of change was best explained by the linear component of trend (5.6% $F(1, 503) = 30.15$, $p<.001$).

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