IUL School of Social Sciences
Department of Social and Organizational Psychology

# To whom do we communicate? Stage tailoring and framing of health messages in the promotion of fruit and vegetable intake

Cristina Isabel Albuquerque Godinho

Thesis submitted in partial fulfillment of the requirements for the degree of
Doctor in Psychology
Specialty in Clinical and Health Psychology

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April, 2014

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À memória da minha madrinha.

Ao Filipe, meu tudo.

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*The quality of health is heavily influenced by lifestyle habits. (...) By managing their health habits, people can live longer and healthier and retard the process of aging. Self-management is good medicine. If the huge health benefits of these few habits were put into a pill, it would be declared a scientific milestone in the field of medicine.*

- Albert Bandura -

*Let food be thy medicine and medicine be thy food.*

- Hippocrates –

**Resumo**

As campanhas de saúde são amplamente utilizadas para persuadir as pessoas a adoptarem estilos de vida saudáveis, incluindo o consumo de frutas e vegetais. O principal objectivo desta tese foi identificar os mecanismos pelos quais preditores sócio-cognitivos afectam o consumo de frutas e vegetais, utilizando esse conhecimento, e teoria, para o desenvolvimento de mensagens de saúde, avaliando a sua eficácia na promoção deste comportamento. Realizaram-se quatro estudos, descritos em cinco capítulos. As hipóteses formuladas sustentam-se no modelo Health Action Process Approach (Schwarzer, 2008) e na literatura sobre enquadramento de mensagens. Nos estudos descritos nos capítulos 2 e 3 verificou-se a utilidade teórica do modelo para este comportamento e selecionaram-se as crenças mais relevantes para cada constructo, a fim de desenvolver mensagens dirigidas a pessoas em diferentes estádios de mudança. No capítulo 4, demonstrou-se a superioridade de mensagens adequadas ao estádio na promoção da auto-eficácia entre pessoas num estádio não-intencional e intencional, e da intenção e progressão de estádio entre não-intencionais, sustentando a validade dos estádios. Os estudos apresentados nos capítulos 5 e 6, demonstraram o valor da adequação entre o enquadramento da mensagem e a orientação motivacional e as intenções dos destinatários, o qual mostrou variar consoante a qualidade percebida da mensagem. Os contributos aplicados apoiam o uso de teorias psicológicas no desenvolvimento de mensagens de saúde e a adaptação do seu conteúdo e enquadramento de acordo com o estádio de mudança e/ou orientação motivacional da audiência, para maior eficácia na promoção de mudanças nos comportamentos de saúde.

**Palavras-chave:** mensagens de saúde, adaptação ao estádio, enquadramento da mensagem, consumo de frutas e vegetais.

**PsycINFO Codes:**
2750 Mass Media Communications
3360 Health Psychology & Medicine
3365 Promotion & Maintenance of Health &Wellness

**Abstract**

Health communication campaigns are ubiquitous in the endeavor of persuading people to adopt healthier lifestyles, including fruit and vegetable intake. The central aim of this dissertation was to identify relevant mechanisms by which key psychological antecedents affect fruit and vegetable intake, using this knowledge and theory to inform the design of health messages, and evaluating their effectiveness in promoting this health behavior. We conducted four studies, which are described in five chapters. The theoretical underpinning of our hypotheses was based on the Health Action Process Approach (Schwarzer, 2008), and on the literature on health message framing. The studies described on chapters 2 and 3 allowed to verify the theoretical model utility in predicting fruit and vegetable intake, and to select relevant beliefs under the theoretical constructs for the development of health messages targeted at people in different stages of change. The study described on chapter 4 demonstrated the superiority of staged-matched health messages for instilling self-efficacy among non-intenders and intenders, and intention and stage progression for non-intenders, supporting the validity of stage assumptions. The two other studies, presented in chapters 5 and 6 demonstrated the value of matching the frame to the recipients´ motivational orientation and baseline intentions, which was shown to vary according to the perceived message quality. The applied contributions support the use of psychological theories for the development of health messages, and matching their content and frame to the recipient stage and/or motivational orientation for increased effectiveness in promoting health behavior change.

**Keywords:** health messages, message tailoring, message framing, fruit and vegetable intake

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# 1

# INTRODUCTION

## Introduction

Nowadays, the existence of a link between dietary choices and health is unquestionable and the relevance of eating habits for the maintenance of good health is undeniable. Among other dietary aspects, the importance of a sufficient fruit and vegetable intake has been stressed on the basis of its preventive role regarding the major causes of death in developed countries (WHO, 2009), and its benefits for health and wellbeing (Hakkarainen et al., 2004; Sanchez et al., 2012). Clear recommendations for fruit and vegetable intake have been established (Lock, Pomerleau, Causer, & McKee, 2004), however data from different countries around the world converge in showing that only a small percentage of the population attain such intake levels (Hall, Moore, Harper, & Lynch, 2009).

Health campaigns are a widespread means for trying to persuade people to change their dietary habits, such as fruit and vegetable intake (Pomerleau, Lock, Knai, & McKee, 2005). They have the advantage of reaching a higher number of people at a relatively low cost per head (Wakefield, Loken, & Hornik, 2010). However, not all campaigns successfully attain their goals, arguably because some health messages are developed in the absence of a clear theoretical grounding or empirical evidence supporting content selection and framing.

The present dissertation will focus on two communication strategies that have been studied as a means of enhancing health messages´ effectiveness: tailoring / targeting and framing. We defend that psychological theories on health behavior change may help to refine such strategies and, thus, provide information on the development of effective health messages, thus contributing to increasing the odds of reaching the ultimate goal of such campaigns: successfully changing health behaviors, such as fruit and vegetable intake. Our main tenet is that different people have different needs in terms of information and skills, as well as different preferences towards the way in which such information is framed. These differences may arise from the specific barriers and challenges people face at a certain stage of their change process or from individual differences in dispositional characteristics. In each case, the central idea is that when health messages are adapted in a way that fit these situational or dispositional individual differences, they should lead to increased success in health behavior change processes.

This dissertation is organized in seven chapters. The present chapter presents the general background, an overview of different aspects related to fruit and vegetable intake, and the theoretical framework supporting our research questions. The following five chapters (Chapters

2, 3, 4, 5 and 6) are empirical chapters, based on published or submitted articles. Following the empirical chapters, Chapter 7 provides a summary and integrated discussion of the main findings, as well as their main contributions on both theoretical and applied levels, while drawing conclusions with regard to their implications and raising questions that have yet to be addressed.

In the following introduction, we will begin by outlining the general background of this research. In the first section, the myriad of influences over eating behaviors will be reviewed, stressing the importance of psychological factors for understanding food choices and as potential intervention targets. The need for intervention in this domain will then be reinforced by shedding light upon the link between food choices and health and its implications, such as premature death, quality of life and public spending, as well as other benefits that are relevant from a primary prevention perspective. Finally, the advantages of using health campaigns as a means to fostering changes in health behaviors, including the improvement of dietary habits will be presented, as well as evidence pertaining to campaign effects and effectiveness evaluations.

The second section will focus on presenting the health behavior of interest in the studies presented in this dissertation: fruit and vegetable intake. It begins with a definition of what "fruit and vegetables" actually are, and by reviewing the recommendations regarding their intake. Specific health benefits associated with fruit and vegetable intake are then presented, as well as available data on fruit and vegetable consumption in different countries, including Portugal, with a view to demonstrating the need for its promotion. Social-demographic, contextual and psychological factors accounting for differences in levels of consumption are then briefly reviewed, with special emphasis on the psychosocial factors, given that they are the primary targets of health communications that set out to directly influence behavior. Finally, a classification of different strategies to promote changes in fruit and vegetable intake is provided, situating health communication interventions within the broader set of possibilities.

In the third section, the theoretical underpinnings of our thesis will be presented. A brief historical overview of persuasion and attitude change models is provided, followed by a presentation of the most prominent social cognitive health behavior change models. A detailed description of the theoretical framework underlying the present research program, the Health Action Process Approach (Schwarzer, 2008a) is then given, and is followed by a review of the most relevant literature on the two communication strategies being addressed: message tailoring / targeting and message framing. Finally, the fourth section provides an outline of the

empirical chapters, describing the aims of the different studies, and how they seek to contribute to the current state of the literature on the motivational and volitional mechanisms involved in fruit and vegetable intake, on stage models of health behavior change and their implications for tailoring / targeting and on health message framing.

## 1. General background: From nutrition to health

### 1.1. Why do we eat what we eat?

Despite its apparent simplicity, the answer to the question of why we eat what we eat is rather complex, not only because of the number of factors involved, whether food or individual-related, but also due to the multiple contexts where eating takes place, which are embedded in a specific time and cultural matrix. Eating is a survival need, as well as being a source of pleasure, and throughout our lives, it evolves to become a source of meaning and a way of expressing our identity.

Food choices have, to some extent, a sensory and physiological basis. For example, the "natural" preference for sweet tastes, even in newborns, is well documented, as are the expulsion reactions that follow the exposure to bitter and sour tastes (Steiner, 1977). Moreover, sensory-specific satiety is a physiological mechanism that operates in the short-term regulation of intake, so that the greater the sensory and nutritional diversity of foods, the higher the overall intake (Rolls & Hetherington, 1989). Both the preference for sweet tastes and aversion towards the bitter or sour, plus the use of the sensorial aspects of food as a cue for variety make sense from an evolutionary point of view. As omnivores, human beings have the advantage of being able to live in almost every part of the Earth´s surface. However, without a clear genetic predisposition to stick to a specific kind of food, the likelihood of ingesting toxic foods or a nutritionally unbalanced diet is increased (Rozin, 1996). Thus, sensorial aspects of food are used as a vehicle for food selection, with sweet signaling energy-dense foods and bitter or sour tasting food pointing to a potentially inedible or toxic substance (Conner & Armitage, 2002). Furthermore, they act as a cue for variety, ensuring intake of the different necessary nutrients (Rolls & Hetherington, 1989).

Despite the existence of innate predispositions, different studies have confirmed that preferences are shaped, to a large extent, through experience and learning processes (Beauchamp & Moran, 1984; Bertino et al., 1982). This is how one may understand that some

food and beverages, despite having a sour or bitter taste, such as beer, may, nonetheless, be greatly appreciated in certain cultures. The life of each child begins with only one type of food, milk, but the variety of foods expands greatly even in the very early years. During this process, the mere exposure to foods (Birch & Marlin, 1982), the associative learning between the eating of certain foods and their social, emotional and even physical consequences (Birch, Zimmerman, & Hind, 1980; Rozin & Vollmecke, 1986) and the social learning experiences with the family (Pearson et al., 2009), peers (Birch, 1980) and through the media (Halford et al., 2004) are important socialization and learning experience vehicles that influence food choices and the development of dietary habits.

Whether preferences are innate or learned through experience, the liking for certain foods and dislike for others is an important choice determinant (Shepherd & Farleigh, 1989). Eating is a pleasurable experience and people do not eat just to satisfy their nutritional needs. However, there is no direct correspondence between liking and food choice, and sensation is not the sole factor involved in the choice of food (Armitage & Conner, 2002). Moreover, the physiological aspects related to food choice are often mediated by cognitive processes, as individuals establish associations between specific sensory characteristics of foods and their post-ingestive or post-absorptive effects, and learn to regulate them through their dietary choices (Booth, 1985).

Cultural traditions are also important in determining what we eat (Katz, 1989). It has been argued that, from the production of food to its preparation and ingestion, eating should be regarded as a predominantly cultural act (Montanari, 2004). Unlike other species, humans do not only eat what nature offers. Through agriculture and livestock, man actually produces what is eaten. Moreover, most of what is eaten is first transformed by the use of fire and other technologies that constitute what may be called a "cuisine", a cultural body of knowledge related to food selection and preparation that is handed down from generation to generation (Katz, 1989).

Throughout history, food has served as an element to express self-identity and to establish differences among social classes. Food choices have played a role in affirming social status, through how much is eaten and what is being eaten (Montanari, 2004). Standards of value have changed over time, especially since food industrialization, which has democratized access to food, both in terms of quantity and diversity. Standards of value may also change from one society to another, however all cultures differentiate between high and low status foods (Gelfand, 1971). There is little doubt that eating is a communicative act (Conner & Armitage,

2002); we form impressions of others based on their dietary choices (Basow & Kobrynowicz, 1993; Chaiken & Pliner, 1987) and self-presentation concerns may determine how much we eat in a specific social situation (Mori et al., 1987; Pliner & Chaiken, 1990). Therefore, in addition to biological predispositions, cultural and social contexts exert an important influence over dietary choices. Multiple other factors may also play a role in food choices, such as socio-economic factors (e.g., income, price of foods), educational factors and nutritional knowledge, religious practices, environment-related factors (e.g., food availability, advertisement), demographic factors (e.g., gender, age), to name but a few. Different models have been proposed (e.g., Conner & Armitage, 2002; Khan, 1981; Shepherd, 1985), presenting different selections of these (and other) factors, arranging them according to different inherent logics. All such models are, however, essentially descriptive and arguably none of them are totally comprehensive.

Despite the complex picture of factors influencing food choices, many of them exert their influence, at least partially, through individuals´ perceptions, beliefs and attitudes towards food (Conner & Armitage, 2002). In other words, their influence is often mediated by psychological (i.e., social-cognitive and emotional) aspects within the individual. Such factors are, therefore, crucial to understand an individual´s food choices and are the main focus of the present dissertation.

### 1.2. Dietary habits and health

The main causes of death have dramatically changed over the last hundred years or so. Data from the United States shows that in 1900 the main causes of mortality were infectious diseases, such as influenza and pneumonia, tuberculosis and gastrointestinal disorders, whereas in 2010, non-communicable diseases, such as cardiovascular disease and cancer, topped the list (Jones, Podolsky, & Greene, 2012). In Portugal, cardiovascular diseases were responsible for 37% of all deaths in 2010, cancer for 26%, and other non-communicable diseases and diabetes accounted for a further 13% and 6%, respectively (WHO, 2011).

Dietary habits have also undergone profound changes over the last century. Although many people in low- and middle-income countries still suffer from malnutrition, worldwide, overweight and obesity already cause more deaths than underweight (WHO, 2009). In developed countries we live in an affluent society nowadays. Some have even coined today´s food environment, where the access to a huge variety of ready to be consumed food products,

in which high sugar concentration is prevalent, as "toxic" or "obesogenic" (Swinburn, Egger, & Raza, 1999).

Five out of the ten major metabolic and behavioral risk factors linked to main causes of death in high-income countries are related to diet: high blood pressure, overweight and obesity, hyperglycemia, high cholesterol and low fruit and vegetable intake (WHO, 2009). In conjunction with physical inactivity, these factors account for 19% of deaths worldwide and 7% of disability-adjusted life years. Indeed, nutritionally poor diets contribute to huge expenditure, most of which is related to treating their consequences, such as medical appointments, in-patient and day-case admissions, out-patient attendances and drug costs (McCormick, & Stone, 2007). The financial burden of obesity and diabetes represented 1.2 % and 1.3 % of the GDP of the US in 2000 and 2002, respectively (Yach, Stuckler, & Brownell, 2006), and in the UK alone, more than 7 billion Euros were spent in connection with diet-related ill health in 2006-07 (Scarborough et al., 2011). In sum, the main causes of death nowadays may be attributed, to a large extent, to poor dietary habits. Besides premature death, these habits also contribute to reducing quality of life and to massive healthcare expenses, mainly in order to treat the consequences of such diet-related diseases. Given that dietary habits are amenable to change, both health and financial burdens could be prevented through interventions in this domain.

Promoting dietary habit change falls within the scope of a primary prevention approach, where efforts are geared towards the modification of risk factors and prevention of the onset of an initial episode of disease. This approach has great potential in overcoming secondary prevention, thus contributing towards improving the health of populations in a cost-effective manner, with virtually no side effects (Kaplan, 2000). In lieu of the biomedical model, primary prevention endorses a bio-psycho-social health model, focused on health promotion rather than on disease detection and treatment. In fact, besides reducing mortality and morbidity, other beneficial outcomes are related to a nutritionally balanced diet, such as increased vitality and quality of life (Sánchez et al., 2012), mental health and wellbeing (Hakkarainen et al., 2004; Rogers, 2001), better oral health (König, 2000), improved skin condition (Boelsma et al., 2003) and suitable weight (Swinburn, Caterson, Seidell, & James, 2004). All these benefits are worth considering when the aim is to go beyond the prevention of early death, to improve the lives and wellbeing of individuals.

### 1.3. How is this related to health communication?

Health campaigns play an important role in societal efforts aiming to foster healthful practices. Campaigns have been defined as an "organized communication activity, directed at a particular population for a particular period of time, to achieve a particular goal" (Snyder, 2007). Typically, the ultimate goal is to influence individuals´ health behaviors, but the chosen pathways may be direct or indirect (Wakefield et al., 2010). Campaigns aiming to have a direct impact on behavior normally seek to trigger emotional or cognitive responses that are relevant for individuals´ decision-making and/or behavioral enaction. Other ways of influencing behavior indirectly include setting an agenda for the discussion of the health topic, promoting a change in social norms, or initiating the public debate of a certain health issue, that may lead to or be used in support of a change in policy (Wakefield et al., 2010).

Despite their widespread use, the effectiveness of health campaigns may vary. Historically, three generations of research on campaign effects may be distinguished (Rogers & Storey, 1987). The first, or the "era of minimal effects" (Perloff, 2003), emerged with the first systematic evaluations of campaign effectiveness, that were rather disappointing. However, this pessimistic view started to change in the 1960s and gave rise to the "era of campaign success", which was grounded on a review entitled "Some reasons why information campaigns can succeed" (Mendelsohn, 1973). Some of the reasons behind the minimal effects perspective were clarified, such as the unrealistically high success expectations, a tendency to blame the audience for the lack of effects, the absence of sophisticated methods to detect subtle changes in attitudes and behavior, as well as referring to the period before television (Perloff, 2003). This second generation of studies, conducted during the period between the late 60s and early 80s pointed to the huge success of campaigns. However, this view was again overridden in the 80s, by what was denominated the "contemporary era of moderate effects" (Perloff, 2003). This perspective is grounded on the observation that some campaigns are successful, but others fail to achieve their objectives. In fact, several factors have an impact on campaign effectiveness, such as the type of outcome being considered (i.e., whether the focus is to influence knowledge, attitudes or behavior), the dose of information, degree of repetition, integration with interpersonal communication, and the concomitant use of other social change strategies, such as reinforcement or environmental changes (Salmon & Atkin, 2003). Another important aspect is whether the behavior is episodic, such as screening and vaccination, or ongoing, for example, dietary choices or exercise. In this regard, the available evidence points

to the relative success of campaigns in promoting episodic behaviors when compared to ongoing ones (Wakefield et al., 2010).

Moreover, a meta-analysis has revealed that the type of behavior being promoted is of paramount importance (Snyder, 2001; Snyder at al., 2004). For campaigns promoting the commencement of a new behavior, such as seat belt use, exercise, condom use, or fruit and vegetable intake, 12% more people in the campaign sites adopted the behavior, on average, than in the control communities. However, for campaigns promoting the cessation of acquired habits, such as smoking cessation and unprotected sex, only an average of 5% more people ceasing those practices was observed. Thus, campaigns seem to be more effective in the promotion of behaviors that may contribute to enhancing health, rather than instigating the cessation of health-impairing behaviors. Nevertheless, facts such as the behavior being addictive or not and the campaign having an enforcement component or not should also be taken into account (Snyder et al., 2004).

Campaigns have the potential of reaching high proportions of large populations. This is important, given that from an epidemiological point of view, effective prevention has been found to require changes in environmental or lifestyle factors which involve the population as a whole (Rose, 1992). Within the scope of a population, greater contribution to the total disease burden is conveyed by a higher number of people at the center of the risk factor distribution, than by those who are exposed to more of a risk, i.e., the lower number of people on the extreme end of the distribution (Rose, 1992). This is why a limited impact on the population may be expected from efforts to prevent disease based on targeting only those who are at a high-risk level (Rose, 1992).

Moreover, it has been estimated that even a small change in the distribution mean engenders considerable changes in the overall prevalence of disease (Emberson, Whincup, Morris, Walker, & Ebrahim, 2004), since the mean of a certain risk (or protective) factor has been found to predict the prevalence of cases in a given population. Thus, even if the overall effects of population-based approaches, such as health campaigns, might seem small in terms of reducing risk factors, these changes may give rise to significant changes in the total prevalence of disease.

Campaigns have the potential of being widely disseminated, at a fairly low cost per person. For example, a cost-effectiveness study of a campaign to promote fruit and vegetable intake concluded that the health benefits were obtained at a net cost saving (WHO, 2002). However, this potential is not always fully accomplished, and sometimes campaigns may even

backfire, as some are developed in the absence of a clear theoretical background or empirical support, and are not informed by health behavior change theories. Thus, we believe that campaigns have great potential as contributors to the population's health, but further research is necessary in order to increase the likelihood of campaigns being more successful in their endeavors and to avoid boomerang effects. Contrarily, a lot of money might be spent on efforts that fail to achieve their ultimate aim, namely to improve the health, quality of life and wellbeing of individuals.

## 2. Fruit and vegetable intake

### 2.1. Definition and recommendations

One of the crucial elements of a healthy diet is to eat an adequate amount of fruit and vegetables (WHO, 2002). Different definitions of what may be considered a "fruit" and a "vegetable" exist, depending on the criteria that is used. According to Agudo (2005), nutritional properties and health benefits related to their consumption should be the main criteria, and culinary definitions should be preferred over botanical ones, since they relate to individuals´ common understanding of foods and their cultural uses. In trying to establish a more consensual definition, vegetables have been defined as the edible parts of plants, and other food items that are used as such, for instance mushrooms or some fruits and sprouts, such as tomato, cucumber, pepper and eggplant, whether they are eaten fresh, canned, frozen or dried. Potatoes, tubers and dry pulses are normally excluded from the definition. Fruit include all sorts of fresh, canned and dried fruits, and may include nuts, although inclusion of the latter is more debated (Agudo, 2005). Fruit juices may also be considered, as long as they are totally natural, i.e., without any other added ingredient.

From a health promotion standpoint, establishing clear recommendations for the daily intake of fruit and vegetables is a step forward in terms of its monitoring and promotion. Guidelines from the World Health Organization recommend an average intake of at least 400 grams of fruit and vegetables a day (WHO, 2004), although some adjustments may have to be made according to individuals´ age, gender and physical activity level (Gidding et al., 2006; USDA, 2011). In order to help people understand what the amount of 400 grams of fruit and vegetables refers to, in some countries this quantity is communicated in servings / portions. Although some variability across countries exist, a minimum intake of five portions of fruit and

vegetables a day is the most common recommendation (Pomerleau et al., 2005). One serving/ portion is 80 grams, and is roughly equivalent to a cup of raw vegetables and half a cup of minced or cooked vegetables, one medium sized piece of fruit (e.g., orange, apple, banana), two small pieces of fruit (e.g., plums, kiwi), and half a cup of berries (e.g., strawberries, cherries) (Agudo, 2005). A recent study with a British representative sample has, however, drawn attention to the fact that there are possibly greater health benefits when the intake is above seven daily portions (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014). Nevertheless, further research is still required before an adjustment in the adopted recommendations can be made.

### 2.2. Health benefits associated with fruit and vegetable consumption

Nutritionally, fruit and vegetables are low-dense energy foods, constituting an important source of fiber, vitamins, minerals and phytochemical elements (OMS, 2006). Many of the phytochemicals present in fruit and vegetables work as important antioxidants, protecting the cells and the body tissues from free radicals and aging (Kaur & Kapoor, 2001), they interfere with inflammatory processes, whose inhibition is important, for example, to control cardiac diseases (Esposito & Giugliano, 2006) and inhibit the proliferation of cancer cells (Gescher, Pastorino, Plummer, & Manson, 1998).

Epidemiological studies have also corroborated the link between fruit and vegetable intake and a lower risk for cardiovascular diseases (Dauchet, Amouyel, Hercberg, & Dallongeville, 2006; He, Nowson, Lucas, & MacGregor, 2007), certain types of cancer (Boggs et al., 2010; Liu & Russel, 2008), type II diabetes (Carter, Gray, Troughton, Khunti, & Davies, 2010) and obesity (Ledoux, Hingle, & Baranowski, 2011). According to the World Health Report (2002), it is estimated that a low fruit and vegetable intake causes 2.7 million deaths a year worldwide. Thus, it comes as no surprise that an increase in fruit and vegetables has been defined as a major public health goal (PNS, 2012; WHO / FAO, 2005).

### 2.3. Adherence to the recommendations

Different methods exist to estimate fruit and vegetable intake levels, which range from using aggregate population data (e.g., measures of food supply, such as food balance sheets) to individual level data (e.g., self-report measures of fruit and vegetable intake) (Agudo, 2005). Furthermore, estimates of fruit and vegetable consumption may be requested for quantity (e.g., number of portions eaten in a regular day) or frequency (e.g., number of days per week that one

eats fruit), and the definitions of what may be considered fruit and/ or vegetables may also vary. Thus, results of different studies are not always readily comparable.

Data from 52 countries from four continents (Africa, America, Asia and Europe) taking part in the World Health Survey (2002-2003) revealed that more than 70% of individuals eat less than the recommended 400 grams of fruit and vegetables a day (Hall, et al., 2009). A recent report by the Organization for Economic Cooperation and Development (OECD), encompassing 24 countries, revealed that, on average, 57% of men and 69% of women consumed fruit every day, although there was great variability across countries, with only 20% of men in Finland eating fruit daily, whereas in Australia the percentage for men was 90% (OECD, 2013). For vegetable intake, 64% of men, on average, and 73% of women consumed vegetables on a daily basis. Again, levels varied greatly across countries, with only 30% of men eating vegetables every day in Germany, against almost 100% of men doing so in Korea (OECD, 2013).

In another study with more than 500,000 adults from ten different European countries, average fruit and vegetable intake, measured by means of a 24-hour recall measure, was below 400 grams (335 grams/day) (Boffetta et al., 2010). Some variability across countries was found once again, with the lowest level in Sweden (231 grams/day) and the highest in Spain (511 grams/day), and with generally higher levels of intake registered in southern rather than northern European countries (Boffetta et al., 2010). Another study conducted in several European countries with a sample of school-aged children showed that the fruit and vegetable intake of Portuguese children was one of the highest (264 grams/day), although still considerably low in comparison to the recommendations (Yngve et al., 2005). In the same study, Spain and Iceland registered the lowest intake levels (176 and 143 grams/day, respectively).

Very little updated data is available to estimate fruit and vegetable intake among the Portuguese adult population, since the only National Food Inquiry with a representative sample of the Portuguese population was conducted in 1980 (Ferreira, Cruz, Martins, Mano, & Dantas, 1985). Thus, available estimates stem, primarily, from measures of food supply, such as the Portuguese Food Balance Sheet (INE, 2010). By comparing the daily availability of fruit and vegetables for the period 2003-2008 with the recommendations for each food type, it was concluded that in order to attain the recommended intake levels, a 79% increase in vegetables and 48% in fruit consumption would be required (INE, 2010). However, measures of this nature

tend to overestimate the amount of food that is actually eaten, due to the fact that losses, resulting from waste and food processing, are generally not accounted for (Agudo, 2005).

On the basis of data from the National Health Inquiry (Inquérito Nacional de Saúde 2005/2006, INE /INSA, 2009) it is only possible to ascertain the percentage of individuals who say they eat fruit (80%) and salad / cooked vegetables (69%) as part of their main meals. Thus, these figures do not provide any information on the consumption frequency or quantity of such food items.

### 2.4. Factors associated with fruit and vegetable intake

#### *Social-demographic predictors*

A common finding across different studies on fruit and vegetable intake, whether national or international, is that, on average, women eat more fruit and vegetables than men (Baker & Wardle, 2003; Boffetta et al., 2010; INE /INSA, 2009; OECD, 2013; Wardle et al., 2004). Gender differences in fruit and vegetable intake have been explained by the fact that women have better nutritional knowledge (Baker & Wardle, 2003), tend to consider fruit and vegetable intake as being more relevant to health (Wardle et al., 2004), attribute more importance to having a healthy diet (Miles & Eid, 1997), are more concerned with weight management and with eating low-calorie foods (Wardle et al., 2004) and express higher subjective norms related to fruit and vegetable intake (Backman, Haddad, Lee, Johnston, & Hodgkin, 2002).

Older people also tend to eat more fruit and vegetables than younger individuals (Ball, Crawford, & Mishra, 2006; Blanck, Gillespie, Kimmons, Seymour, & Serdula, 2008; OECD, 2013). However, to our knowledge, no study has specifically addressed the question of why older people eat more fruit and vegetables. A plausible explanation is that it is associated with the more generalized changes in dietary patterns (Casagrande, Wang, Anderson, & Gary, 2007; Daniel, Cross, Koebnick, & Sinha, 2010) and/or with changes in taste and flavor that accompany aging (Stevens & Cain, 1993).

Social-economic status is another frequently mentioned predictor of fruit and vegetable intake, with people from a higher status (i.e., higher education and/ or higher income) consuming more fruit and vegetables (De Irala-Estevez et al., 2000; Giskes, Turrell, Patterson, & Newman, 2002). This association might be explained by the higher nutritional knowledge and awareness of the importance of eating healthy foods among well-educated individuals

(Parmenter, Waller, & Wardle, 2000), with financial availability, considering that the cost is consistently referred to as a major barrier for fruit and vegetable intake (e.g., Cassady, Jetter, & Culp, 2007). The area of residence is also an important factor, given that more affluent neighborhoods tend to have easier access to fruit and vegetables (Dubowitz et al., 2008). Notwithstanding, in some cases, the association between higher social economic status and higher fruit and vegetable intake is negligible (e.g., for vegetable consumption in Belgium, Italy, Greece, Slovenia and the Slovak Republic) or may even be reversed (e.g., for fruit consumption in Greece and Spain) (see OECD, 2013), so any generalization should be made with care.

Other studies reveal a positive association between being married and a greater fruit and vegetable intake (Billson, Pryer, & Nichols, 1999; Devine, Wolfe, Frongillo, & Bisogni, 1999; Pollard, Greenwood, Kirk, & Cade, 2001). One possible explanation is that the husband/ wife may be a primary source of social support for the practice of different health behaviors, such as healthy eating habits (Umberson, 1992), but this association also lacks further grounding. The relationship between having children and fruit and vegetable intake is yet another unclear association, given that some studies point to a positive relationship, whereas others to the opposite (Kamphuis et al., 2006).

Although knowledge concerning the social-demographic factors associated with higher and lower levels of fruit and vegetable consumption may be relevant for the selection of specific audiences in greater need of intervention, we contend that it is important to bear in mind that these factors are distal and hardly likely to be direct causes of fruit and vegetable intake. Their effect is dependent upon contextual factors and is largely mediated by psychological factors, such as those presented in the following sections.

### *Contextual and lifestyle predictors*

Fruit and vegetable availability, i.e., access to fruit and vegetables in a place and time, arranged in such a way that consumption is facilitated, is one of the most mentioned contextual predictors of fruit and vegetable intake (Cullen et al., 2003). Although the specific mechanisms are not yet well understood, reviews sustain that the availability of fruit and vegetables, at home and/or in the neighborhood, is associated with increased fruit and vegetable intake in children, adolescents and adults (Jago, Baranowski, & Baranowski, 2007).

Price is also generally referred to as an important barrier to fruit and vegetable consumption (Cassady et al., 2007; Mushi-Brunt, Haire-Joshu, & Elliott, 2007), and the consumption of pre-prepared food is also associated with lower fruit and vegetable intake (Kamphuis, van Lenthe, Giskes, Brug, & Mackenbach, 2007). Besides the individual social economic level, the social-economic status of the residency area has also been found to explain fruit and vegetable intake (Dubowitz et al., 2008). The latter explanation may reside in the quantity and quality of food stores and restaurants available in different residency areas that determine the access and cost of fresh produce. The possibility of growing one's own fruit and vegetables has also been referred to in some studies as being related to higher fruit and vegetable intake (Billson et al., 1999; Devine et al., 1999).

Besides factors related to the physical environment, some aspects of the social contexts are powerful motivators and have been shown to influence dietary behaviors (Pliner & Mann, 2004). Most of the studies relating social norms to food intake have analyzed their influence on the amount of food that is eaten (e.g., de Castro, 1997; Roth, Herman, Polivy, & Pliner, 2001). However, studies conducted on social judgment have confirmed that social factors also play an important role in food selection. Eating is a communicative act, and people use information about food choices to infer characteristics of others (Chaiken & Pliner, 1987), and sometimes also make their food choices for impression management (Mori et al., 1987). Several studies have shown that individuals are judged in a more positive light (i.e., as being more intelligent and attractive) when they choose healthier foods (Mooney & Lorenz, 1997; Steim & Nemeroff, 1995). Moreover, in the presence of strangers, individuals tend to choose and eat more apples rather than chips, when compared to situations where they are alone or in the presence of friends (Batista & Lima, 2013). Thus, it may not be solely the presence of others that influences food choices and fruit and vegetable intake; who those persons are and the nature of the social relationships may be at the root of this influence.

The co-occurrence of health behaviors is also a known fact. Studies have confirmed a general tendency towards an association between different health-promoting behaviors, such as healthy eating and exercise (Lippke, Nigg, & Maddock, 2012), as well as between different health-compromising behaviors, such as smoking and alcohol consumption (Wiefferink et al., 2006). Along these lines, other studies have revealed that higher intakes of fruit and vegetables is associated with physical activity, and with being a vegetarian or vegan (Pollard et al., 2001), whereas smoking is associated with low fruit and vegetable intake (Billson et al, 1999; Pollard et al., 2001).

***Psychological predictors***

Individuals have the ability to exert control over the environment and their own behaviors, i.e., they are able to self-regulate their behaviors. Self-regulation may be defined as a "systematic process involving conscious efforts to modulate thoughts, emotions and behaviors in order to achieve goals within a changing environment" (Cameron & Leventhal, 2003, p.1). It also encompasses both motivational processes that culminate in goal-setting, and volitional processes involved in the development and enaction of strategies for goal pursuit and on-going evaluation of discrepancies between goals and current states. The factors involved in motivation and/ or volitional processes are, therefore, important for the understanding of dietary behavior, including fruit and vegetable intake (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011a), and have been detailed in different social cognitive models presented in section 3.2 of the present chapter. For now, we will focus on the factors relevant to fruit and vegetable intake gearing our review towards the motivational and volitional processes, rather than to the underlying models.

Perceived social influences, beliefs about consequences of behavior, and beliefs about capabilities are considered to have an important influence on the development of an *intention* to change one's own fruit and vegetable consumption (Guillaumie, Godin, & Vézina-Im, 2010). However, changing dietary behaviors is a complex process and requires considerable self-regulatory efforts, besides the formulation of an intention to change. In a study where predictors of intention were targeted by an intervention, a significant change in intention failed to translate into an increase in overall fruit and vegetable intake (Kothe, Mullan, & Butow, 2012). Two systematic reviews on the psychosocial factors associated with fruit and vegetable intake have shown that, besides taste and some nutritional knowledge, *self-efficacy* (i.e., the belief that one will be able to change one's own behavior), *perceived social support* (i.e., perception of support for the behavior from the individual's social network), and *habit* are important predictors of actual fruit and vegetable intake (Guillaumie et al., 2010; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008).

The observation that people often fail to act upon their intentions has fueled research specifically aiming to bridge this so-called "intention-behavior gap" (Sheeran, 2002), by unveiling the psychological mechanisms that operate in the translation of an intention into action. One crucial identified process is planning. Planning may encompass both *action planning*, i.e., a mental simulation regarding when, where and how to implement the intention to increase fruit and vegetable intake and *coping planning*, i.e., the anticipation of possible

barriers that might hinder fulfillment of the action plans and the establishment of plans to overcome the identified barriers (Sniehotta, Schwarzer, Scholz, & Schüz, 2005).

Simple interventions that asked people to formulate action plans and then to jot them down, specifying when, where and how they would implement them proved to be more effective for the promotion of fruit and vegetable intake than simply providing nutritional information (e.g., Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012; Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Stadler, Oettingen, & Gollwitzer, 2010). In another two studies, participants were asked to think about barriers that could prevent them from eating five portions of fruit and vegetables a day and then to write down some strategies that could be used to overcome those specific barriers. When compared to the control group, a significant increase in fruit and vegetable intake was obtained, both one month (Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2011) and three months later (Guillaumie et al., 2012), with the effects of the intervention being mediated by changes in coping planning.

*Action control*, i.e., the self-monitoring of behavior and the adjustment of subsequent behavior in order to attain the intended goals (Sniehotta, Scholz, & Schwarzer, 2005) is another process that has been analyzed as being determinant in the translation of intentions into action. To our knowledge, no prior studies have examined action control in the context of fruit and vegetable intake. A previous intervention study with action control was conducted in the oral health domain. Participants were asked to note every day in a simple calendar whether they had flossed their teeth on that particular day. This simple intervention targeting action control, proved to be effective in increasing the self-monitoring of flossing behavior and the behavior itself (Schüz, Sniehotta, & Schwarzer, 2007). Thus, exploring the role of action control for fruit and vegetable intake seems to be a promising avenue, and is one of the goals of the study presented in Chapter 2.

Distinct self-efficacy beliefs are also important in the volitional phase, such as *maintenance self-efficacy*, i.e., optimistic beliefs about one's own ability to deal with the barriers that might occur during the maintenance phase, and *recovery self-efficacy*, i.e., optimistic beliefs about one's own ability to get back to the previous behavioral pattern after a setback or failure (Schwarzer et al., 2007). Self-efficacy may be promoted through different strategies, such as mastery experience, observational learning, or through verbal persuasion (Bandura, 1997). One or a combination of these strategies was used in intervention studies to attest the relevance of self-efficacy for fruit and vegetable intake (Guillaumie et al., 2012; Kreausukon et al., 2012; Luszczynska, Tryburcy, & Schwarzer, 2007).

### 2.5. Strategies to promote fruit and vegetable intake

Interventions aiming to promote fruit and vegetable intake in a certain population may try to do so by targeting one or more of the aforementioned contextual and/or psychological predictors. For such to be accomplished, strategies may be selected, ranging from the establishment of guidelines, to communication and marketing, engendering environmental and social changes, reviewing legislation, ensuring service provision, setting up regulation and making use of fiscal measures (Michie, van Stralen, & West, 2011). Although a number of these strategies merit attention as means of promoting changes in health behaviors, in the present dissertation we will focus on communication as a way of informing and persuading people to increase their fruit and vegetable consumption. Particular attention will be given to two communication strategies that have been studied as a way of increasing health message persuasiveness: message tailoring / targeting and message framing. In the following section, we will start by addressing different theories and models with a view to clarifying how communication may be used as a way of persuading people to change their attitudes and health behaviors, and then review the specific literature on message tailoring / targeting and framing.

## 3. Health Promotion Messages

### 3.1. Persuasion and attitude change

The attempt to change other peoples´ attitudes through the transmission of a message dates back to Ancient Greece, where, with the advent of democracy, persuading other people through discourse, rather than by force, became central (Corneille, 2010). However, the scientific study of persuasion within psychology was only initiated in the wake of World War II, at Yale University, with an important research program on the effects of mass communication, under the direction of Carl Hovland (McGuire, 1999). This message-learning approach applied principles of learning theory in order to understand persuasion, assuming that learning and recall of message content were vital for the effectiveness of communications (Bohner & Schwarz, 2001). The role of variables related to the message source (e.g., credibility, attractiveness), content (e.g. type of appeal, message structure), recipient characteristics (e.g., mood) and communication channel (e.g. written versus spoken), were studied in order to describe the conditions under which persuasion was most likely to occur. Moreover, from this

perspective, attitude change following a persuasive communication would only occur if different processes were sequentially engaged, including attention to and comprehension of the message content, and acceptance of the arguments (Bohner & Wänke, 2002; Hovland, Janis, & Kelley, 1953).

This approach, which aimed at describing the effects of a given variable (e.g., source credibility) on persuasion in a rather systematic way, assuming that there was a direct correspondence between such variables and message learning and, hence, persuasion, was very influential and had a profound impact on subsequent research in this field (Bohner & Schwarz, 2001). However, the fact that it was not guided by an overarching theory led to the accumulation of poorly integrated findings that were, at times, contradictory (Bohner & Schwarz, 2001). On the other hand, the assumption that recall and learning of message content were the key to persuasion did not pass the empirical test, when evidence that memory of message content was not a predictor of persuasion emerged (Eagly & Chaiken, 1993; McGuire, 1969).

Subsequently, attention was drawn, among members of the Yale group, to the recipients´ thoughts about the content of the message. From this new cognitive stance, the message recipient assumed a pivotal role, with the information treatment processes at times explaining persuasion success as well as resistance to persuasion (McGuire, 1969). Instead of considering the passive reception of the message content, this new approach focused on the active processes of information transformation, elaboration and generation of new arguments (Petty, Ostrom, & Brock, 1981). Self-persuasion through role-playing was explored as a way of promoting behavior change, such as smoking cessation (Mann & Janis, 1968), and inoculation procedures. Exposing the message recipient to a small amount of a persuasive communication promoting the unwanted behavior (McGuire, 1964), as well as forewarning message recipients of the persuasive intent of a message (McGuire & Papageorgis, 1962) were investigated as a means of instigating the recipient to develop his/her own arguments in order to be more resistant to subsequent - and stronger - attempts of persuasion.

A new model latter evolved from the findings generated under this approach, namely the cognitive-response model (Greenwald, 1968). According to this perspective, the extent and direction of cognitive responses to the persuasive message determine attitude change, in the sense that the more positive responses evoked by a message, the greater attitude change.

Two of the most influential contemporary persuasion models are the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and the Heuristic-Systematic Model (Eagly & Chaiken, 1993), which are referred to as the dual process models of persuasion. Both models

sustain that processes involved in persuasion vary according to a continuum ranging from low effort to demanding cognitive processes. Depending on their motivation (e.g., relevance of the issue) and ability (e.g., cognitive resources, time) individuals may engage to a greater or lesser degree in the scrutiny of message arguments (i.e., message elaboration). Thus, when either motivation or ability to process the message content is low, people will rely on peripheral cues, such as source credibility, for attitude formation. This is the *peripheral route* to persuasion, following ELM terminology, or *heuristic processing*, in heuristic-systematic model terms. However, when motivation and ability are high, persuasion will be dependent upon the number and valence of thoughts that are elicited by the message. In these conditions, individuals will be more sensitive to the quality of the arguments presented (Petty & Cacioppo, 1986). This is the *central route* to persuasion that relies on the *systematic processing* of the information contained in the message.

Instead of the learning-approach, which aims at describing the systematic effect of a given variable (e.g., source credibility) on persuasion, dual models assume that the effect of a given variable will depend on the type of message processing. Therefore, in order to study the different processing types influencing persuasion, the presence of peripheral cues in the message and/or the strength of arguments are usually manipulated (Bohner & Schwarz, 2001). In fact, the systematic variation of argument quality has been used as a way to infer the role of a given variable in the persuasion process from the pattern of results it produces (Petty & Cacioppo, 1986).

However, the value of studying attitude change in persuasion is mainly rooted in the assumption that it will ultimately contribute to behavior change. Although initial theorizing on attitude change stemmed from this assumption (Schwarz & Bohner, 2001), later studies demonstrated the absence of a relationship between attitudes and behaviors (Wicker, 1969), which raised questions regarding the usefulness of the study of attitudes for behavior change. In response to these concerns, several factors have been pointed out as accounting for variations in the attitude-behavior relationship. Some of these factors are related to the correspondence between measures of attitudes and behavior (Ajzen & Fishbein, 1977), individual differences in the need for cognition (Cacioppo, Petty, Kao, & Rodriguez, 1986), self-monitoring (Snyder, 1974), self-awareness (Carver, 1975) and factors related to attitude strength, such as intra-attitudinal consistency (Norman, 1975), attitude accessibility (Fazio, 1995) and cognitive effort in attitude formation (Petty & Wegener, 1998). However, even when the correspondence principle is observed (Ajzen & Fishbein, 1977), i.e., attitudes are operationalized as the attitudes

towards behavior, their value is mostly relevant for the prediction of behavioral intentions, while often being unsatisfactory as far as behavioral changes are concerned (Ajzen, 1991).

### 3.2. Beyond attitudes: Social cognitive models of health behavior change

A number of models have been developed to describe the social cognition factors accounting for variations in the performance of behaviors that influence health (see Conner & Norman, 2005 for a review). Some of these models have stemmed directly from social psychology, while others have emerged from health psychology and have been specifically designed for the prediction of health behaviors. In addition to attitudes, all these models include social and/or cognitive constructs, some of which are posited as more proximal determinants of behavior (e.g., intention). Focusing on the social and cognitive determinants of health behaviors is relevant from a public health perspective, considering that these determinants are potentially amenable to change. Social cognition models offer a theoretical background for changing health behaviors, and thus, provide a framework for the development of theory-informed health communications.

Despite a plethora of social cognitive models for health behavior change, there is, however, a great degree of overlap among the different models (Armitage & Conner, 2000). One important distinction is whether they conceptualize behavior change as a *continuum* or rather as a *staged* process (Weinstein, Rothman, & Sutton, 1998). In *continuum* models, all factors are combined in a single prediction equation, and individuals may be differentiated according to their place along the continuum of action likelihood. The Theory of Reasoned Action (Fishbein & Ajzen, 1975), and its successor, the Theory of Planned Behavior (Ajzen, 1991), not to mention the Health Belief Model (Janz & Becker, 1984; Rosenstock, 1974), the Protection Motivation Theory (Rogers, 1983) and the Social Cognitive Theory (Bandura, 1986), are all examples of continuum models. Most of these models conceptualize intention as being the most proximal predictor of behavior (Armitage & Conner, 2000).

These continuum models have helped to map important predictors of intention formation, but have left out the volitional processes that help individuals to translate their intentions into action (Abraham, Sheeran, & Johnston, 1998). Therefore, attention has more recently been drawn to the self-regulatory processes involved in the initiation, monitoring and maintenance of health behaviors. The observation that people often fail to act on their intentions has been designated as the intention-behavior gap (Sheeran, 2002; Webb & Sheeran, 2006), and its acknowledgement has fostered the development of behavioral enaction models (Armitage &

Conner, 2000), as well as research that specifically examines the psychological processes that mediate between intention and behavior (e.g., Gollwitzer & Sheeran, 2006; Schwarzer, 2008a). Moreover, in guiding intervention, continuum models postulate that increases in the various determinants will boost the likelihood of behavioral change occurrence. Thus, these models imply that "one-size-fits-all", i.e., all individuals will benefit from the same type of intervention, and no specific order of intervention components is posited as being more effective.

Stage models, on the contrary, defend that some discontinuities exist in the process of behavior change, where people go through several mindsets (stages) with specific cognitive and behavioral characteristics. Thus, some predictors will be relevant for particular stage transitions, but might be irrelevant for others. Since people at the same stage are likely to face similar barriers, and different barriers must be overcome by people at different stages, interventions should be adapted to fit the needs of people at different stages of change (Weinstein et al, 1998). Progress throughout the stages, i.e., forward transitions between the stages, are thus considered in stage theories as a valid intervention goal.

Lewin´s 3-Step model of change (Lewin, 1947) may be regarded as a precursor of these models. It comprises three phases - unfreezing, moving and refreezing -, which broadly correspond to motivational, volitional and maintenance phases. Despite the fact that this model is frequently mentioned in relation to organizational change, it was not developed specifically for conceptualizing organizational issues (Burnes, 2004). More recent examples of stage models in the health domain (see Schüz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009 for a review) are the Transtheoretical Model of Change (TTM; Prochaska & DiClemente, 1983, 1984), the Precaution Adoption Process Model (Weinstein, 1988; Weinstein & Sandman, 1992), the I-Change model (de Vries, Mesters, van de Steeg, & Honing, 2005) and the Health Action Process Approach (HAPA; Schwarzer, 2008a), although the latter may be considered a hybrid model. In fact, the HAPA might be used in its continuum version or as a stage model, depending on whether the purpose is to predict behavioral changes or to guide interventions (Schwarzer, 2008b). Furthermore, conceiving change as being composed of two self-regulatory phases, it integrates some of the motivational factors considered by continuum models with volitional factors, such as planning (Gollwitzer, 1999), which are important to address the relatively poor correspondence between motivational variables, such as attitudes and intentions, and subsequent behavior. Besides, and unlike other stage models (e.g., TTM), it is a clearly-specified and parsimonious model, establishing which predictors are relevant for each of the stage transitions, and defining the stages by means of psychologically meaningful differences

in intention and behavior, rather than by arbitrary definitions relying on time frames. Therefore, the HAPA model has been chosen as the main theoretical background for the present dissertation, and is described in more detail in the following section.

### *Health Action Process Approach*

The Health Action Process Approach (HAPA; Schwarzer, 2008a) contends that there are two major phases in the behavior change process: a motivational phase, which culminates with the setting of a specific goal (i.e., the establishment of a behavioral intention), that is followed by a volitional phase, which leads to the initiation of the intended behavior. The volitional phase may be further divided into a pre-action phase and a post-action phase, thus enabling a distinction among three qualitatively different stages: the non-intentional, comprising the individuals who are not yet in possession of an intention to change their behavior, the intentional, encompassing the individuals who have already entered the volitional phase but have not yet initiated action and, finally, the action stage, where individuals are already acting upon their intentions. One of the main assumptions of the HAPA is that a different set of processes is relevant for different stage transitions (see Figure 1). Risk perception is considered a distal predictor in the motivational phase, in the sense that it might instigate thoughts about change, yet it is not sufficient for intention formation. By weighing the pros and cons, namely holding positive outcome expectancies (i.e., anticipating positive consequences from change), and action self-efficacy (i.e., the belief that one will be able to perform the desired action) are considered the main predictors of intention. Therefore, interventions aiming to move individuals from a non-intentional to an intentional stage of change should target at least some of these constructs.

Once an intention is formed, the individual enters the volitional phase and planning the implementation of the desired action is a key determinant of behavioral enaction. Planning covers both action planning (i.e., a mental simulation of when, where and how the behavior will be performed) and coping planning (i.e., the anticipation of barriers and the generation of alternative behaviors to overcome them). Besides planning, maintenance self-efficacy (i.e., the optimistic belief about one's own ability to deal with barriers that might arise in the maintenance period) and recovery self-efficacy (i.e., conviction of one's own ability to resume the behavior after a setback or failure) are important predictors of behavior. Another construct, that has more recently received attention within the HAPA, is action control (Sniehotta et al., 2005). Action

control is considered the most proximal determinant of behavior, as it partially takes place during behavior enaction, and encompasses three facets related to being mindful of the intended goals (*awareness of standards*), monitoring one's own behavior and comparing it to the desired standards (*self-monitoring*), and making an effort to counteract impulses and former habits (*effort*). Thus, interventions aiming to move individuals from an intentional to an action stage of change should target constructs such as action planning, coping planning, maintenance self-efficacy and action control. On the other hand, interventions targeting actors should foster behavioral maintenance by reinforcing coping planning, maintenance and recovery self-efficacy and/or action control.

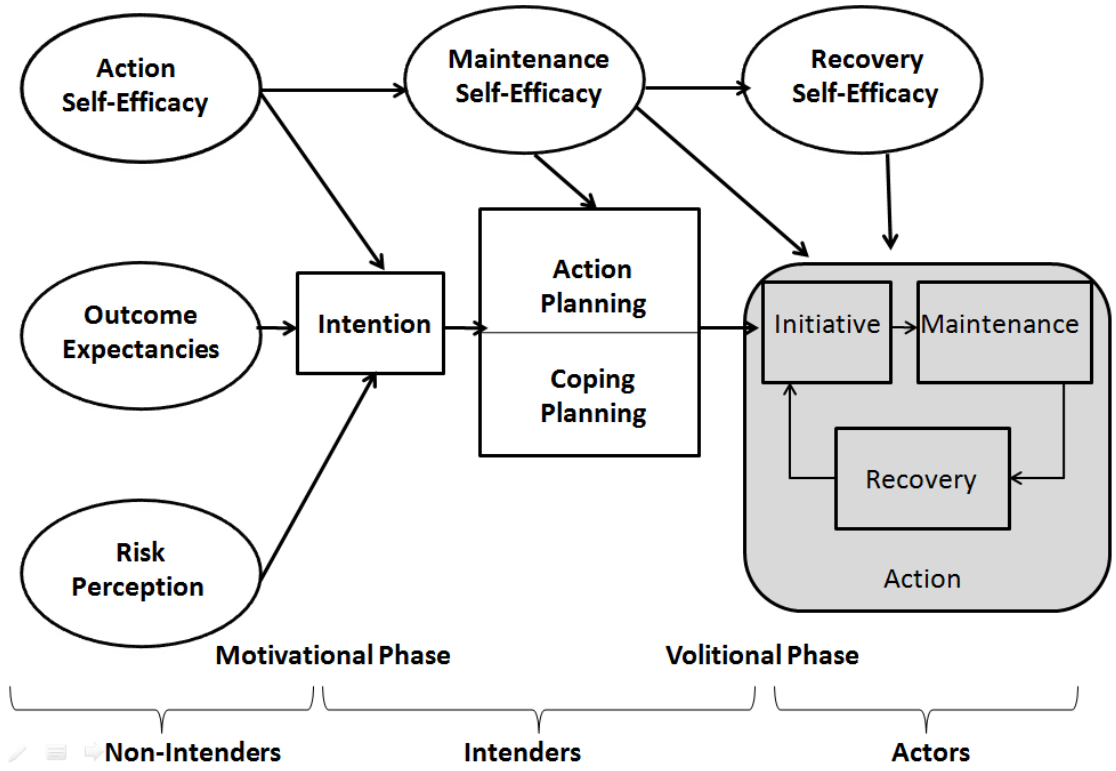


*Figure 1*. The Health Action Process Approach (adapted from Schwarzer, 2008).

The continuum version of the HAPA model has been tested in the longitudinal and experimental studies that have used the model in its entirety or focused on some of its constructs, for a huge range of health behaviors, such as breast self-examination (Luszczynska & Schwarzer, 2003), physical activity (Renner, Spivak, Kwon, & Schwarzer, 2007), condom

use (Teng & Mak,2011), eating a healthy diet (Renner et al., 2008), and fruit and vegetable intake (e.g., Kreausukon et al., 2012).

Other studies have used the stage version of HAPA, either examining the predictors associated with specific stage transitions (e.g., Wiedemann et al., 2009, for fruit and vegetable intake), or testing the stage assumptions by means of matched-mismatch interventions (e.g., Lippke, Schwarzer, Ziegelmann, Scholz, & Schüz, 2010; Luszczynska, Goc, Scholz, Kowalska, & Knoll, 2011). However, very few match-mismatch studies have used a complete design, i.e., with matched, mismatched and control treatments being randomly applied to people at different stages (for an exception see Schwarzer, Cao, & Lippke, 2010). Moreover, despite the fact that some of the intervention studies using the HAPA comprised the development of brief persuasive messages, the messages typically targeted the predictors of intention (e.g., Luszczynska et al., 2011; Reuter, Ziegelmann, Wiedemann, & Lippke, 2008), but not the most proximal predictors of behavior, such as planning. Thus, in the present dissertation we set out to use a complete match-mismatch design, considering its relevance for testing the underlying assumptions of stage theories (Sutton, 2006; Weinstein et al., 1998), and to employ the same intervention format (i.e., health messages) to target not only the predictors of intention, but also the most proximal predictor of health behavior. Thus, the goal is based on manipulating the message´s content, testing its effectiveness to promote changes among people at different stages in a complete match-mismatch design, while keeping the same intervention format.

### 3.3. Communication strategies

As stressed in the previous section, multiple factors, which can be classified as being related to the message source, channel, recipients, and characteristics of the message content, may contribute towards enhancing the effectiveness of messages, or instead, to hinder their intended effects. The following two communication strategies, message tailoring / targeting and message framing, are related to the choice of content that will be part of the message, and have been studied as a way of rendering health messages more effective in persuading people to change their health behaviors, including fruit and vegetable consumption (e.g., Resnicow et al., 2009; Churchill & Pavey, 2013).

### *Message tailoring and targeting*

Depending on their degree of individualization, health communications may be generally classified as mass communication, when the same message is provided to large audiences, targeted communication, when messages are adapted to fit the needs and preferences of a sub-group of individuals, or tailored communication, when they are adapted to the characteristics of one individual (Kreuter, Strecher, & Glassman, 1999). These are not, however, strictly discrete categories, as they vary along a continuum of progressive message segmentation, i.e., division of the audience into homogeneous groups, and message customization, i.e., message design that reflects individuals´ characteristics (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008).

Research has shown that individualized messages are perceived as being more relevant by the audience (Kreuter & Wray, 2003), which in turn increases the likelihood of being processed systematically (Eagly & Chaiken, 1993). Indeed, research has shown that tailored messages have an increased likelihood of being read and remembered (Skinner, Strecher & Hospers, 1994), to be discussed with others (Brug, Steenhuis, van Assema, & de Vries, 1996) and are perceived as being more interesting and engaging (Brug et al., 1996; Kreuter, Kull, Clark, & Oswald, 1999). Another important fact is that tailored messages have been shown to be conducive to greater changes in health behaviors, even when compared to generic or targeted messages (Noar, Benac, & Harris, 2007). Thus, in principle, for greater effectiveness, one should seek the maximum degree of individualization possible. However, that does not come cost-free, since a higher degree of individualization implies the identification and measurement of an increasing number of variables that are relevant for the intended outcome, as well as the development of an exponentially higher number of individualized messages that correspond to the assessed individual characteristics (Hawkins et al., 2008). It has been argued that such an effort may only be worthwhile whenever a high level of variability exists within the target population in the determinants that are relevant for the outcome. Furthermore, there has to be a feasible way of collecting this data, and tailoring the communication content accordingly, in order to deliver different messages to the different audience segments (Kreuter & Wray, 2003).

Audiences may be segmented into a virtually infinite number of variables, but the most common approach is to use demographic variables, such as gender, age, ethnicity and income, as a basis for message targeting and tailoring (Slater, 1995). Although this type of tailoring / targeting may contribute to increased persuasion (Noar et al., 2007), given that the health messages may be perceived as being more personally relevant, demographic variables are not

open to change and other more proximal determinants of health behavior adoption exist (Armitage & Conner, 2000). Thus, one arguably more sophisticated approach would be to target the major motivational and volitional variables that are known to influence health behaviors. This tailoring / targeting strategy has been referred to as content matching and has been defined as an attempt to "direct messages to individuals´ status on key theoretical determinants (knowledge, outcome expectations, normative beliefs, efficacy and/or skills) of the behavior of interest" (Hwakins et al., 2008), with the goal of providing the information most likely to increase the odds of behavioral change.

Stage models offer a useful template for content matching, as they provide guidance for the selection of a parsimonious set of relevant determinants for different audience segments. Up to now, the Transtheoretical Model (TTM; Prochaska & DiClemente, 1983, 1984) has been the most popular model in the message tailoring / targeting arena. Despite being widely applied, the model has, nonetheless, received a great deal of criticism related to, for instance, fundamental problems with stage definitions and a lack of model specification in terms of which predictors influence each of the stage transitions (e.g., Brug et al., 2005; Sutton, 2005). Moreover, reviews of randomized controlled trials have found little support for increased effectiveness of stage-matched interventions according to the TTM (Bridle et al., 2005; Riemsma et al., 2003). Unlike the TTM, the HAPA model is a clearly specified theoretical model that has been established as a good predictor of a wide range of health behaviors (e.g., Schwarzer et al., 2007). As a stage model, it provides a useful framework for content matching, offering the possibility of segmenting the audience into three specific groups (i.e., non-intenders, intenders and actors), for whom particular determinants should be targeted. Stage tailored messages are, thus, posited as being more effective than an undifferentiated, i.e., "one-size-fits-all", type of message. This is due to the fact that messages matching peoples´ stage convey only the information that is supposedly most helpful for the individual at that specific stage, omitting information that could otherwise be perceived as being repetitive, inadequate or irrelevant by the recipient, possibly instilling reactance (Brehm & Brehm, 1981). Thus, in our view the HAPA model may be helpful in indicating a parsimonious set of predictors that are potentially able to afford maximum effectiveness at a lower cost and with less effort.

### *Message framing*

Message framing refers to the emphasis given in a health message to either the positive consequences of adopting the health behavior, or the negative consequences of not doing so

(Rothman & Salovey, 1997). Thus, health messages aiming to persuade people to change their health behaviors may do so by presenting the benefits of performing the behavior or the costs of failing to perform the behavior, even when the outcomes are the same. For example, with the goal of promoting fruit and vegetable intake, a health message could stress "*If you eat* at least five portions of fruit and vegetables a day, you will be *protected* against several diseases" (gain frame) or "*If you do not eat* five portions of fruit and vegetables a day, you will be *unprotected* against several diseases" (loss frame). The two message frames do not differ greatly and convey information that is factually equivalent, only the presentation format is different (i.e., gains for compliance vs. losses for non-compliance). Interestingly, research has shown that this rather small difference in the format of presentation has important consequences for intention to perform the behavior (e.g., van´t Riet, Ruiter, Smerecnik, & de Vries, 2010) and for health behavior change (e.g., Gallagher, Updegraff, Rothman, & Sims, 2011).

The research on message framing was initiated with the development of the Prospect Theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981), which revealed that the framing of the same problem induced a shift in decision-making and in the preferences for a given solution. The theory asserts that losses loom larger than gains, and thus, people tend to be conservative in their decisions when the problem is framed in terms of gains, but tend to take more risks when the same problem is framed in terms of losses.

Drawing upon the principles of the Prospect Theory and applying them to decisions related to the performance of health behaviors, Rothman and Salovey (1997), initially proposed that the function that the particular health behavior served, i.e., if it served mainly an illness detection or illness prevention function, should determine the type of frame that would be more effective in promoting it. Given that illness detection behaviors, such as undergoing screening exams, entail some degree of risk or uncertainty, a loss frame would be more effective for its promotion. Conversely, illness prevention behaviors, such as sunscreen use or exercise, are mostly safe and certain in their outcomes, and, therefore, a gain frame would be more effective. Many studies contrasting the use of a gain vs. loss frame for detection behaviors (e.g., Cox & Cox, 2001; Meyerowitz & Chaiken, 1987; Schneider et al., 2001) and prevention behaviors (e.g., Detweiler, Bedell, Salovey, Pronin & Rothman, 1999; Jones, Sinclar, & Courneya, 2003; Millar & Millar, 2000) have confirmed this general hypothesis. Moreover, this pattern of findings was replicated in a study where the function of the same health behavior, namely mouth rinse use, was manipulated (Rothman, Martino, Bedell, Detweiler, & Salovey, 1999). When its use was presented as a means of detecting the presence of plaque, the loss-framed

message was more effective, whereas the gain-framed message was more effective when it was described as a means of preventing the accumulation of plaque.

Despite these encouraging results, two subsequent meta-analyses in prevention behavior studies (O´Keefe & Jensen, 2007) and in detection behavior studies (O´Keefe & Jensen, 2009) questioned the generalization of this principle. In these meta-analyses, a small but statistically significant advantage was found for gain-framed messages for the promotion of prevention behaviors, but these effects were mostly attributable to a large effect obtained in studies related to dental hygiene behaviors. For the disease detection behaviors, a small but statistically significant effect also emerged for the loss-framed messages, but the overall effect was attributable to the studies on breast cancer detection. Thus, no advantage was attributed to the use of either a gain or loss frame for behaviors other than those related to dental hygiene and breast cancer detection (O´Keefe, 2012).

However, these two reviews used attitudes and intentions, rather than actual behavior, as the main outcomes of their analyses (Gallagher & Updegraff, 2012). This distinction is relevant, not only due to the fact that processes underlying attitude and intentions change may not be the same as those that most likely engender behavioral changes (Schwarzer, 2008a), but also since - from an applied point of view - behavioral change should be the main outcome of interest. In fact, when behavior was used as the main outcome in evaluating the persuasiveness of the type of frame, gain framed messages proved to be more effective in fostering prevention behaviors, especially so in the case of skin cancer prevention, smoking cessation and exercise (Gallagher & Updegraff, 2012), although no effects of framing on behavior were obtained for detection behaviors.

Besides considerations regarding the outcomes for which framing effects are most likely to be observed, other research has tried to refine some of the previous postulates, such as the prevention vs. detection distinction, preferring to examine the underlying assumptions concerning the way people construe a given health behavior (Rothman, Wlaschin, Bartels, Latimer, & Salovey, 2008). For example, the underlying assumption sustaining the reasoning that loss frames would be more effective for detection behaviors is because these behaviors were considered to generally afford a certain degree of uncertainty and risk. However, due to the extent to which variability exists in the way people construe a given detection behavior, the relative effectiveness of a loss or gain frame is expected to vary accordingly. Thus, instead of focusing on behavior categories as the moderating factor of framing effects, recent studies have

started looking at individuals´ construal of a given behavior to predict the relative effectiveness of a gain vs. loss frame (Latimer, Salovey, & Rothman, 2007).

In support of such reasoning, one study on smoking cessation showed that a gain framed message advantage was revealed only for women who perceived smoking cessation as entailing low risk (Toll et al., 2008). Conversely, a loss-framed message was shown to be more effective for the promotion of mammography, but only for women whose levels of perceived susceptibility to breast cancer were moderate to high (Gallagher et al., 2011). In another study (Bartels, Kelly, & Rothman, 2010), the risk implications of a prevention behavior (a vaccine) and a detection behavior (a screening test) were manipulated. As expected, regardless of the function of the behavior, when the risk associated with those behaviors was low, gain-framed messages proved to be more effective, whereas loss-framed messages were more effective when the risk associated with the behavior was high.

The way people construe a given health behavior is thought to be influenced by the process of socialization, including the way the behavior is normally referred to in the mass media or by health care professionals, by personal or close others´ experiences with the behavior and a person´s dispositional tendencies for a promotion or prevention orientation (Gray, 1990; Higgins, 1997). In fact, individuals´ dispositional sensitivity towards losses and gains has consistently proven to be a moderator of framing effects (Rothman, & Updegraff, 2011; Updegraff & Rothman, 2013).

Research stemming from both an approach-avoidance framework (Elliot, 2008; Gray, 1990) and a promotion-prevention regulatory framework (Higgins, 1997) has shown that people who have either higher scores in behavioral activation, or are promotion-oriented, tend to respond more favorably to gain-framed messages. On the other hand, people who have either higher behavioral inhibition or are prevention-oriented tend to respond more favorably to loss-framed messages. This moderating effect of the individuals´ motivational orientation on the impact of framed health messages has already been demonstrated for a range of health behaviors, including flossing (Mann, Sherman, & Updegraff, 2004; Sherman, Mann, & Updegraff, 2006), papillomavirus vaccination (Gerend & Shepherd, 2007), physical activity (Latimer et al., 2008) and healthy eating (Yi & Baumgartner, 2009).

Although other individual characteristics have been investigated as plausible moderators of message framing effects, such as ambivalence (Broemer, 2002), depth of processing (e.g., Gallagher & Updegraff, 2011; Umphrey, 2003), issue involvement (e.g., Greenlee, 1997) and

perceived susceptibility / severity (e.g., Lee & Aaker, 2004), the individual´s dispositional motivational orientation is the moderator for which evidence is more reliable (see Covey, 2014).

Besides motivational orientation, in her review, Covey (2014) also referred to self-efficacy beliefs as being another moderator for which the evidence is relatively consistent. The theoretical underpinnings of this perspective are grounded in the Extended Parallel Process Model (EPPM; Witte, 1992), which highlights that higher levels of threat, instigated by a health message, may lead to higher message effectiveness, provided that people hold high levels of perceived efficacy. Thus, considering that loss framed messages evoke a greater sense of threat than gain framed messages (Cox & Cox, 2001; Shen & Dillard, 2007), they are expected to be more effective among people who hold higher levels of perceived efficacy, i.e., who simultaneously perceive the recommended action as an effective way of averting the threat (response efficacy) and have confidence in their ability to perform the recommended behavior (self-efficacy). However, it is important to underline that, despite higher threat perception, which frequently leads to an experience of negative emotions, including fear, available evidence has failed to document direct effects of emotion arousal in the effectiveness of framed messages (Salovey & Wegener, 2003).

A good deal of empirical evidence thus supports the claim that both individual characteristics as well as the construal of the health behavior may moderate message framing effects. The interplay of these two classes of moderators has, however, been less explored to date, but it has been suggested that dispositional orientations are what mainly drive framing effects to the extent that the behavior under consideration does not elicit a strong set of beliefs or particular mindset (Rothman & Updegraff, 2011). Furthermore, although the evidence regarding the moderators of framing effects is clear, less is known about the underlying mechanisms that may account for such effects.

One study analyzed brain activity during the resolution of decision-making economic problems in which the individual had to choose one out of two loss- or gain-framed options (risky vs. safe) (De Martino, Kumaran, Seymour, & Dolan, 2006). This study concluded that amygdala activity, which is involved in the detection of both negative (aversive) and positive (appetitive) emotionally relevant information that is present in contextual and social cues, was significantly higher when individuals followed the pattern of decisions that is described by the prospect theory, i.e., choosing the safer option when the options were positively framed, and the riskier option when the frames were negatively framed. Given that in this study both inter-individual as well as intra-individual differences were detected, this pattern of findings is

consistent with the observation that framing effects may be influenced both by individual characteristics, and situational cues. Moreover, the authors suggested that framed effects are mediated by emotional responses, and that an affect heuristic may explain the typically observed framing effects (De Martino et al., 2006). However, in many of the framing studies in the health domain, the observed effects were far more enduring than just differences in the immediate behavior or decision, sometimes observable after weeks, months and even a year after message exposure (e.g., Banks et al., 1995; Schneider et al., 2001). Given that enduring behavioral changes are more likely favored by higher rather than lower information-processing effort, it is plausible that other mechanisms, based on increased scrutiny of message processing, may also contribute to message framing effects.

It has been suggested that the frame might bias peoples´ perception of the argument's strength (Salovey & Wegener, 2003), in the sense that gain-framed arguments may be regarded as being stronger for prevention behaviors, whereas loss-framed arguments may be perceived as stronger for detection behaviors. In fact, the underlying motives for practicing prevention and detection behaviors imply a different *status quo*. The reason for practicing prevention behaviors is to maintain good health, whereas for adopting detection behaviors is that one might already be ill. Thus, gain-framed information that offers information about continued health may seem more appropriate when referring to prevention behaviors. On the contrary, loss-framed information, focusing on a lack of health may seem more appropriate in the context of detection behaviors. Although we are using the prevention vs. detection distinction here, the same reasoning should apply whenever the outcomes of a detection behavior are perceived as being relatively safe, and thus, as being health-affirming, or when the outcomes of a prevention behavior are perceived as being risky.

Another possibility is that either the risk associated with a given behavior or the dispositional orientation of the person interact with the frame to influence the amount of message processing. In a study on HIV testing, perceived risk of a positive result interacted with the message frame to influence message elaboration (Hull, 2012). Moreover, elaboration was found to mediate the effect of the frame on intentions to perform the test. Consistent with the possibility that framing effects may be attributable to increased message elaboration, individuals discriminated better between strong and weak arguments when there was a match between message frame and their motivational orientation (Updegraff, Sherman, Luyster, & Mann, 2007). In other words, when the messages were congruent with their motivational orientation, individuals became more sensitive to the quality of the message. In addition,

another possibility stemming from the literature on regulatory focus is that people "feel right" whenever they experience regulatory fit, i.e., when there is a match between the frame and their motivational orientation (Cesario, Grant, & Higgins, 2004). This feeling may be described as a feeling of correctness or importance that is transferred to the evaluation of the message. This constitutes an alternative explanation to why message quality may be evaluated more differently under conditions of fit, since under such conditions people feel right with the evaluations of the message they have formed, consequently boosting and making those evaluations more extreme (Updegraff & Rothman, 2013).

## 4. Overview of the empirical studies

The aim of the present dissertation is to expand knowledge on the relevant psychological processes for fruit and vegetable intake, applying it to the development of more effective health messages for its promotion. The ultimate goal is to contribute to the theoretical understanding of health behavior change and to the conditions that facilitate this process, as well as to support the development of effective, theory-grounded interventions.

Previous research has attested the relevance of psychosocial predictors for the explanation of the practice of different health behaviors, including fruit and vegetable intake (e.g., Conner & Norman, 2005). We also now know that despite motivational factors being good predictors of behavioral intention (Ajzen, 1991), they provide only a partial account when it comes to predicting behavior change (Webb & Sheeran, 2006). For this reason, volitional factors have been more recently studied in an attempt to understand the self-regulation processes involved in behavioral enaction (e.g., Hagger & Luszczynska, 2014; Mann, de Ridder, & Fujita, 2013). Moreover, better results of stage tailored interventions have been attested (Noar et al., 2007) and different sets of predictors of the HAPA model have proven to be important for different stage transitions related to fruit and vegetable intake (Wiedemann et al., 2009), supporting the idea that stage matched health messages may be more effective than mismatched ones. Moreover, several studies have demonstrated the importance of the choice of framing to the success of health messages promoting different health behaviors (Rothman & Salovey, 1997), and moderators for the relative success of the type of frame (gain vs. loss) have been indicated, namely the degree of uncertainty or risk associated with the behavior and the motivational orientation of the message recipient (Rothman & Updegraff, 2011).

Thus, the evidence is clear in terms of both the value of social cognitive constructs for the understanding of fruit and vegetable intake, and the usefulness of message tailoring / targeting and message framing as strategies for increasing the persuasiveness of health messages. However, several important questions remain unanswered, some of which will be addressed in the present dissertation and presented in the following five empirical chapters.

As already mentioned, the role of motivational factors in intention formation has been extensively studied and is now better established (Armitage & Conner, 2000). In contrast, although the first studies on volitional factors, such as action planning, date back to long ago (e.g., Leventhal, Singer, & Jones, 1965), they have only started to attain the more consistent attention of researchers over the last decade. A considerable part of the work on volitional determinants has used the HAPA model as a theoretical backdrop, and has shown that volitional determinants, such as action planning, are more proximal and are able to further explain variability in behavior (Gollwitzer & Sheeran, 2006). However, despite an abundance of evidence for the role of action planning, also in relation to dietary behaviors (e.g., Adriaanse, Vinkers, de Ridder, Hox, & de Wit, 2011b), volitional factors have still been neglected in two recent systematic reviews on the psychological predictors of fruit and vegetable intake (i.e., Guillaumie et al., 2010; Shaikh et al., 2008). The number of studies examining action planning and establishing its role in fruit and vegetable intake has increased considerably over recent years (Adriaanse et al., 2011b). In contrast, there is a relatively small amount of research on coping planning for fruit and vegetable intake and, to our knowledge, no prior studies have looked at action control for fruit and vegetable intake, despite the existence of theoretical and empirical reasons to expect the relevance of these processes for fruit and vegetable intake. Thus, little is known about the role of coping planning and action control in the context of fruit and vegetable intake, and how they might help the translation of intention into more fruit and vegetable intake. Therefore, the following questions will be addressed in Chapter 2: *"Are coping planning and action control volitional predictors of fruit and vegetable intake? Do they sequentially mediate the relationship between intention and behavior?"*.

Some authors have questioned the utility of applying knowledge from psychological / social-cognitive theory to health message design (O´Keefe, 2012). Nevertheless, we argue that the HAPA model provides a good guide to develop health messages tailored for people at different stages, however formative research is necessary to identify the specific beliefs that are relevant for a particular audience. Thus, in Chapter 3 we will seek to answer the following question: *"Which beliefs, under each of the HAPA´s theoretical constructs, are more relevant*

*to include in health messages aiming to promote fruit and vegetable intake among people at different stages?"*.

The usefulness of developing theoretically-based stage-matched health messages is proven if these messages outperform stage-mismatched messages. Despite the identification of different sets of predictors for different stage transitions being an important indicator in favor of the utility of stages (Wiedemann et al., 2009), experimental studies where the effects of a matched treatment are contrasted with those of a mismatched one is the most important test for the validity of stage theories. However, the empirical evidence stemming from match-mismatch experimental designs is still scarce. The study presented in Chapter 4 aims to fill this gap, addressing the following questions: *"Are stage-matched health messages (according to the HAPA) more effective in the promotion of fruit and vegetable intake? Which specific psychological mechanisms may account for the intervention's success?"*.

Besides the selection of content, the selection of frame is also relevant, as it is known that exactly the same information may be delivered in a gain or loss framed format, with implications for adherence to health behaviors. Prior research has highlighted some of the conditions under which a given frame should be more effective, such as the "riskiness" afforded by the behavior (e.g., Rothman & Salovey, 1997) or the motivational orientation of the message recipient (e.g., Mann et al., 2004). However, the interplay of these two classes of moderators has seldom been examined for a single behavior. Moreover, considering that people at different stages differ in their mindsets, holding qualitatively different cognitions, perceived barriers and action tendencies, it is also believed that they might also differ with regard to the preference for a given frame. Thus, in Chapter 5 we will seek to answer the following questions: *"Which factor is more important in moderating the effectiveness of framed health messages promoting fruit and vegetable intake: the degree of uncertainty associated with the behavior or the recipients´ motivational orientation? Do people who hold a strong intention to increase their fruit and vegetable intake differ from those who hold a weak intention in their responses to a gain vs. loss frame?"*.

Moreover, many of the studies showing that motivational orientation is a moderator of health message framing effects were conducted for flossing and some discrepancies in the results, stemming from this line of research, applied to other health behaviors have been found (Covey, 2014). Thus, evidence for the congruency effect for other behavioral domains, as well as understanding whether other factors may account for the disparate findings is crucial. Therefore, the study presented in Chapter 6 will pose the following question: *"Does perceived*

*message quality interfere with the effects of matching the frame to the recipient's motivational orientation, explaining some of the existent variability?".*

In order to address the above mentioned questions, four studies with four different samples were conducted: one qualitative study (Chapter 3), one survey (Chapter 3), and two experimental / longitudinal studies (Chapters 2, 4, 5 and 6). The qualitative study, the survey and one of the experimental studies used Portuguese samples. The other experimental study was conducted in the United States. These studies are presented in the following five chapters, which are based on published (Chapters 2 and 3) or submitted articles (Chapters 4, 5 and 6). Since these chapters were written for publication in scientific journals, the rationale under consideration is provided in each chapter, as well as the specific hypotheses, when appropriate, and so they can be read independently of each other. In Chapter 2, a longitudinal analysis of data collected over a two-week period, by means of on-screen questionnaires is presented, with a view to understanding the psychological mechanisms that operate in fruit and vegetable intake, and specifically looking at the mediating role of coping planning and action control in the relationship between intention and fruit and vegetable intake. In Chapter 3, data collected through a qualitative study using focus groups is combined with data collected through an online survey, for selecting beliefs under five theoretical constructs of the HAPA model, with a view to developing theory-based health messages targeting relevant beliefs for audiences at different stages of change. These messages were subsequently used in one of the experimental / longitudinal studies, described in both Chapters 4 and 5. In Chapter 4 data collected in this experimental study was analyzed with the aim of testing whether stage-matched health messages are more effective than mismatched or control messages for the promotion of fruit and vegetable intake and the mechanisms that may account for such effects were examined. Chapter 5 presents data collected in the same study, that was then analyzed with a view to comparing predictions based on the two most prominent perspectives on framing for a single behavior, fruit and vegetable intake, and testing whether strength of intention may also moderate the effectiveness of message framing. Finally, Chapter 6 presents another experimental study, conducted in order to test whether perceived message quality may be a boundary condition for the effectiveness of matching the frame to the message recipient motivational orientation in the context of fruit and vegetable intake.

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# 2

# The Health Action Process Approach on the prediction of fruit and vegetable intake

**This chapter is based on the paper**

Godinho, C. A., Alvarez, M. J., Lima, L. , & Schwarzer, R. (2014). Will is not enough: Coping planning and action control as predictors of fruit and vegetable intake. *British Journal of Health Psychology*. Advance online publication. doi: 10.1111/bjhp.12084.

## 1. Abstract

*Objectives:* This study investigates the joint role of coping planning and action control as volitional predictors of changes in the daily consumption of fruit and vegetables. *Design:* In a longitudinal online survey, 203 participants completed assessments at baseline (Time 1), one week (Time 2) and two weeks later (Time 3). *Methods:* Structural equation modelling was used to test a series of three nested models. In model 1 only intention predicted behaviour, in model 2 both coping planning and action control were tested as mediators between intention and behaviour, and model 3 specified coping planning and action control as sequential mediators between intention and behaviour. *Results:* Model 3 provided the best fit to the data. The mediating role of coping planning and action control between intention and fruit and vegetable intake was confirmed, whereby multiple mediation occurred in a sequential manner, with coping planning preceding action control. *Conclusions:* For motivated individuals who are not yet following the recommendations for fruit and vegetable consumption, coping planning and action control reflect a psychological mechanism which operates in changes in fruit and vegetable consumption.

*Keywords:* self-regulation, planning, action control, intention, fruit and vegetable intake, double mediation.

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## 2. Introduction

Despite the benefits provided by fruit and vegetables, data from different countries (Lock, Pomerleau, Causer, & McKee, 2004) shows that most people eat well below the World Health Organization recommendation of a minimum of 400 grams of fruit and vegetables (i.e., approximately five portions) per day. Low fruit and vegetable intake is among the top ten risk factors contributing to mortality and morbidity worldwide (WHO, 2002). Thus, a better understanding of the cognitive mechanisms that are relevant for the promotion of fruit and vegetable intake is vital for the development of evidence-based interventions. Dietary behaviour change requires not only basic nutritional knowledge, but also motivational and volitional processes which guide self-regulatory efforts (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese,2011a; Verhoeven, Adriaanse, Evers, & De Ridder, 2012).

### Motivational and volitional mechanisms of health behaviour change

Research pinpointing the psychological processes that mediate between intentions and behaviour has flourished in recent years in an attempt to bridge the so-called intention-behaviour gap (Sheeran, 2002), and has contributed to the prediction of several health behaviours (e.g., Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011b; Mann, de Ridder, & Fujita, 2013). The study of volitional processes that help individuals to translate their intentions into action is especially important for complex behaviours where multiple barriers are anticipated. Changing complex behaviour, such as eating at least five portions of fruit and vegetables on a daily basis, requires more than simply formulating an intention, and its implementation may not be achieved through a single act of will, but rather demands considerable self-regulatory effort.

The aim of the present study is to unveil the mechanisms through which intentions to eat fruit and vegetables are translated into actual behaviour. More specifically, we set out to investigate the relevance of two volitional processes (i.e., coping planning and action control) for fruit and vegetable consumption inspired by the Health Action Process Approach Model (HAPA, Schwarzer, 2008).

## Health Action Process Approach Model

The HAPA provides a framework for the study of both the motivational predictors of intention, such as outcome expectancies, self-efficacy and risk perception, and the volitional predictors of behaviour. *Outcome expectancies* are beliefs regarding the benefits or costs the individual expects to experience by adopting (or not) the behaviour, and are predictors of intentions (Schwarzer, 2008). *Self-efficacy* is an optimistic belief about one's personal ability to perform novel or difficult behaviour, even when confronted with potential barriers. The model also includes *risk perception* as a putative motivational predictor, but is considered to be negligible in the context of fruit and vegetable consumption (Schwarzer et al., 2007).

Self-efficacy and outcome expectancies contribute jointly to intention formation, but then the "good intention" has to be transformed into action. Both planning, such as coping planning, and mastering self-regulatory skills, i.e., successful action control, are crucial volitional processes for this transition.

### *Coping planning*

Reviews have documented the role of planning in health behaviour change, including fruit and vegetable consumption (Adriaanse et al.,2011b; Kwasnicka, Presseau, White, & Sniehotta, 2013), and several studies have specified planning as a mediator between intention and action (e.g., Gholami, Lange, Luszczynska, Knoll, & Schwarzer, 2013; Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2011).

Planning encompasses both action planning and coping planning. *Action planning* pertains to a mental simulation of when, where and how one intends to perform the behaviour. It is a task-facilitating strategy that helps link the desired end state, formulated through intention, to specific situational cues and may, therefore, be especially important for the initiation of behaviour. *Coping planning* involves anticipating potential obstacles in the process of behaviour enactment and preparing strategies for dealing with such barriers. The number of studies examining action planning and establishing its role in fruit and vegetable intake has increased considerably over recent years (Adriaanse et al., 2011b). In contrast, research on coping planning in fruit and vegetable intake is still scarce, although the anticipation of strategies for overcoming barriers has been

considered relevant for the maintenance of complex behavioural changes (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008; Sniehotta, Schwarzer, Scholz, & Schüz., 2005a). Therefore, in the present study we will focus on this less explored type of planning.

Studies attest the importance of coping planning for the prediction of behaviour and its effectiveness as an intervention strategy for behavioural change (Kwasnicka et al., 2013). Higher levels of coping planning were associated with the practice of physical exercise (Sniehotta et al., 2005a), and another study demonstrated that an intervention combining action planning with coping planning was more effective in the promotion of physical exercise than an action planning intervention alone, indicating that coping plans may act as a shield to protect action plans from emerging barriers (Sniehotta, Scholz, & Schwarzer, 2006).

There are fewer studies on coping planning for fruit and vegetable consumption, however, available evidence points to similar results. Interventions explicitly including action planning and coping planning prompts promoted significant increases in fruit and vegetable intake at follow-up, and these effects were fully (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012) or partially mediated (Wiedemann et al., 2011) by coping planning. Moreover, increases in action planning were only converted into higher fruit and vegetable intake when coping planning had also increased sufficiently (Wiedemann et al., 2011). This suggests that making plans for the implementation of an intention may not suffice to change a particular behaviour, such as fruit and vegetable consumption. Indeed, there is plenty of literature on the barriers for fruit and vegetable intake (e.g., John & Ziebland, 2004), thus suggesting that coping planning might be conducive to achieving the goal of eating sufficient quantities of fruit and vegetables per day.

### *Action Control*

In order to self-regulate their behaviour, individuals must be aware of the desired end-states (*awareness of standards*), monitor their current behaviour and continuously compare it to the standards they seek (*self-monitoring*), and endeavour not to act upon impulse or habitual behaviour patterns (*effort*) (Baumeister & Heatherton, 1996). These three self-regulation processes are components of the *action control* construct (Sniehotta,

Scholz, & Schwarzer, 2005b), which has been conceptualized as the most proximal determinant of behaviour. Whereas planning must be set beforehand, action control is an on-going regulatory process which partially occurs during behavioural enactment.

Action control has been found to be a good predictor of behaviour. In a longitudinal study with cardiac rehabilitation patients, action control had the strongest direct effect on physical exercise, when compared to action planning and maintenance self-efficacy. Moreover, the effects of intention on behaviour were mediated by action control (Sniehotta et al., 2005b). A further two longitudinal studies demonstrated that changes in adopting a low-fat diet and smoking cessation were associated with change in action control over and above the effects of intentions (Scholz, Nagy, Göhner, Luszczynska, & Kliegel, 2009). Even stronger evidence comes from a study on dental flossing, where a very simple action control intervention (i.e., a dental flossing calendar) promoted an increase in the frequency of flossing among volitional individuals (i.e., those who already had the intention to floss), but did not have any effects on intention (i.e., motivational effects) (Schüz, Sniehotta, & Schwarzer, 2007).

In short, evidence from different studies has converged in indicating the importance of action control as a predictor of behaviour. Fewer studies, however, have tested whether action control mediates the relation between intention and behaviour. Moreover, to the best of our knowledge, no study has explicitly investigated the relevance of action control as a mechanism for explaining fruit and vegetable intake. Nevertheless, there are several reasons for expecting action control to play a role in fruit and vegetable intake. Firstly, holding inappropriate standards (i.e., too high or too low) has been shown to preclude the process of self-regulation (Heatherton & Ambady, 1993) and studies on fruit and vegetable intake have corroborated that a lack of awareness of the discrepancy between one´s present intake and the recommended amount of fruit and vegetable intake hinders higher levels of consumption (e.g., Brug, Debie, Assema, & Weijts, 1995). Secondly, self-monitoring is particularly relevant for behaviours that should unfold throughout the day, every single day, as is the case of fruit and vegetable consumption. Finally, habit is known to be an important determinant of food choices (e.g., Verhoeven et al., 2012), making behavioural enactment less of an effort,, since habitual behaviours become automatic (Verplanken & Wood, 2006). Thus, when the habit of adequate daily fruit and vegetable intake is absent, effort is needed to attain the goal of eating at least five portions a day. On the other hand, the taste of food is a major determinant of consumption

(Shepherd, 1999), and some effort might be required for choosing fruit and vegetables over other more tempting foods. In short, efforts must be made by those who want to change their habitual pattern of behaviour to eat more fruit and vegetables and to refrain from acting upon impulses that are not in line with their goals.

### Aims of the present study

There is still scarce evidence attesting the relevance of coping planning for fruit and vegetable intake in generally healthy adults, and hardly any of the studies in the literature have specifically addressed action control in the explanation of fruit and vegetable intake. Hence, we aim to investigate the joint role of coping planning and action control in the context of fruit and vegetable consumption and, more specifically, to test whether they sequentially mediate the relation between intention and fruit and vegetable intake.

A longitudinal design with three assessment points over a two week period will be used to test a series of predictions inspired by the HAPA for fruit and vegetable intake:

*H1.* Higher positive outcome expectancies and higher perceived self-efficacy measured at baseline (Time 1) are associated with higher intentions towards fruit and vegetable intake one week later (Time 2).

*H2.* Intention to eat fruit and vegetables (T2) predicts actual fruit and vegetable intake a further week later (Time 3).

*H3.* Both coping planning, a more distal process, and action control, a more proximal process, are volitional predictors of behaviour.

*H4.* Coping planning (T2) and action control (T3) sequentially mediate the relation between intentions and fruit and vegetable intake.

## 3. Method

### Participants

A total of 236 university students completed the first questionnaire. Thirty two participants failed to complete one or more of the assessment points, and a further participant was vegetarian. Hence, they were excluded from the sample. The final sample

consisted of 203 participants who completed the three measurement points in time. One hundred and seventy three (85.2%) were women, and the ages of the final sample ranged from 18 to 50 years (*M*= 22.19, *SD* = 5.33). None of the participants had medical restrictions against eating fruit and/or vegetables.

**Procedure**

Participants were recruited from three universities, in exchange for a course credit or a 5€ voucher. The study was presented in one of the following ways: in the classroom before classes by the first author or by a trained researcher who was aware of the study objectives (63.7%); through the mailing lists of student unions (18.1%); through the laboratory of the Psychology Department (18.1%). Those who volunteered to participate provided their e-mail addresses so as to receive the links to the questionnaires (Time 1). One week after receiving the first, participants answered the second questionnaire (Time 2) through the same software, but in an in-lab session, to avoid high rates of dropout. After a further week (Time 3), participants received the link to the third questionnaire via e-mail.

All questionnaires were set up online using Qualtrics software. At the beginning of the first questionnaire, the study was explained in more detail and data confidentiality was assured. Participants then provided their informed consent, in accordance with the ethical standards of the three universities.

**Measures**

All measures of the HAPA constructs were based on those presented in Schwarzer (2008), except the action control measure, where items from Sniehotta et al. (2005b) were used as indicators of the second-order factor. The items to measure fruit and vegetable intake are similar to those used by Luszczynska, Tryburcy and Schwarzer (2007). With the exception of the items on fruit and vegetable intake, all responses were given on a 7-point scale ranging from 1 (*totally disagree*) to 7 (*totally agree*).

**Outcome expectancies.** The positive outcome expectancy measure started with *'If I ate 5 portions of fruit and vegetables a day...'* and was followed by four items (T1, Cronbach's α = .79) such as: *'I would improve my health'*.

**Perceived self-efficacy.** To assess perceived self-efficacy four items (T1, Cronbach's α = .87) were used. The first item was: *'I believe I can eat 5 or more portions of fruit and vegetables a day'*, and for the next three items this stem was followed by barriers such as: *'even if I have to establish a detailed plan not to forget to eat fruit and vegetables'*.

**Intention.** Three items (T2, Cronbach's α = .95) such as *'I intend to eat at least 5 portions of fruit and vegetables a day from today on'* were used to access intention regarding the daily intake of at least five portions of fruit and vegetables.,

**Coping planning.** To assess coping planning, the stem *'I already have concrete plans...'* was followed by three items (T2, Cronbach's α = .92) such as: *'what to do in difficult situations in order to stick to my intentions'*.

**Action control.** Action control was measured by three items (T3, Cronbach's α = .93), each of which addressed a different component of action control: '*Presently, I evaluate my behaviour in order to confirm that I am eating at least 5 portions of fruit and vegetables a day'*, for comparative self-monitoring, *'The intention to eat 5 portions of fruit and vegetables a day is always present in my mind'*, for awareness of standards, and *'I make an effort to act in accordance with my intention to eat 5 or more fruit and vegetables a day'* for self-regulatory effort.

**Fruit and vegetable intake.** Two items, one for fruit and one for vegetables, were used to measure fruit and vegetable intake: *'Within the (last two weeks (T1) / last week (T3)), how many (pieces of fruit / portions of vegetables) (have you eaten/did you eat) on a typical day?'*, followed by some examples of what could be considered a portion of vegetables (e.g., soup or one bowl of salad) and by the explanation that a glass of juice could be considered a portion of fruit provided that it was freshly squeezed and 100% fruit. Similar items were validated against a food frequency questionnaire and dietary biomarkers (Steptoe et al., 2003). Responses were given on a 6-point scale ranging from 0 (*less than one piece/portion a day*) to 5 (*more than four pieces/portions a day*).

**Confirmatory factor analysis**

In order to evaluate the quality of fit of the proposed measurement model to the correlational structure of the observed variables, a confirmatory factor analysis (CFA) was performed. Seven factors were specified (i.e., outcome expectancies, perceived self-efficacy, intention, coping planning, action control and fruit and vegetable intake, both at baseline and at Time 3), and were allowed to freely inter-correlate. All factors were standardized by fixing their variances to 1.00. The final measurement model presented a good fit: $\chi^2(168) = 278.45$, $p < .001$, $\chi^2/df = 1.66$, CFI = .96, TLI=.95, RMSEA= .057, 90% CI [.045; .069], indicating that the items measured the seven proposed constructs.

**Data Analysis**

Structural equation modelling (SEM) with AMOS 20 was performed using the variance-covariance matrix of the indicators. All parameters were estimated by bootstrapping, generated from 5,000 samples. Bootstrapping is a non-parametric re-sampling procedure that does not require the normality of the sample distribution, and is recommended for mediation analyses (Hayes, 2009)[1]. Structural equation modelling was chosen to analyse the data as it enables the testing of the global adjustment of complex models and an estimation of their parameters, while controlling for measurement errors. After deletion of dropout participants, there was no missing data in the database.

To explore the volitional mechanisms capable of mediating between behavioural intentions and fruit and vegetable intake at Time 3, three nested models were estimated. The models included the motivational variables (outcome expectancies and perceived self-efficacy), that were measured at Time 1, as predictors of intention measured at Time 2. Intention and coping planning (measured at Time 2), and action control (measured at Time 3), were specified as predictors of fruit and vegetable intake at Time 3. Moreover, to test the hypothesized sequential mediation, an additional path from coping planning to action control was specified. Past behaviour (i.e., baseline fruit and vegetable intake) was included in all models as a direct predictor of fruit and vegetable intake at Time 3. All the

[1]Although the reported results are from bootstrapping, analysis using a normal-theory approach yielded similar results.

predictors were specified as latent variables. All motivational variables and past behaviour (i.e., variables measured at Time 1) were allowed to correlate.

The sequence of estimated models ranged from a more constrained model, where only intention predicted behaviour (model 1), to a less constrained model, where the volitional predictors were tested as multiple mediators between intention and behaviour (model 2), to an unconstrained model, where the two volitional predictors were specified as sequential mediators between intention and behaviour (model 3). Paths not used in models 1 and 2 were constrained to zero. In model 3 all parameters were freely estimated.

To evaluate the overall fit of the different models, several goodness of fit indices were used, such as the chi-square test, the comparative fit index (CFI), the Tucker-Lewis index (TLI) and the root mean square error of approximation (RMSEA), representing absolute (i.e., $\chi^2/df$), comparative (i.e., CFI and TLI) and residual aspects of fit (i.e., RMSEA). A $\chi^2/df$ under 2.0 is indicative of overall goodness of fit (Arbuckle, 2008). For CFI and TLI, values over 0.90 indicate acceptable model fit and values over 0.95 a very good fit (Bentler, 1990; Bentler & Bonett, 1980). For RMSEA, values under 0.08 indicate an adequate model fit (Hu & Bentler, 1999). In order to compare the fit among the three competing models estimated with the same data, we additionally used the Akaike Information Criterion (AIC), with lower values being indicative of better and more parsimonious fit (Kline, 2010), and the chi-square difference test (Bollen, 1989).

## 4. Results

### Dropout analysis

A dropout analysis was conducted to verify whether there were any differences at baseline between those who completed all three measurement points in time and those who did not. A multivariate analysis of variance (MANOVA) showed no significant differences regarding levels of fruit and vegetable intake and baseline social-cognitive determinants between the longitudinal sample and those who dropped out. Furthermore, an analysis of variance (ANOVA) revealed no significant differences in age, and a chi-square test revealed no gender differences between the groups.

**Descriptive statistics**

Table 1 presents the means, standard deviations and inter-correlations between all latent variables included in the model at the corresponding time of measurement, including baseline level of fruit and vegetable intake.

Table 1. *Descriptive statistics and correlations of the latent variables*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | Mean | *SD* |
|---|---|---|---|---|---|---|---|---|---|
| 1. Outcome expectancies (T1) | - | | | | | | | 5.84 | 0.79 |
| 2. Perceived Self-Efficacy (T1) | .23** | - | | | | | | 4.75 | 1.32 |
| 3. Intention (T2) | .36** | .40** | - | | | | | 4.94 | 1.38 |
| 4. Coping Planning (T2) | .36** | .35** | .59** | - | | | | 3.97 | 1.50 |
| 5. Action Control (T3) | .45** | .33** | .62** | .61** | - | | | 4.12 | 1.71 |
| 6. FV Intake (T1) | .14 | .31** | .34** | .24** | .20** | - | | 2.59 | 2.15 |
| 7. FV Intake (T3) | .12 | .28** | .47** | .36** | .42** | .60** | - | 2.43 | 1.90 |

*Note.* *$p$< 0.05; **$p$< 0.01

The average fruit and vegetable intake was 2.59 portions (*SD*= 2.15) at baseline and 2.43 (*SD* = 1.90) at Time 3, with 89.2% (87.7%, at Time 3) of the sample not attaining consumption of five portions of fruit and vegetables a day. All variables showed significant associations with each other, but all correlations were weak to moderate, meaning that they were measuring different constructs. All determinants had positive significant associations with fruit and vegetable intake. Fruit and vegetable intake at Time 1 showed the highest correlation with fruit and vegetable intake at Time 3, which reflects some stability of fruit and vegetable intake over a two-week period.

**Model 1: Intention as a predictor of fruit and vegetable intake**

The first estimated model (Figure 2) had intention as the only predictor of fruit and vegetable intake at Time 3, besides the level of fruit and vegetable intake at Time 1 (i.e., past behaviour), and the model fit was good: $\chi^2$ (180) = 340.82, $\chi^2/df$ = 1.89, CFI = .95, TLI =.94, RMSEA = .067, *p* (RMSEA) = .007 , AIC= 442.82.

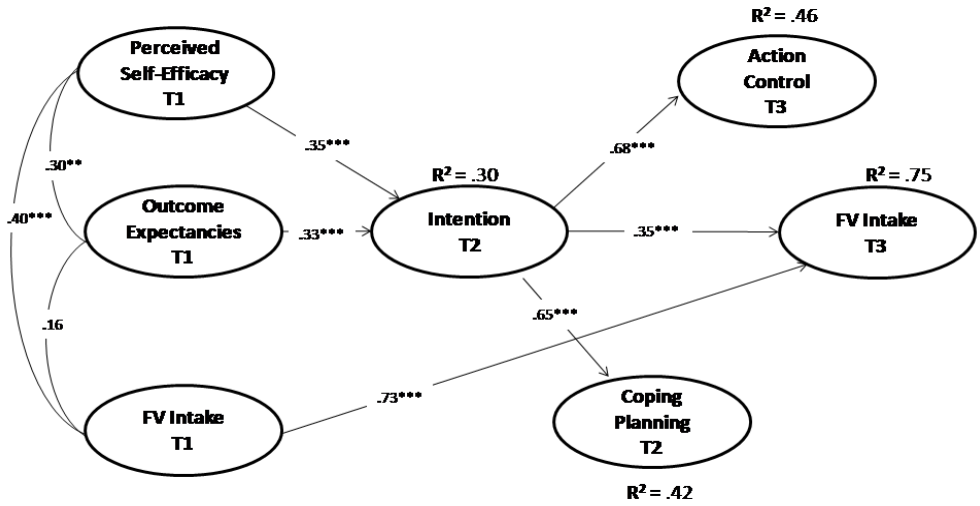


*Figure 2.* Model 1 with standardized coefficient estimates. *Note.* ***p*< 0.01; ****p*< 0.001

In support of the first hypothesis, both perceived self-efficacy and positive outcome expectancies measured at baseline were positively and significantly associated with intentions measured one week later (Time 2), β = .35 and β = .33, *p*<.001, accounting for 30% of the variance in intention. Moreover, as stated in the second hypothesis, intention was positively and significantly related to fruit and vegetable intake a further week later (Time 3), β = .35, *p*<.001, and alone accounted for 35% of the total variance of fruit and vegetable intake at Time 3. Together with the baseline intake level of fruit and vegetables, the total variance explained increased to 75%.

**Model 2: Coping planning and action control as multiple mediators of the relationship between intention and fruit and vegetable intake**

In the second model the paths between coping planning and behaviour and between action control and behaviour were freely estimated (Figure 3). The model fit was again good: $\chi^2$ (178) =336.10, $\chi^2/df$ = 1.89, CFI = .95, TLI =.94, RMSEA = .066, *p* (RMSEA) = .01, AIC =442.10, and the model enabled explanation of 37% of the variance of behaviour (and 80% with past behaviour).

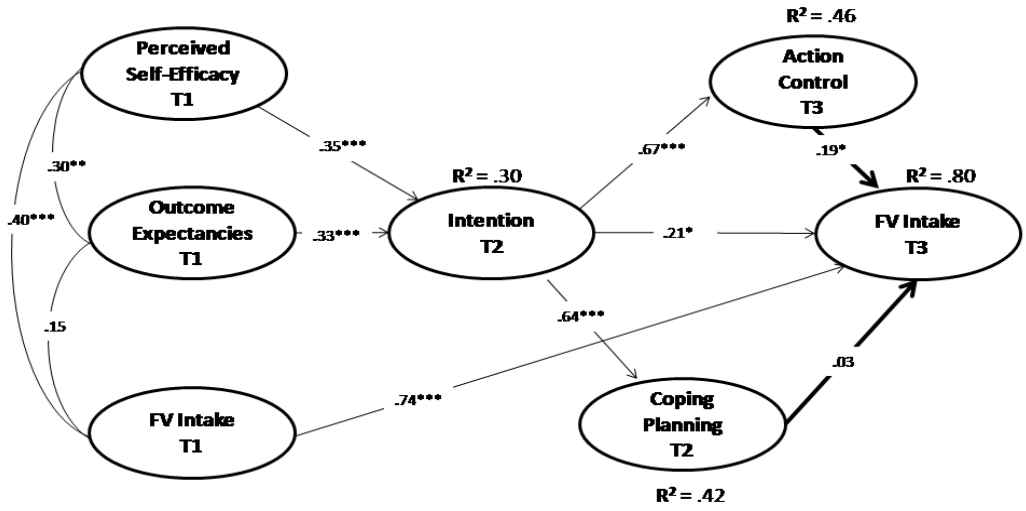


*Figure 3*.Model 2 with standardized coefficient estimates. *Note.* ***p*< 0.01; ****p*< 0.001

Intention was a strong and significant predictor of both coping planning, β = .64, *p*< .001, explaining 42% of its variance, and of action control, β = .67, *p*< .001, explaining 46% of its variance. Coping planning failed to directly predict fruit and vegetable intake at Time 3, β = .03, *p* = .73, but action control proved to be a significant predictor of fruit and vegetable intake, β = .19, *p* = .04. Thus, our third hypothesis was partially confirmed. The inclusion of both volitional predictors lowered the effect of intention over behaviour, β = .21, *p* = .06, revealing partial mediation of the effect of intention on behaviour through action control, β = .14, 95% CI [.03; .34].

**Model 3: Coping planning and action control as sequential mediators of the relationship between intention and fruit and vegetable intake**

In model 3, the path from coping planning to action control to behaviour was freely estimated. This model (Figure 4) also presented a good fit to the data: $\chi^2$ (177) =309.17, $\chi^2/df$ = 1.75, CFI = .96, TLI =.95, RMSEA = .061, *p* (RMSEA) = .059, AIC = 417.17. Intention remained a strong predictor of coping planning, β =.63, *p*< .001, and of action control, β =.42, *p*< .001. Coping planning also predicted action control, β =.39, *p*< .001, and together with intention enabled explanation of 53% of its variance. In turn, action control directly predicted fruit and vegetable intake at Time 3, β =.20, *p* = .05.

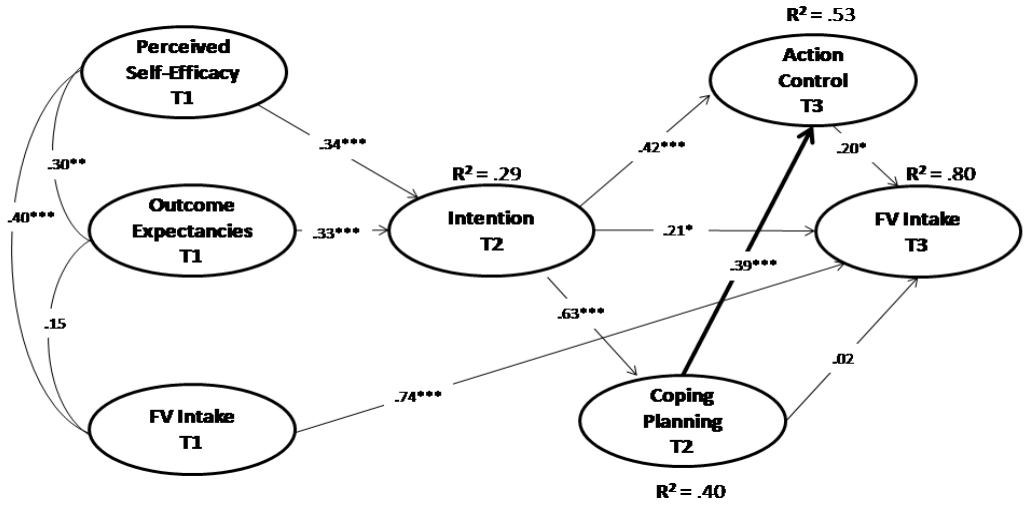


*Figure 4.* Models 3 with standardized coefficient estimates. *Note.* ***p*< 0.01; ****p*< 0.001

The more complex double-mediation was then tested. This three-path mediation examined whether the effect of intention on fruit and vegetable intake was sequentially mediated by coping planning and action control. The indirect effect of intentions on behaviour doubly mediated by coping planning and action control was reliable (Table 2). The direct path from intention to behaviour remained significant, which is indicative of partial mediation, albeit decreasing from β = .35, *p*<.001 to β = .21, *p* = .03, when the indirect path was included. Thus, our fourth hypothesis was confirmed, with both coping planning and action control sequentially mediating the effects of intention on fruit and vegetable intake.

Table 2. *Decomposition of the effect of intention on fruit and vegetable intake at time 3, controlling for fruit and vegetable intake at time 1.*

| | Fruit and vegetable intake | |
|---|---|---|
| | Estimate | 95% CI |
| Total effect | .35 | (.22, .50) |
| Indirect Effects through | | |
| Coping Planning | .06 | (-.04, .18) |
| Action Control | .18 | (.03, .37) |
| Both mediators | .15 | (.01, .31) |
| Direct Effect | .21 | (.02, .40) |

*Note.* Estimates are standardized coefficients. CI = confidence interval

Without past behaviour, the model explained 38% of the variance in fruit and vegetable consumption at Time 3. The third model showed the lower AIC, which is indicative of a better fit. Moreover, when contrasting the third model with the first one, there was a significant increase in the model fit, $\Delta \chi 2$ (3) = 31.64, $p$<.001, and the same occurred when comparing model 3 with model 2, $\Delta \chi 2$ (1) = 26.92, $p$<.001. Thus, model 3, where the sequential mediation was considered, was the best among the tested models.

## 5. Discussion

The present three-wave longitudinal study has examined the psychological mechanisms that might operate in the context of fruit and vegetable consumption. The main focus of the study was on the post-intentional processes and, more specifically, on the role of coping planning and action control as mediators of the relation between intentions and fruit and vegetable intake. As hypothesized, both volitional processes sequentially contributed to the translation of intentions into actual behaviour. This is a new finding, although in line with that of Sniehotta et al. (2005b), where action control was found to mediate the relation between action planning and physical activity, suggesting that planning must be converted into closer monitoring of behaviour in order to affect fruit and vegetable intake. In fact, although the relationship between intention

and behaviour was not mediated by coping planning alone (i.e., when the estimation was based on a two-path, single mediator model), the sequential mediation by coping planning and action control was found to be significant, offering support for such reasoning. Moreover, the time lag between measures of the different processes is also suggestive of the validity of the assumption that planning is a more distal volitional predictor, whereas action control is a more proximal volitional predictor of fruit and vegetable intake.

Double mediation occurred in a sequential manner, with action control following coping planning within the volitional process. Future studies should examine whether the outlined mediational chain varies according to the individual´s stage of readiness to adopt this particular behaviour and make use of experimental designs in order to attest for causality.

Other research, in which perceived self-efficacy was selected instead of action control in addition to coping planning (Kreausukon, Gellert, Lippke & Schwarzer, 2012) has found similar mediation processes, with both constructs simultaneously mediating the relationship between the type of intervention and fruit and vegetable consumption. Coping planning has also been identified as a mediator between experimental conditions and fruit consumption, whereas action planning served this function only for vegetable consumption (Guillaumie et al., 2012), raising the question as to whether analyses should be more behaviour specific, separating fruit from vegetables.

Adding planning components to interventions has induced larger effects than interventions based solely on information provision (Stadler, Oettingen, & Gollwitzer, 2010). Furthermore, several randomized controlled trials have accumulated evidence in favour of the established mediators, coping planning and action control, for dietary (e.g., Guillaumie, et al., 2012; Kreausukon et al., 2012; Lange et al., 2013) and other types of behaviour (e.g., Sniehotta et al., 2006). Thus, planning components and on-going monitoring appear to be useful self-regulatory intervention strategies to promote dietary changes. Future research should examine the circumstances under which other mediators operate (e.g., self-efficacy, action planning, social norms) and whether moderating effects can be identified.

Our first two hypotheses were also confirmed, and are in line with other studies on fruit and vegetable intake (see Guillaumie, Godin & Vézina-Im, 2010), where higher positive outcome expectancies and action self-efficacy measured at baseline were

associated with higher intentions towards fruit and vegetable intake one week later, and intention predicted fruit and vegetable intake a further week later.

Some limitations of this study need to be addressed. The research design was non-experimental which does not allow for causal inferences, although there was at least a temporal order to justify the mediation model. Also, the fact that intention and coping planning were assessed in the same data collection point, as well as action control and behaviour, calls for some prudence in the interpretation of the present findings. All data was self-reported and no objective measures were available. This can generate bias as people may forget to record consumed food items, or to cover up poor eating habits. In spite of this potential bias, there was stability in the average of reported fruit and vegetable consumption over the two-week period, attesting that, at least throughout the study, mere measurement effects did not occur. Moreover, the fact that the sample consisted primarily of women should be taken into account when generalizing the present findings.

The present study contributes to cumulating evidence of the usefulness of the chosen constructs and the demonstrated sequential mediation design. Moreover, it highlights the relevance of action control in the context of fruit and vegetable consumption and how it works in conjunction with coping planning in the translation of behavioural intentions into actual fruit and vegetable intake. This is important, since by revealing the mechanisms involved in fruit and vegetable consumption a valuable backdrop for future intervention studies is provided.

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# 3

# Formative research for health messages development: Target beliefs for audiences at different stages of change

**This chapter is based on the paper**

Godinho, C. A., Alvarez, M.J., & Lima, L. (2013). Formative research on HAPA model determinants for fruit and vegetable intake: Target beliefs for audiences at different stages of change. *Health Education Research, 28,* 1014-1028. doi: 10.1093/her/cyt076

## 1. Abstract

Theoretically-driven health communications are needed to promote fruit and vegetable intake among people at different stages of change. The Health Action Process Approach (HAPA), a clearly specified model and good predictor of fruit and vegetable intake, was used as a framework to guide a formative research for the development of health messages targeting individuals at either a non-intentional or intentional stage of change. A mix-method approach was used, combining eight focus groups ($n$ = 45) and a questionnaire ($n$ = 390). Target beliefs for people at both stages were identified under five theoretical constructs (risk perception, outcome expectancies, action planning, coping planning and self-efficacy). Highlighting health problems due to low fruit and vegetable consumption, health benefits, weight reduction and pleasure, and enhancing self-efficacy to increase fruit and vegetable intake are the main guidelines for designing messages to non-intenders. For intenders, messages should reassure them of their ability to maintain adequate fruit and vegetable consumption, outline specific plans for increased consumption, identify barriers such as preparation, forgetting or being tired and unwilling to eat fruit and vegetables, and suggest strategies to overcome them, such as presenting some practical examples on how to include fruit and vegetables when eating out.

*Keywords:* formative research, message targeting, HAPA stages of change, health message design, fruit and vegetable consumption

## 2. Introduction

Epidemiological evidence supports the crucial role of nutrients present in fruit and vegetables (FV) for the prevention of major diseases such as cancer (Block, Patterson, & Subar, 1992; Danaei, Vander Hoorn, Lopez, Murray, & Ezzati, 2005) and cardiovascular diseases (Dauchet, Amouyel, Hercberg, & Dallongeville, 2006; He, Nowson, & MacGregor, 2006) and its association with lower weight and lower body mass (Kahn et al., 1997; Moreira, & Padrão, 2006) has suggested FV increase is a way of minimizing the obesity pandemic (Rolls, Ello-Martin, & Tohill, 2004). However, many adults do not eat the recommended amount of fruit and vegetables (i.e., 400 grams a day), and, thus, the increase of fruit and vegetable intake among that layer of the population constitutes a major public health goal (WHO /FAO, 2005).

The launch of health campaigns is a common type of intervention for public health purposes (Salmon, & Atkin, 2003; Wakefield, Loken, & Hornik, 2010), and studies have revealed positive effects of this type of intervention for FV consumption (Pomerleau, Lock, Knai, & McKee, 2005; Snyder, 2007). This type of intervention might be especially suited to adult populations since they are responsible for their own dietary choices, unlike most adolescents and children (Kristjansdottir et al., 2006; Young, Fors, & Hayes, 2004). Notwithstanding, certain communication strategies have the potential to increase health communications´ effectiveness for the changing of health behaviours and, ultimately, to contribute towards improving the population´s health. One of such strategies is message targeting (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008), which consists of the development of health messages directed at a specific segment of the audience, increasing the change of compliance with the message recommendations by fitting the message content to the audience´s interests and needs (Noar, Benac, & Harris, 2007).

The effectiveness of health communications also depends on whether they are theoretically-driven. Studies have shown that interventions specifically targeting theoretically established beliefs are more effective in the promotion of health behaviour change (Noar et al., 2007; Michie, & Abraham, 2004). The determinants of health behaviours as established by social cognitive models are, therefore, essential targets for developing messages for the promotion of health behaviours such as FV intake. In particular, stage models of health behaviour change, such as the Health Action Process Approach (HAPA) (Schwarzer, 2008a) are an appealing template for the development of health messages, enabling the development

of messages that are theoretically-driven and, at the same time, relevant for people at different moments of the change process. In the present study, the constructs of the HAPA model will be used to guide the search for contents to include in health messages promoting FV intake in people at different stages of change.

**Health Action Process Approach**

The Health Action Process Approach is a clearly specified hybrid model that has been established as a good predictor of a wide range of health behaviours including FV intake (Schwarzer et al., 2007), and that can be conceptualized as a stage model, mainly for intervention purposes (Schwarzer, 2008b). Health behaviour change is considered a sequence of motivational processes leading to intention formation which are then followed by volitional processes that operate between intention formation and behaviour enactment, thus, helping to fill in the intention-behaviour gap (Schwarzer, 2008a). The volitional phase may be divided into a pre-action and an action phase, and, thus, three stages of change may be defined: non-intentional stage (i.e., preceding intention formation), intentional stage (i.e., after intention formation) and action stage (i.e., after behavioural enactment).

Taken as a stage model, it provides a useful framework for intervention, offering the possibility of segmenting the audience in three specific target groups, for whom particular types of messages are posited as being more effective than an undifferentiated, i.e., "one-size-fits-all", type of message. In each of the stages or "mindsets", distinct social cognitive predictors are relevant for the transition to the following stage. For those at a non-intentional stage (i.e., non-intenders), predictors leading to intention formation, such as *risk perception*, *outcome expectancies* and *action self-efficacy* are the most important targets for intervention (Schüz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009). *Risk perception* pertains to perceiving oneself to be at risk of a certain health condition and might act as a trigger for starting to think about changing one's health behaviour. *Outcome expectancies* concern the anticipation of positive rather than negative consequences resulting from the behavioural change, and *action self-efficacy* is the belief that one will be able to initiate the behavioural change.

On the other hand, those at an intentional stage (i.e., intenders) would mostly benefit from an intervention targeting the proximal predictors of behaviour (i.e., the mediators between intention and behaviour), such as *action planning, coping planning* and *maintenance self-efficacy* (Schwarzer, 2008a). *Action planning* refers to setting up when, where and how one will

perform the intended behaviour and *coping planning* encompasses anticipating barriers that might hinder the accomplishment of the intended changes, as well as strategies for dealing with such barriers. *Maintenance self-efficacy* is vital for the initiation and maintenance of behavioural changes and refers to holding an optimistic belief about one's ability to maintain the behavioural changes.

In short, according to the model, there are theory-specified constructs that constitute relevant targets for an intervention addressing people at different stages of change. However, like other social cognitive models, the HAPA model only provides the "skeleton" (i.e., framework) for the intervention that then has to be supplemented with "flesh and blood" (i.e., substantive contents relevant for the particular audience) (Abraham, Sheeran, & Johnston, 1998). Moreover, the perspective of the health message designer is not necessarily the same as that of the message recipient, and the specific motivations, barriers and self-regulatory strategies related to the adoption of the health behaviour may vary accordingly (Holtgrave, Tinsley, & Kay, 1995). Formative research is, therefore, a crucial step towards a better understanding of the target audience and it is fundamental for identifying the specific contents that should be included in the messages (Atkin, & Freimuth, 2001).

**Content selection under the theoretical constructs**

The specification of evidence-based contents under relevant theoretical constructs for health behaviour change that are important for the target audience is crucial to guide the design of health messages. However, besides eliciting a range of beliefs to give body to each of the relevant theoretical constructs for change in FV intake, it is also necessary to identify those which should be selected to figure in health messages. On this level, some authors have suggested that beliefs differentiating intenders from non-intenders and/or which best predict intentions are important targets when designing an intervention for non-intenders (Armitage, & Conner, 1999). The rationale is that through changing such beliefs there is a higher chance of them being translated into changes in intentions, thus, helping non-intenders to progress to an intentional stage. Applying the same reasoning, when designing an intervention for intenders, the most important targets will be those beliefs that differentiate actors from intenders and/or that best predict behaviour. Those specific beliefs are the ones that will most likely contribute towards translating intentions into behaviours, therefore leading intenders to progress to an action stage.

## Aims

The aims of the present study were to identify and prioritize beliefs under HAPA theoretical constructs that may be used for the development of health messages targeting generally healthy adults whether at a non-intentional or intentional stage of change. Through the use of qualitative methods, we first sought to identify an array of beliefs under the theoretically-specified antecedents of FV intake that could serve as contents for crafting health messages. Then, whenever it was required to sort and prioritize the previously identified beliefs, owing to such a broad range of beliefs being elicited under a single construct, quantitative methods were subsequently used. Hence, through a formative research guided by the HAPA model we expect to support the development of health messages for the promotion of FV intake that may have an impact on theoretically established constructs, in a way that is relevant for each of the target groups.

## 3. Method

The present formative research stems from a pragmatic mixed-method approach, in which both focus groups and a questionnaire were used sequentially to answer the following research questions (Mertens, 2005): 1) the identification of beliefs under the HAPA constructs; 2) the prioritization of identified beliefs. Both data collection techniques are commonly used in formative research (Atkin & Freimuth, 2001). Focus groups allow for the identification of a wide range of lay beliefs under a specific topic that would probably not emerge through other data collection techniques (Bryman, 2004). The use of standardized questionnaires is also important, allowing the systematic measuring of a broad array of variables and is, therefore, particularly helpful for the establishment of a hierarchy of intervention priorities for each target group, while controlling for possible confounds (Atkin & Freimuth, 2001). Therefore, the added value of this mixed-method approach was to combine information on a wide range of beliefs for each theoretical construct (elicited through the focus groups) with information on the relative importance of each belief for the target group (gathered through the questionnaire).

**Identification of beliefs under the HAPA constructs (Focus Groups)**

**Participants**. Forty-five adults, 18 men (aged 20-60; *M* = 34.5; *SD* = 12.6) and 27 women (aged 20-66; *M* = 36.7; *SD* = 15.2), participated in the focus groups. Both to allow for a certain degree of homogeneity in the groups (i.e., people in the group share a characteristic in which the researcher is interested), and a degree of heterogeneity among the groups, enabling the identification of differencesin perspectives across the groups, they were organized in order to bring together individuals at the same stage of change regarding FV intake. A total of eight groups were formed (3 groups of non-intenders; 3 groups of intenders; 2 groups of actors), with 4-7 participants per group. Six of the eight groups, were composed of participants recruited from a professional training centre, the other two were recruited from two faculties of psychology. Focus groups occurred where the recruitment took place. None of the participants had any medical restrictions regarding fruit and vegetable consumption.

**Measures.**

*Fruit and vegetable intake.* Two items based on those of Luszczynska, Tryburcy and Schwarzer (2007), were used to measure FV intake, the first concerning fruit intake and the latter vegetable intake: *"In the last two weeks you ate a (portion of fruit/vegetables)…",* and was followed by some examples of what constitutes a portion of fruit and vegetables. Responses ranged from 0 ("a few times a week or less") to 5 ("more than four times a day").

*Stage of change.* Stage of change followed the criterion of the World Health Organization of eating at least five portions of fruit and vegetables a day and was derived using an algorithm that comprised the answer to FV intake questions and the answer to a question evaluating participants´ intentions regarding FV intake for the following month ("*In the next month, do you intend to eat more portions of fruit / of vegetables a day? If so, how many?)* (Figure 5).

*Questioning guide.* A semi-structured questioning guide that had been previously developed and pilot-tested was used to conduct the focus group sessions, and addressed all the constructs of the HAPA model of interest for this study (Table 3).

**Procedure.** The study and its objectives were presented by the first author during a short break between classes, and those who agreed to participate completed a short questionnaire to

determine their stage of change and leave their contact details for schedule the focus group sessions.

Informed consent was obtained from all participants at the beginning of the focus group session authorizing video-taping for transcription purposes. Two trained moderators were present in each session which lasted, in total, between one hour and one hour and a half. At the end of each session a 20€ voucher was drawn as a reward for participation. Before leaving, participants filled in a questionnaire assessing social demographic data (e.g., age, gender, level of schooling). All the procedures were carried out in accordance with the ethical standards of the APA and were approved by all the institutions involved.

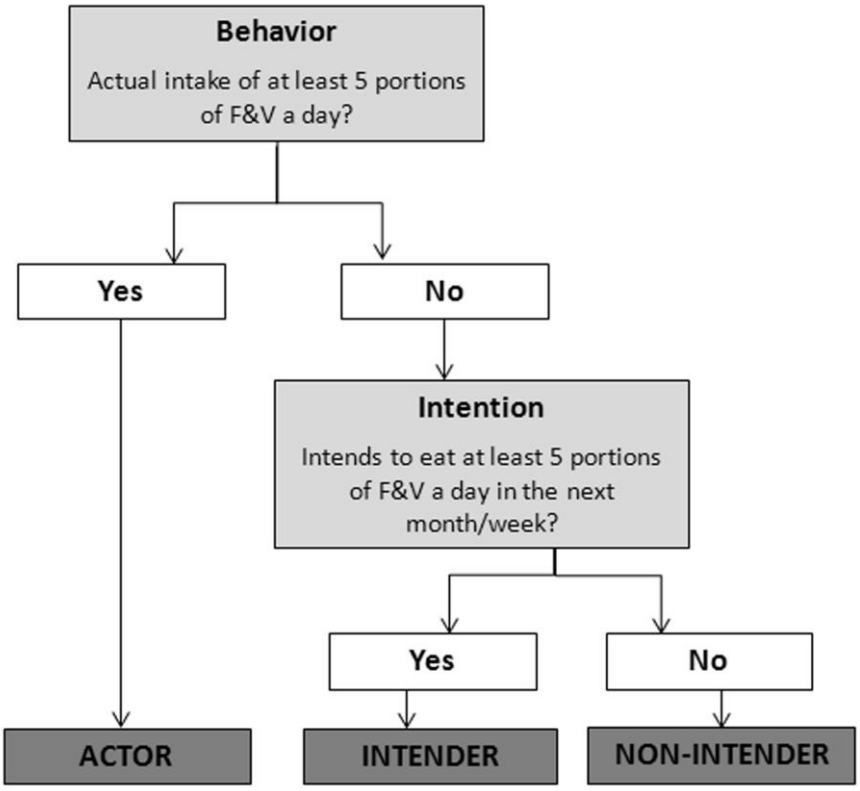


*Figure 5.* Stage of change allocation according to actual behaviour and intention.

**Analytic Strategy**. The content of the focus groups was transcribed verbatim and thematic content analysis was conducted using computer assisted qualitative data analyses software (MAXQDA 10). All names were removed from the texts and replaced by letters to ensure the confidentiality of comments.

Sampling units were defined semantically, by identification of the underlying theme. Coding was carried out using a coding scheme based on the HAPA that included 6 categories for fruit and vegetable consumption determinants (risk perception, outcome expectancies, action self-efficacy, action planning, coping planning and maintenance self-efficacy). The coding of all the transcripts was performed by the first author. Two judges, familiar with the HAPA model, were given the same coding scheme and independently coded 25% of the material. After resolving some disagreements through discussion, the inter-rater agreement was .86 (Krippendorff´s Alpha).

Table 3. *Questioning guide under the topic "Social cognitive determinants for fruit and vegetable consumption".*

| HAPA Constructs | Question sample |
|---|---|
| Risk Perception | "Do you feel at risk of any health problems?" "How did (could) that change your nutritional habits?" |
| Outcome expectancies | "What would be the consequences of eating at least 5 portions of fruit and vegetables a day?" |
| Action Planning | "Imagining you decided to eat at least 5 portions a day, how do you think you could manage to achieve this goal?" |
| Coping Planning (Barriers) | "What difficulties might arise that could prevent you from eating 5 portions a day?" |
| Coping Planning (Strategies) | "How could you overcome those barriers?" |
| Action Self-efficacy | "Would it be easy for you to start eating at least 5 portions of fruit and vegetables every day?"; |
| Maintenance self-efficacy | "Once you had started, do you think it would it be easy to maintain eating those 5 portions a day?"; |

**Prioritizing the identified beliefs (Questionnaire)**

**Participants.** A total of 393 participants, 131 men (aged 17-60; *M* = 30.6; *SD* = 9.5) and 262 women (aged 18-70; *M* = 28.1; *SD* = 8.2), completed an online questionnaire that was distributed through the mailing lists of the two faculties of psychology. None of the participants had any medical restriction regarding the consumption of fruit and vegetables.

**Measures.** An online questionnaire was developed to prioritize beliefs under the constructs addressed in the focus groups where great variability was encountered, namely outcome expectancies (23 items), barriers encountered for eating fruit and vegetables (16 items) and coping planning strategies to overcome those barriers (11 items). Since the information on risk perception and on specific action plans for increasing FV intake, collected through the focus groups, was very consistent across groups and that, although quantitative differences in self-efficacy beliefs were found between people at different stages, no qualitative differences in substantive self-efficacy beliefs were found across stages, these three constructs were not included in the questionnaire. Thus, the information was considered as being sufficiently informative for health messages´ development.

*Outcome expectancies.* The outcome expectancies measure began with "*What do you think (are/would be) the consequences (of eating /if you started to eat) at least 5 portions of fruit and vegetables every day? If I ate at least 5 portions of fruit and vegetables a day...",* and was followed by 23 positive and negative outcomes (e.g., *"I would feel better"; "I would not feel satiated after meals"*) that were derived from the qualitative analysis of the focus groups. Responses were given on a 7-point scale ranging from 1 ("totally disagree") to 7 ("totally agree"). The reliability of this scale was α = .76.

*Coping Planning (Barriers).* Participants were asked *"To what extent do you think each of the following things (make it difficult / could make it difficult) to eat at least 5 portions of fruit and vegetables a day, provided you decided to eat this amount of fruit and vegetables a day?".* A total of 16 barriers identified through the qualitative analysis (e.g., *"I hardly ever feel like eating fruit and vegetables"*; *"It is hard to find options that include fruit and vegetables when eating out"*) were included as items. The response scale ranged from 1 ("it does not make it difficult at all") to 7 ("it makes it a lot more difficult"). The reliability of the scale was α = .86.

*Coping Planning (Strategies).* The question: *"As a way to overcome the barriers that prevent you from eating more fruit and vegetables, to what degree would it be important for you…"*, was followed by 11 items (e.g., *"to make healthier options, that include fruit and/or vegetables when eating out"*; *"to buy fruit to have at work"*) which were strategies derived from the analysis of the focus groups. Responses were given on a 7-point scale with endpoints of 1 ("not important at all") to 7 ("very important"). The reliability of the scale was $\alpha = .86$.

*Intention.* Two items, one for fruit and another for vegetables, were used to access the intention to eat FV: *"Do you intend to eat more (fruit/vegetables) in the following month? If so, how many portions of (fruit/vegetables) do you intend to eat daily in the next month?".* Responses were given on a 4-point scale ranging from 1 ("definitely not") to 4 ("definitely yes"). The inter-correlation between the intended amount of fruit intake and of vegetable intake was moderate and significant ($r = .51$, $p < .001$).

*Fruit and vegetable intake.* Two items were used to measure FV intake, the first concerning fruit intake and the latter vegetable intake: *"In the last two weeks you ate a (portion of fruit/vegetables)…",* and was followed by some examples of what constitutes a portion of fruit and vegetables. Responses ranged from 0 ("a few times a week or less") to 5 ("more than four times a day"). The inter-correlation between the amount of fruit intake and vegetable intake was moderate and significant ($r = .46$, $p < .001$).

*Stage of Change.* Based on the responses to the items accessing actual intake and intentions regarding fruit and vegetable consumption, stage of change was determined by means of the same algorithm used on the focus groups (see Figure 5).

**Procedure.** Invitations to participate in the study were made by an e-mail presenting the purpose of the study (i.e., getting to know peoples´ ideas about food and nutrition) and containing the link to access the questionnaire. Prior to responding to the online questionnaire, participants were assured about confidentiality of all the data to be collected. Their informed consent was then provided in accordance with the ethical standards approved by both institutions at the time the study took place.

**Analytic Strategy.** In order to determine if there were differences between non-intenders and intenders regarding specific outcome expectancy beliefs and between intenders and actors

regarding specific barriers and strategies, multiple ANCOVAs were run, one for each specific belief. Variables where differences were found between stages of change groups, such as gender, age, having children, household income level and residence area, were included as covariates.

With a view to determining the outcome expectancies that were the best single predictors of intention, a regression analysis was conducted for the 23 beliefs on intention. This analysis was performed using the non-intenders sub-sample, given that the non-intenders group is the one that would benefit more from an increase in positive outcome expectancies and/ or a decrease in negative outcome expectancies. A further two regressions were performed both for barriers and strategies for eating FV on behaviour. These analyses were performed using the intenders sub-sample, given that intenders were expected to benefit more from an intervention targeted at coping planning beliefs. All regressions performed used the stepwise method to select the best set of predictors. This method was chosen because it is specially recommended when the predictors are significantly correlated (Fox, 1997).

Finally, for the selection of the specific outcome expectancies, barriers and strategies to overcome those barriers to be included in the health messages, three criteria were sequentially articulated: 1) those that enabled to establish significant differences between the target groups (Armitage & Conner, 1999); 2) those that were predictors of intention (in the case of outcome expectancies) or of behaviour (in the case of barriers and strategies) (Armitage & Conner, 1999) and; 3) those that were rated as being relevant/ important by the target group.

## 4. Results

### Focus Groups

**Descriptive findings.** The average intake of FV for the whole sample was 2.95 (*SD* = 2.31), 1.87 (*SD* = 1.45) among non-intenders, 1.82 (*SD* = 1.13) among intenders and 6.27 (*SD* =1.27) among actors. In total, 75 % of the sample ate less than the minimum amount recommended by the World Health Organization (i.e., less than 5 portions a day).

Some differences were found among participants across stages of change, with more men participating in groups of non-intenders, $\chi^2$ (2) = 6.99, $p$ = .03, and more actors living in rural areas $\chi^2$ (2) = 12.48, $p < .01$. However, there were no significant differences across the stage

of change groups in terms of age, schooling, income level, having children and number of people in the household.

**Identification of beliefs under HAPA constructs.**

*Risk perception.* Several participants mentioned having changed or being willing to change their habits regarding the consumption of FV after experiencing a health problem. Older participants, in particular, referred to having changed their diets due to a health condition or for being currently more concerned about their health than when they were younger. Some younger participants also referred to the fact that having a health problem would be the only reason to motivate them into eating more FV: *"Getting a fright, I would have to have a fright to shake me up"* [Group 6, man, 23].Others mentioned that becoming a parent had made them think more realistically about the risks of bad nutritional habits, which was an important trigger to their changing process. Although participants recognized that FV intake is generally good for health, some revealed that they were not aware of the risks of low FV intake or of the benefits of eating FV for the prevention of specific diseases such as cardiovascular diseases and cancer: *"I knew we should eat 5 portions of fruit and vegetables a day, but I did not know that could help to prevent cancer"* [Group 1, woman, 21]. Furthermore, many participants showed that they were not aware of the recommended amount of FV that should be eaten every day.

*Outcome expectancies.* A high range of outcome expectancies for fruit and vegetable consumption were identified through analysis of the qualitative data. In general, outcome expectancies for fruit and vegetable consumption were mostly positive. The most cited positive outcome expectancies were health benefits, including having a healthy lifestyle, having better health, and preventing diseases such as cancer and cardiovascular diseases. Pleasure in eating fruit and vegetables and weight reduction were the second and third most common outcome expectancies related to fruit and vegetable consumption. Other positive outcome expectancies included well-being, looking better and slower aging and being socially accepted and trendy (e.g., *"It's somewhat fashionable. [People associate] salad, healthy… Advantage is taken of this"* [Group 8, woman, 40]). Some participants also referred to eating fruit and vegetables as a means to compensate for other unhealthy behaviours (e.g., overeating, eating non healthy foods and for not doing physical exercise) or an alternative option to eating other foods (e.g., *"Because by doing so, I actually eat less of the main meat or fish dish."* [Group 7, woman, 20]).

Negative outcome expectancies were far less cited, and were only mentioned by non-intenders and intenders, not by actors. Several participants shared the belief that most of the fruit and vegetables available nowadays in the market are of poor quality due to a high amount of pesticides used in their cultivation and their poor nutritional properties *(*e.g., *[fruit and vegetables] no longer have so many vitamins and properties…."* [Group 4, man, 55]). Other negative outcome expectancies included dislike and fruit and vegetables not being fulfilling enough (e.g., *"it is often far more important for people to feel full with pasta, rice and potatoes rather than being fulfilled with fruit or lettuce which do not fill at all"*[Group 3, woman, 46]). Fewer participants mentioned the discomfort when eating fruit and vegetables in some social contexts, such as parties (e.g., *"The other day I was at a party and someone said: "There you are, eating healthily!" [meaning] "You are not letting yourself go like us""*[Group 6, woman, 42]) or taking fruit and vegetables from home to eat at work or at school (e.g., *"in terms of society, at least this is how I see it, people live according to the opinions of others rather than in terms of what they feel like doing or what is actually good for them. Thus (...) not being used to taking a piece of fruit may also be related to this: "It is pointless, people would make fun of me*" " [Group 3, man, 24]). One participant even said that it might not be healthy or advisable to eat the five portions a day, because in that case one would not be eating the necessary amount of proteins that should be part of a balanced diet. Another mentioned that in such cases people would be taking in more calories than they would burn.

*Action planning.* Plans regarding eating five or more portions of fruit and vegetables per day were consistent across participants in all stages of change, and included eating soup at lunch and dinner, accompanying main dishes with a salad or vegetables, and eating fruit throughout the day (before or at breakfast, mid-morning, mid-afternoon, before going to bed). One participant suggested: *"If one eats fruit mid- morning, another mid- afternoon, opting at lunch for soup and a salad, and arriving home at night and having another soup and another piece of fruit, I think we will already have reached the five [portions]"*[Group 4, woman, 47] ). Eating soup was mentioned in all groups and - with few exceptions - represented a very important form of vegetable consumption for the majority of participants: *"I always have to eat soup at lunch - soup is essential."* [Group 2, woman, 53].In contrast, only a few participants mentioned drinking natural juices. When planning how to increase their intake of fruit and vegetables, some participants said they could take fruit and vegetables with them to school / work or when going to the beach and cook with more vegetables (e.g., *"making an effort every day. When I*

*am cooking, using vegetables every day and always being willing to use vegetables"*[Group 6, man, 23]).

*Coping planning.* Several barriers for eating 5 or more portions of fruit and vegetables a day were identified by participants of the focus groups. Lack of time and/or having a stressful life, difficulties related to the preparation of fruit and vegetables, and eating out were the barriers that were most mentioned by participants. Lack of time and /or having a stressful life (e.g., *"Stress… Work demands so much of people that they don't even think about it"* [Group 4, man, 23]) were only mentioned by non-intenders and intenders. The preparation of fruit and vegetables as a barrier included peeling (e.g., *"Fruit is not the easiest thing to eat; because it normally has to be peeled and gets your hands dirty (…)"* [Group 6, woman, 42]), washing (e.g., *"Perhaps it would take longer as they have to be washed. A packet of biscuits is more practical for me; I just put it in my bag, and that's it!"* [Group 4, woman, 44]), cooking (e.g., *"Yes, meat is much easier, much quicker. (…) [Fruit and vegetables] involve more work…"* [Group 4, woman, 44]) and knowing how to cook FV (e.g. *"Usually, the majority of people do not know how to cook them"* [Group 4, woman, 47]). Eating out was also a very cited barrier, since fruit and vegetables were often not available in places where people go to eat and that it was not practical to take fruit or vegetables to eat in the workplace/ school (e.g., *"I end up taking as little as possible so I don't have to carry too much around with me. So, I just have a main dish and that is enough!"*[Group 3, man, 24]) or even that it was easier to give into temptations when eating out.

Other barriers that were mentioned less frequently were that fruit and vegetables were not tempting and that they were pricey. A few participants also shared some nutritional beliefs that might have prevented them from eating more fruit (e.g., that one should avoid eating more than one type of fruit at a time, or eating acidic fruits, like oranges, in the evening). Making just a few meals per day, not being used to eating FV, forgetting to eat FV and fatigue, especially in the evening, after a tiring day and arriving home late, were also less frequently mentioned as barriers to FV consumption.

Groups diverged in the number of barriers to the consumption of 5 or more portions a day that were cited. Non-intenders indicated more barriers than intenders, and actors could only recall very few barriers. Furthermore, the type of barriers invoked varied across groups: lack of time /having a stressful life and lack of quality / trusting the quality of the available FV were more referred to by non-intenders than by the other stages, whereas intenders, who were already

willing to eat more fruit and vegetables, mentioned more barriers related to the preparation of FV than people at the other stages.

Participants mentioned several strategies for overcoming these barriers, such as: planning meals ahead and taking food from home; making healthy choices to include FV when eating out (e.g., asking for salads, soup and fruit when eating at restaurants and cafes); making fruit and vegetables look and taste better (e.g., adding some condiments in the preparation of vegetables or serving fruit with yoghurt); showing that fruit and vegetables are easy to prepare, being a practical choice when one has little time; showing that fruit and vegetables are not expensive; and to acquire the habit of starting a meal with soup and ending it with fruit. One participant revealed another kind of strategy used: *"I buy three types of vegetables at a time. […] When I'm not willing to cook them, "Oh, I have to cook it, because otherwise it will go bad"* [Group 8, woman, 39].

*Self-efficacy beliefs*. Regarding action self-efficacy, most of the participants expressed the belief that eating 5 portions a day was a realistic goal, although it might not always be easy to achieve, since in order to do so frequently means changing well-established eating habits and routines: "*You only need to have soup at lunch and dinner; an apple at lunch and mid-afternoon and that's it, you've got the five portions (…) but it's [hard to change] a habit!"* [Group 8, woman, 2].There were, nonetheless, some differences across groups. Whereas none of the actors expressed a lack of confidence in being able to eat 5 portions of FV a day, almost half of the non-intenders and some intenders expressed the thought that eating 5 portions of FV a day was an unrealistic goal and that it would not be easy to do it on a regular basis.

With regard to maintenance self-efficacy, opinions were consensual. Regardless of the stage of change, participants shared the belief that once one started eating 5 or more portions of fruit and vegetables a day, it was not difficult to maintain: *"I think it is really hard to change. But from the moment we start that routine, after we miss that piece of fruit or that meal… For instance, for me eating a meal without greens, I feel something is missing…"*[Group 3, woman, 46]. Fruit and vegetable consumption was, thus, conceived as a habit that once acquired is difficult to break. One participant stated: *"Several years ago, I hardly ever ate soup or vegetables. But now, I could not let a single day go by without soup"* [Group 3, woman, 49].

**Online questionnaire**

**Descriptive findings.** The average FV intake was 3.25 portions a day (*SD* = 1.94) for the whole sample, with an average intake of 2.11 (*SD*= 1.23) among non-intenders, 3.00 (*SD*= 1.14) among intenders, and 5.77 (*SD*= 1.16) among actors. A total of 73.8% participants ate less than five portions a day, with 52.9% of the sample being classified as non-intenders, 20.9% as intenders and 26.2% as actors.

Several differences were found across stages of change, with more men being classified as non-intenders, $\chi^2$ (2) = 13.14, *p*< .01, the mean age of actors being higher than that of non-intenders, *F* (2, 325) = 5.47, *p* < .01, more actors having children, $\chi^2$ (2) = 11.68, *p*< .01, more actors reporting having a household income level of above 2400€ per month, $\chi^2$ (10) = 18.31, *p* = .05, and less non-intenders living in a rural area, $\chi^2$ (2) = 6.48, *p* < .05. However, there were no differences between stages regarding schooling or number of household members.

**Prioritizing the identified beliefs.**

*Outcome expectancies.* A total of eight outcome expectancies differed significantly between non-intenders and intenders, with positive outcome expectancies being higher among intenders and negative outcome expectancies being higher among non-intenders (Table 4). When compared to non-intenders, intenders were more keen to agree that were they to eat 5 portions of fruit and vegetables a day they: *would improve health*, *F*(1, 206) = 8.45, *p* < .01; *would prevent cardiovascular diseases*, *F*(1, 206) = 8.62, *p* < .01*; would be an example to their children*, *F*(1, 206) = 4.94, *p* = .03, *would feel better F*(1, 206) = 6.17, *p* = .01, *would prevent cancer*, *F*(1, 206) = 6.64, *p* = .01, *would eat less of other less healthy foods*, *F*(1, 206) = 8.02, *p* < .01, *would feel satisfaction and pleasure*, *F*(1, 206) = 18.77, *p* < .001. Conversely, non-intenders agreed more than intenders that eating 5 portions of fruit and vegetables a day *would be a sacrifice*, *F*(1, 206) = 6.04, *p* = .02.

The linear multiple regression analysis indicated that among non-intenders, four outcome beliefs independently predicted intention : *I would improve my health*, β = 0.32 , *t* (203) = 4.53, *p*< .001, *I would feel satisfaction and pleasure,* β = 0.27 , *t* (203) = 4.12 , *p*< .001, *I would lose some weight,* β = 0.18 , *t* (203) = 2.78, *p* = .01, *I would encourage my family to eat better* β = -0.15 , *t* (203) = 2.20, *p* = .03. Each of these beliefs independently accounted for between 2 and 8% of the variance of intention. Together, these four beliefs accounted for 21.7% of the variance of intention (Table 4).

*Coping Planning*. Five barriers were significantly rated as being more important for intenders than for actors: feeling tired, $F(1, 131) = 5.03$, $p = .03$, forgetting, $F(1, 131) = 6.32$, $p = .01$, considering that fruit and vegetables go bad very easily, $F(1, 131) = 12.26$, $p < .01$, not having the desire to eat them, $F(1, 131) = 3.86$, $p = .05$ , and preparation, $F(1, 131) = 4.13$, $p = .04$. There was also a trend towards significance for the barrier "perceiving one's life as being stressful", $F(1,131) = 3.35$, $p = .07$ (Table 5). No strategy was differentially rated between groups of intenders and actors (Table 6).

Two linear multiple regression analyses were run independently: one for the barriers and another for the strategies. The results show that forgetting to eat fruit and vegetables was a significant predictor of behaviour among intenders, $\beta = -0.26$, $t(80) = -2.45$, $p = .02$, meaning that the more intenders reported forgetting to eat FV, the less they ate fruit and vegetables. This barrier accounted for 1.6% unique variance on behaviour. Furthermore, among intenders, knowing that it is possible to save money by eating fruit and vegetables, $\beta = -0.36$, $t(79) = -3.16$, $p < .01$, and adding other ingredients or condiments to fruit and vegetables, $\beta = 0.23$, $t(79) = 2.03$, $p = .05$, were predictors of behaviour. Together, these two strategies account for 9.7% of variance of behaviour.

Table 4. *Estimated marginal means and standard deviations for outcome expectancies for non-intenders and intenders and semipartial correlation coefficient for intention among non-intenders.*

| **Outcome expectancies** | **Means (standard deviations)** | | **Semipartial $R^2$** |
|---|---|---|---|
| | Non-Intenders | Intenders | |
| I would improve my health | 5.91** (.08) | 6.33 (.12) | .08** |
| I would prevent cardiovascular diseases | 5.75** (.08) | 6.16 (.12) | n.s. |
| I would be an example to children | 5.56* (.10) | 5.96 (.15) | n.s. |
| I would feel better | 5.45* (.10) | 5.89 (.15) | n.s. |
| I would encourage my family to eat better | 5.14 (.11) | 5.60 (.18) | .02* |
| I would look better | 5.13 (.11) | 5.25 (.16) | n.s. |
| I would slow aging | 5.08 (.10) | 5.36 (.16) | n.s. |
| I would prevent cancer | 5.06** (.09) | 5.48 (.14) | n.s. |
| I would eat less of other less healthy foods | 5.02** (.14) | 5.71 (.22) | n.s. |
| I would lose some weight | 4.85 (.13) | 5.25 (.20) | .03** |
| I would live longer | 4.84 (.10) | 5.02 (.15) | n.s. |
| I would feel satisfaction and pleasure | 4.83** (.09) | 5.58 (.14) | .06** |
| I would cause a good impression on others | 4.18 (.13) | 4.11 (.20) | n.s. |
| I could compensate for other unhealthy habits (e.g., over-eating, not exercising) | 4.15 (.15) | 4.09 (.24) | n.s. |
| I would have to make an effort to learn how to cook with vegetables | 3.69 (.15) | 3.26 (.23) | n.s. |
| I would have to spend more time preparing meals | 3.49 (.14) | 3.15 (.22) | n.s. |
| I would not feel satiated after meals | 3.01 (.13) | 2.69 (.20) | n.s. |
| I would compromise my social life (especially in parties, with friends) | 2.66 (.13) | 2.39 (.20) | n.s. |
| I would feel inadequate in certain situations | 2.63 (.12) | 2.20 (.19) | n.s. |
| My eating patterns would not be healthier because of this | 2.55 (.13) | 2.79 (.20) | n.s. |
| I would have to start eating fruit and vegetables that do not have good quality | 2.52 (.12) | 2.47 (.18) | n.s. |
| It would be a sacrifice for me, because I don´t like fruit / vegetables very much | 2.41* (.12) | 1.86 (.19) | n.s. |
| People would make fun of me | 1.68 (.10) | 1.39 (.15) | n.s. |
| | | | Adjusted $R^2$ = .217 |

*Note.* 'Gender', 'Age', 'Area of residence', 'Having (or not) children' and 'Income level of the household' were included as covariates in the ANCOVAs; Non-Intenders, $n$ = 150; Intenders, $n$ = 62.
*$p$ < .05; ** $p$ < .01.

Table 5. *Estimated marginal means and standard deviations for barriers among intenders and actors and semipartial correlation coefficient for behaviour among intenders.*

| **Coping Planning (barriers)** | **Means (standard deviations)** | | **Semipartial $R^2$** |
|---|---|---|---|
| | Intenders | Actors | |
| It is hard to find options that include fruit and vegetables when eating out | 3.87 (.26) | 4.01 (.23) | n.s. |
| My life is very stressful | 3.37 (.22) | 2.69 (.21) | n.s. |
| When I am tired I do not feel like eating fruit and vegetables | 3.34* (.24) | 2.53 (.22) | n.s. |
| Fruit and vegetables are expensive | 3.33 (.24) | 3.08 (.22) | n.s. |
| I forget to eat fruit and vegetables | 3.14* (.23) | 2.34 (.21) | .16** |
| I have little time during my daily life | 3.12 (.23) | 2.86 (.21) | n.s. |
| I do not trust the quality of the fruit and vegetables that are available (they have lots of pesticides) | 3.12 (.23) | 2.63 (.21) | n.s. |
| I do not buy fruit and vegetables very often because they go bad very easily | 3.05** (.21) | 2.10 (.20) | n.s. |
| I do not eat many meals per day | 2.96 (.23) | 2.60 (.21) | n.s. |
| Fruit and vegetables are not very practical to eat on some occasions | 2.96 (.23) | 2.76 (.22) | n.s. |
| I do not eat acidic fruit at night, like oranges | 2.76 (.25) | 2.48 (.23) | n.s. |
| The majority of fruit and vegetables have poor quality and taste | 2.71 (.21) | 3.35 (.19) | n.s. |
| I hardly ever feel like eating fruit and vegetables | 2.58* (.21) | 1.96 (.19) | n.s. |
| It is laborious to peel fruit and to prepare vegetables | 2.43* (.21) | 1.85 (.19) | n.s. |
| One should not eat different fruit at the same time | 2.04 (.21) | 1.93 (.20) | n.s. |
| I do not like the smell that lingers on my hands after peeling some fruit | 1.71 (.18) | 1.56 (.16) | n.s. |
| | | | Adjusted $R^2$ = .07 |

*Note.* 'Gender', 'Age', 'Area of residence', 'Having (or not) children' and 'Income level of the household' were included as covariates in the ANCOVAs; Intenders, $n$ = 62; Actors, $n$ = 75.
*$p$ < .05; ** $p$ < .01.

Table 6. *Estimated marginal means and standard deviations for strategies among intenders and actors and semipartial correlation coefficient for behaviour among intenders.*

| **Coping Planning (strategies)** | **Means (standard deviations)** | | **Semipartial $R^2$** |
|---|---|---|---|
| | Intenders | Actors | |
| To choose more healthy options, that include fruit and vegetables, when eating out | 5.73 (.19) | 5.39 (.18) | n.s. |
| To buy fruit to have at work | 5.54 (.20) | 5.72 (.18) | n.s. |
| To better plan the meals | 5.51 (.20) | 5.16 (.19) | n.s. |
| To acquire the habit of starting the meal with soup or salad and end it with fruit | 5.45 (.20) | 5.45 (.19) | n.s. |
| To know that there are quick and practical ways of preparing fruit and vegetables | 5.21 (.20) | 5.48 (.18) | n.s. |
| To know that it is possible to save some money by eating more fruit and vegetables | 5.19 (.22) | 4.93 (.20) | .11** |
| To take food from home that includes fruit and /or vegetables when eating out | 4.94 (.22) | 5.29 (.20) | n.s. |
| To add other ingredients or condiments to fruit and/or vegetables to improve their appearance and taste | 4.22 (.26) | 3.76 (.24) | .05* |
| To keep fruit at home in a more accessible place | 4.12 (.24) | 4.19 (.22) | n.s. |
| To buy a lot of fruit and vegetables to then feel obliged to eat them | 3.40 (.24) | 3.72 (.22) | n.s. |
| To peel / prepare a lot of fruit at once and have it ready to eat in the fridge | 3.37 (.26) | 2.99 (.24) | n.s. |
| | | | Adjusted $R^2$ = .097 |

*Note.* 'Gender', 'Age', 'Area of residence', 'Having (or not) children' and 'Income level of the household' were included as covariates in the ANCOVAs; Intenders, $n = 62$; Actors, $n = 75$.
*$p < .05$; ** $p < .01$.

## 5. Discussion

Research has established that interventions and particularly health communications are more effective when targeted and grounded on theory (Noar et al., 2007). However, many campaigns are still not theoretically-guided or evidence-based, and that has been pointed as a reason for the mixed findings on health message effectiveness (Abraham et al., 1998). In the present study we conducted a formative research based on the HAPA model that can be used to sustain the development of theory-based health messages promoting FV intake. Our interest was to unravel the substantive contents under the constructs proposed by the model as being important targets for intervention both for non-intenders and intenders.

### Target beliefs for non-intenders

The findings of the present study support the premise that messages targeted at non-intenders should focus on increasing personal risk perception towards several health problems due to low consumption of FV. This, in turn, will contribute to an enhancement of the self-efficacy perception to follow the recommendations for FV consumption and to stress positive outcomes related to FV consumption.

While perceiving oneself to be at risk of a health condition might not be enough for individuals to succeed in changing their eating habits (Schwarzer et al., 2007; Schwarzer, & Renner, 2000), it might, nonetheless, be a trigger to start contemplating changing one's diet. Different events over the life cycle – becoming a parent, growing older or suffering from a disease – were indicated as crucial turning-point moments in relation to eating patterns. Therefore, risk perception might still be an important intermediate target variable when developing health messages for non-intenders, in order to personalize the risk and deter defensive optimism (Renner & Schwarzer, 2003). Clearly communicating the standards related to the amount of FV that should be eaten daily is also of paramount importance, especially in countries where the campaigns related to FV intake have not included a quantitative recommendation so far. Hence, some individuals may not feel at risk simply because they think that they are already eating an adequate amount of FV, even if such is not the case.

Our findings showing that non-intenders were less confident in their own ability to start eating at least 5 portions of FV per day (i.e., action self-efficacy), when compared to intenders and actors, are in line with both the theoretical expectations derived from the HAPA model and results of previous studies showing that self-efficacy is one of the factors most strongly and

consistently associated with actual FV intake (Resnicow et al., 2000). Considering that self-efficacy may be promoted by verbal persuasion (Bandura, 1997) and that interventions in self-efficacy beliefs have proven to be successful in increasing FV intake (Luszczynska et al., 2007), enhancing individuals' action self-efficacy towards FV consumption should also be a goal of health communications targeting non-intenders.

In keeping with previous studies on the determinants of FV consumption (Brug, Debie, van Assema, & Weijts, 1995; Strolla, Gans, & Risica, 2006), the most important outcome expectancies were related to the positive health consequences of eating FV, to the satisfaction and pleasure (or "liking") provided by eating FV and to losing weight. Interestingly, these beliefs were simultaneously the most cited in the qualitative part of the study, allowing for a distinction of non-intenders from intenders, while also being predictors of the intention to increase FV intake, therefore revealing some consistency in the overall pattern of findings. Such beliefs should, therefore, be included in health messages targeting non-intenders.

**Target beliefs for intenders**

Messages targeted at intenders should focus on presenting concrete action plans for increasing FV intake that are in line with already existing eating patterns and outline some common barriers faced by those wanting to increase their FV intake as well as possible ways of overcoming such barriers. Verbal incentives reassuring the message recipients about their competence to maintain an adequate daily consumption of FV, even in face of obstacles, is also recommended.

Plans to increase FV intake (i.e., action planning) were very consistent across groups and were built around nutritional habits that tend, nonetheless, to vary substantially across cultures. For example, references to vegetable soup were very frequent in the discourses of the focus group participants and assumed a prominent position in the plans they made on how to increase the amount of FV eaten every day. This observation is consistent with the results of a survey on nine European countries showing that unlike the northern countries where raw vegetables are consumed to a larger extent, the main intake of vegetables of Portuguese children comes from vegetable soup (Yngve et al., 2005). The same applies to drinking natural fruit juices that were seldom mentioned by the focus groups participants, while in other countries such as Austria and the Netherlands natural fruit juices constitute an important part of the overall FV

intake (Yngve et al., 2005). Therefore, health messages aiming to increase FV consumption should also be sensitive to the existing dietary patterns of the audience in question.

As for the barriers, besides FV preparation, environmental constraints, such as lack of time, price, and availability, were the most commonly cited. These factors have frequently been mentioned in studies exploring the barriers for FV intake (Brug et al., 1995; Strolla et al., 2006), although the environmental constraints were not found to differentiate people at different stages nor to predict behaviour. Even if expectations stemming from the HAPA model pointed to self-regulation of behaviour as playing an important role in the transition from an intentional to an action stage, to our knowledge beliefs related to self-regulation, such as lack of self-regulatory strength (i.e., *"When I am tired I do not feel like eating fruit and vegetables*) and lack of awareness (i.e., "*I forget to eat fruit and vegetables"*) have not been put forward in previous studies mentioning the barriers for FV intake (Brug, de Vet, de Nooijer, & Verplanken, 2006; Chuan Ling & Horwath, 2001). Nonetheless, these emerged as important barriers for intenders, distinguishing them from actors, and the latter example being a predictor of behaviour. Other barriers worth considering when developing messages for intenders should be that FV spoil easily and not feeling like eating FV and preparing them.

None of the strategies mentioned for increasing FV intake differentiated intenders from actors, but adding other ingredients to FV to improve their appearance and taste was predictive of behaviour and should, therefore, be considered for message development targeting intenders. The negative relationship between saving money by eating more FV and behaviour may stem from the fact that the more individuals eat FV the less they value the economic argument as an incentive for eating FV. Nonetheless, experimental research must be conducted in order to determine the actual causal direction.

In all stages people agree on their ability to maintain the eating of 5 portions of FV a day, once started. This maintenance self-efficacy belief was rooted in the view that FV consumption is mainly determined by habit. In fact, although not explicitly included in the HAPA model, habit or "past behaviour" has been regarded as an important determinant of behaviour (Aarts, Verplanken, & Knippenberg, 1998) and has been identified as an important predictor of eating behaviours (Pollard, Kirk, & Cade, 2002). When geared towards adult populations, health messages on FV intake can either reinforce already existing habits in the sense that those behaviours become even more frequent (Brug et al., 1995), or take advantage of context-disruptive events such as life-cycle transitions for the implementation of novel routines (Devine, Connors, Bisogni, & Sobal, 1998). In either case, and despite this optimistic view, the

fact that habits are not established from one day to another, and that barriers might arise in the process of behavioural maintenance should be borne in the mind of the audience. Therefore, strengthening beliefs of maintenance self-efficacy when faced with barriers should be an intervention goal towards intenders.

**Limitations**

Some limitations may be pointed out in this study. The results were obtained with a convenience sample and might, therefore, not be indicative of the whole target population. Since participation was voluntary, these people may very well have been particularly interested in the topic, thus, introducing some bias. Moreover, cultural influences might play a role, as outlined above, even if, overall, the present findings are very similar to studies conducted in other countries (Brug et al., 1995; Strolla et al., 2006). Also, due to the cross-sectional nature of the quantitative part of the study, it is not possible to draw firm conclusions as far as causality is concerned.

**Conclusion**

The present research study contributes to the identification of an array of beliefs on FV intake under theoretical constructs of the HAPA model that are relevant for the construction of health messages, targeted at different stages of change. Future research should investigate whether health messages designed on the basis of the present findings would be more effective in the promotion of FV intake when matched to individuals´ stage of change than when they are mismatched. Hence, support would be provided both for the described development process and for the relevance of the use of the stage of change construct when targeting health messages.

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# 4

# Promoting fruit and vegetable consumption at different stages of change: A complete match-mismatch design

**This chapter is based on the paper**

Godinho, C. A., Alvarez, M.J., Lima, L., & Schwarzer, R. (submitted). Health messages to promote fruit and vegetable consumption at different stages: A complete match-mismatch design.

## 1. Abstract

*Objective:* To examine the effectiveness of matching health messages promoting fruit and vegetable intake to individuals' stage. *Methods:* In a randomized controlled trial, 205 undergraduate students (non-intenders *n*= 123; intenders *n*= 82) were exposed to one of three health messages, targeted at non-intenders, intenders and controls. Three longitudinal assessments of stage, fruit and vegetable intake, and social-cognitive determinants were obtained. *Results:* Interventions' stage-specific effects were confirmed. For self-efficacy, a stage by health message, a crossover interaction emerged. Non-intenders in the matched condition showed higher risk perception, outcome expectancies, intention and stage progression immediately after message exposure, and lower levels of action planning and coping planning a week later in the mismatched condition. Multiple mediation analyses confirmed the facilitating role of self-efficacy and of behavioral intention among non-intenders. *Conclusions:* Stages should be considered when designing health messages, although more active interventions for intenders and extended measurement time frames may be required.

*Keywords:* fruit and vegetable intake; health message targeting; stage; randomized controlled trial; multiple mediation analyses.

## 2. Introduction

Stage theories of health behavior change have received much attention in recent years, mostly due to the possibility they hold of tailoring interventions according to a limited set of social-cognitive variables, such as people´s confidence in adopting the advocated behavior (i.e., self-efficacy). Despite important differences, all stage theories share the assumption that health behavior change processes evolve through a sequence of qualitatively different stages or mindsets (Sutton, 2005). As a corollary, they sustain that people in different stages should benefit from distinct treatments in order to progress to the following stage (Weinstein et al., 1998).

Evidence on the validity of these theories mostly comes from either cross-sectional comparisons between individuals at different stages (e.g., Turner & Mermelstein, 2005) or longitudinal predictions of stage transitions (e.g., Plotnikoff et al., 2001). It has been argued, however, that the strongest evidence for the existence of stages is provided by experimental studies using matched and mismatched interventions (see Weinstein et al., 1998). If different sets of predictors influence progression to action at different stages, an intervention that is matched to the individual's stage (i.e., targeting the predictors that are relevant for progression at that specific stage) should be more effective than a mismatched one (i.e., targeting predictors that are relevant for individuals at a different stage). However, empirical evidence supporting this hypothesis is still scarce. In the present study, a complete match-mismatch design will be used to test predictions derived from a stage theory of health behavior change, the Health Action Process Approach (HAPA; Schwarzer, 2008).

### Health Action Process Approach Stages

The HAPA model proposes the unfolding of health behavior over three sequential stages: non-intentional, intentional and action stage (Schwarzer, 2008). Risk perception (i.e., perceiving oneself to be at risk for a given disease or health problem), positive outcome expectancies (i.e., anticipating positive outcomes resulting from changing one´s behavior) and self-efficacy (i.e., holding the belief that one will be able to change) have been put forward as the factors that operate in the transition from the non-intentional and the intentional stage (Wiedemann et al., 2009). Transitions from the intentional to the action stage are, on the other hand, assumed to be facilitated by action planning (i.e., the establishment of when, where and

how one will implement the intended changes), coping planning (i.e., the anticipation of barriers for the implementation of action plans and strategies to overcome them), as well as by self-efficacy.

Some studies with the HAPA model have demonstrated that interventions targeting determinants of intention were only effective among non-intenders (Luszczynska et al., 2011; Reuter et al., 2008) and that interventions targeting predictors that are important at the intentional phase were only effective when applied to individuals at that stage (e.g., Lippke et al., 2010, Reuter et al., 2008, Schüz et al., 2007, Wiedemann et al., 2011).. However, none of these studies included mismatched treatment conditions, which are important to ensure that the observed effects in the experimental group are due to the intervention being targeted at stage-specific predictors.

Few studies have used a complete match-mismatched design, where the effects of a motivational intervention could be contrasted with those of a volitional intervention among individuals at both stages. One exception is a study on the promotion of physical activity among adolescents (Schwarzer et al., 2010), where a message targeting the determinants that are relevant for non-intenders was more effective than a planning intervention for participants at a non-intentional stage, whereas a planning intervention was more effective among intenders. In a similar study on sunscreen use (Craciun et al., 2012), an intervention combining planning with risk communication was more effective among non-intenders, whereas a planning intervention alone was more effective for intenders. To our knowledge, no prior study has used a matched-mismatched design with the HAPA model for fruit and vegetable intake, nor have only the intervention contents been manipulated, using the same intervention format (e.g., health messages) in all experimental conditions.

**Matched and mismatched health messages promoting fruit and vegetable intake**

Despite all the benefits of a diet rich in fruit and vegetables (FV), for many people, their consumption is still below the recommended 400 grams (approximately 5 portions) a day (Hall et al., 2009). Therefore, the increase of FV intake constitutes a vital public health goal (WHO / FAO, 2005). Health campaigns constitute an important part of public health efforts and have the advantage of reaching a higher number of people in a cost-effective manner (Wakefield et al., 2010). However, research is still needed on effective communication strategies that can maximize the likelihood of successful behavioral change.

Crafting health messages according to the audiences´ stage is a sophisticated approach to message targeting, since it is based on proximal (i.e., social cognitive, e.g., self-efficacy) rather than on distal (i.e., social demographic, e.g., age) determinants of behavior (Slater, 1995). This strategy may help to increase the effectiveness of messages in changing relevant psychosocial determinants and behavior (Noar et al., 2007).

According to the HAPA (Schwarzer, 2008), non-intenders would mostly benefit from a certain level of risk communication, paired with the presentation of positive consequences of the behavior and the strengthening of perceived self-efficacy. Therefore, a *risk and resources* type of message, that would inform about the risks associated with low consumption of fruit and vegetables, highlight different benefits of eating an adequate amount of fruit and vegetables, and persuade the message recipient of his/her own ability to initiate the behavior is assumed to be more effective among non-intenders. On the other hand, intenders should benefit mostly from planning, as well as the strengthening of self-efficacy beliefs. Thus, a *strategic planning* type of message, that would encourage individuals to formulate their own plans, to think about the barriers that might arise during the implementation of their plans and possible ways of overcoming them, as well as reinforcing the message recipient's ability to initiate and maintain the intended changes would be more effective among intenders.

## Aims and hypotheses

In the present study, we will use an experimental complete match-mismatch design to test a series of predictions based on the HAPA model.

The main hypothesis is that non-intenders will mainly benefit from a risk and resources type of message whereas intenders will mainly benefit from a strategic planning type of message for the promotion of fruit and vegetable intake in the context of cancer prevention. More specifically, we hypothesize that:

***Intervention effects within stages:***

*H1*. Non-intenders exposed to the *risk and resources* message will increase their levels of risk perception, positive outcome expectancies and self-efficacy from baseline to Time 2 (i.e., after message exposure), whereas non-intenders exposed to the *strategic planning* and *control* message will maintain their levels in each determinant.

*H2*. Intenders exposed to the *strategic planning* message will increase their self-efficacy from baseline to Time 2 (i.e., after message exposure) and their action planning and coping planning from baseline to Time 3 (i.e., one week after message exposure), whereas intenders exposed to the risk and resources and control message will maintain their levels in each determinant.

***Matched-mismatched effects over social cognitive determinants and FV intake:***

*H3.* Non-intenders in the *matched* condition will show higher levels in intention and in its determinants immediately after message exposure and higher levels in post-intentional determinants and in FV intake one week later, compared to non-intenders in the *mismatched* and in the *control* conditions.

*H4.* Intenders in the *matched* condition will show higher levels of self-efficacy immediately after message exposure and higher levels in post-intentional determinants and in FV intake one week later, compared to intenders in the *mismatched* and in the *control* conditions.

***Stage progression:***

*H5.* When the content of the message is *matched* to participants´ stage of change there will be more stage progressions, compared to *mismatched* and *control* conditions.

***Stage-specific mechanisms:***

*H6.* Among non-intenders, the effect of the risk and resources message on intention at Time 2 is mediated by changes in intention determinants (i.e., risk perception, positive outcome expectancies and/or self-efficacy) and the effects on FV intake and/or its proximal predictors at Time 3 are mediated by changes in intention at Time 2.

*H7.* Among intenders, the effect of the strategic planning message on FV intake at Time 3 is mediated by changes in action planning, coping planning, and self-efficacy at Time 3.

## 3. Method

### Participants

Two hundred and five undergraduate students, whose FV intake was under 5 portions a day, participated in the experimental session in exchange for either a course credit or a 5€ voucher (see Figure 6 for CONSORT flow chart). The mean age of the sample was 22.2 years (*SD* = 5.6), 179 (87.3%) participants were female, and none had any medical restrictions regarding FV intake.

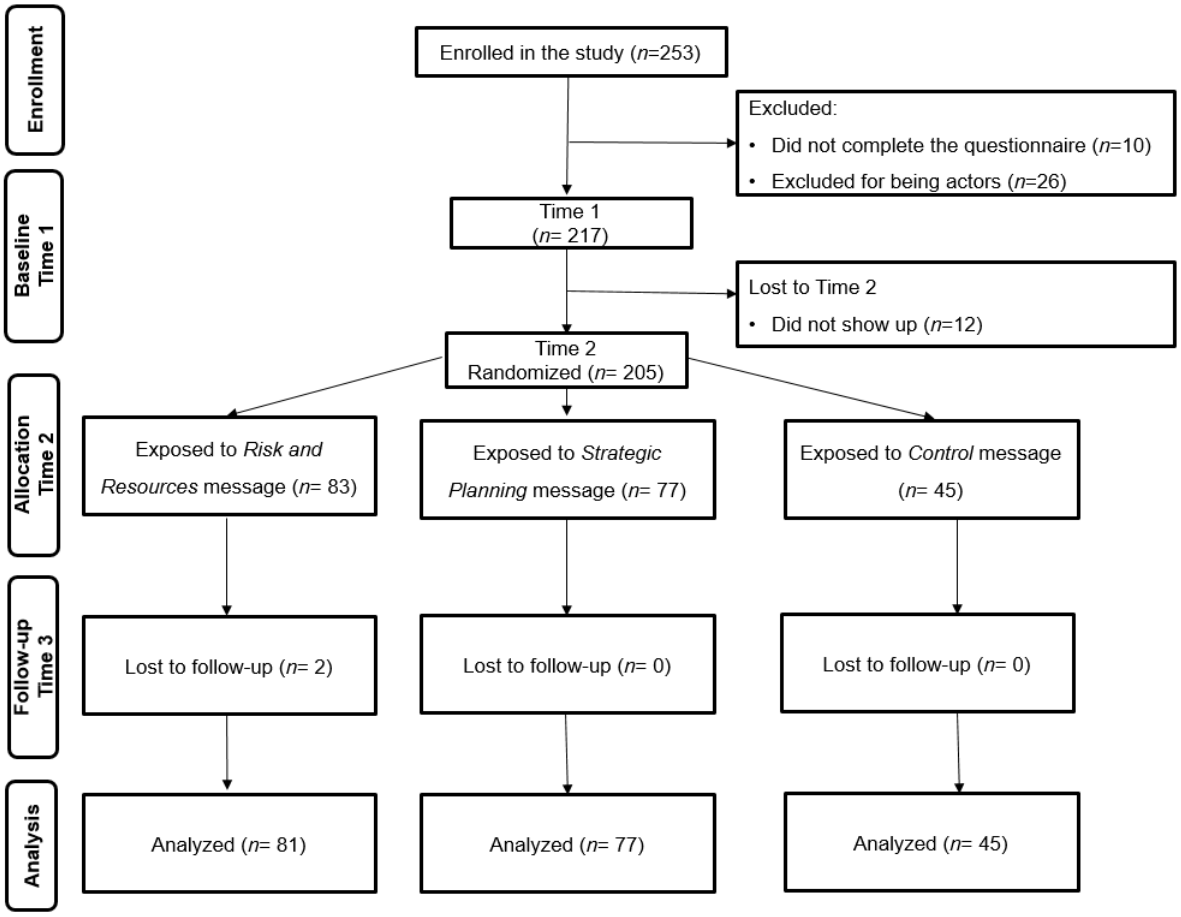



*Figure 6.* Flow diagram depicting information about participants at different phases of the study.

## Materials

Two different types of intervention - *risk and resources* message and *strategic planning* message- were developed based on focus group interviews and a questionnaire applied to the same population, that have been described elsewhere [reference deleted to maintain the integrity of the review process]. Written messages were presented in a video format with duration of approximately two minutes, with the text presented in white font on a black screen, at the pace the same text was read aloud by a voice-over. This presentation format was chosen to control for the effects of stimuli other than the message content and ensure that all participants would be exposed to the same contents and would not skip any parts of the message. In the original language, the *risk and resources* message had 410 words and *strategic planning* had 412 words. The *control* message was presented in the same format and had 411 words.

The *risk and resources* message targeted the putative determinants relevant for individuals in a non-intentional stage, through the use of the following behavioral change techniques (Michie et al., 2013): threat, health and emotional consequences of change and verbal persuasion to boost self-efficacy (Appendix A). The *strategic planning* message targeted the putative determinants relevant for individuals in an intentional stage by encouraging action planning, coping planning and verbal persuasion to boost self-efficacy (Michie et al., 2013) (Appendix B). Finally, to rule out the possibility that merely by focusing on fruit and vegetables messages would function as a prime and, thereby, increase their consumption or at least inflate the results on FV intake predictors, a *control* message was included. This message was based on the functions and processes, supply and distribution of fruit and vegetables, in a purely informative tone (Appendix C).

## Procedure and Design

The study was presented either in a short break in the classes or via students´ associations mailing lists in seven Faculties from three Universities. Students were told that the aim of the study was to test the credibility of messages designed to communicate scientific results about nutrition to the general public. Those who accepted participation provided their e-mail address to receive the first online questionnaire and their schedule availability to participate in the experimental session.

One week prior to the experimental session (Time 1), the first online questionnaire was sent to participants. The aim of the study was recalled and confidentiality of the data to be collected was ensured. Participants then provided their informed consent. This questionnaire assessed baseline measures of the HAPA model determinants, FV intake over the previous two weeks and social demographic information. The stage was then derived using an algorithm based on FV intake during the previous two weeks and intentions regarding FV intake over the course of the following week, and those not meeting the criteria of eating 5 portions a day were contacted so as to schedule the experimental session.

The experimental session took place one week after the baseline assessment (Time 2) in each Faculty. A 2 (pre-intervention stage: non-intenders vs. intenders) x 3 (message content: risk and resources vs. strategic planning vs. control) between-subjects design was used. Participants were randomly assigned by the online software (Qualtrics) to a message specifically targeted at non-intenders (*risk and resources*), intenders (*strategic planning*) or to the *control* message. After message exposure, a set of the HAPA determinants (risk perception, outcome expectancies, self-efficacy, intention) were assessed.

One week after the experimental session (Time 3), participants received the last questionnaire assessing action planning, coping planning and FV intake during the previous week.

**Measures**

Unless otherwise stated, measures were taken and adapted from previous studies on the HAPA model (Schwarzer, 2008) and on FV intake with a similar population [reference deleted to maintain the integrity of the review process], and answers were given on a 7-point scale ranging from 1 (“totally disagree”) to 7 (“totally agree”).

**Risk perception (T1/ T2).** Both absolute and relative risk perceptions were assessed by three items (Cronbach’s T1α = .72, T2α = .75), such as *“How likely is it you will have cancer sometime in your life?”*, and *“Compared to an average person of my sex and age my chances of getting cancer are…”*. For the first items answers were given on a 7-point scale ranging from 1 (“very unlikely”) to 7 (“very likely”), and for the latter the scale ranged from 1 (“well below average”) to 7 (“well above average”).

**Outcome expectancies (T1/ T2).** Following the stem *"What will be the likely consequences if you eat five or more portions of fruit and vegetables a day? If I eat five portions of fruit and vegetables a day…"* six items (Cronbach´s T1α= .82, T2α= .83) were presented to measure positive outcome expectancies (e.g., *"I would improve my health", "I would feel satisfaction and pleasure", "I would prevent cancer"*).

**Self-Efficacy (T1/ T2).** Four items (Cronbach´s T1α = .86, T2α = .88) similar to those presented in a previous study (Luszczynska et al., 2007) were used to assess self-efficacy. The first item was *"I believe I can eat five or more portions of fruit and vegetables a day"*, and for the next three items this stem was followed by barriers such as: *"even if I had to establish a detailed plan not to forget to eat fruit and vegetables"*.

**Intention (T1/ T2).** Intention to eat at least five portions of fruit and vegetables a day was assessed by three items (Cronbach´s T1α = .94, T2α= .95), such as *"I intend to eat at least 5 portions of fruit and vegetables a day from today on"*.

**Action Planning (T1/ T3).** Three items (Cronbach´s T1α = .88, T3α = .95) were used to measure action planning. The stem *"I already have concrete plans regarding…"* was followed by *"when to eat more fruit and vegetables (for example, at meals or in-between meals)", "where to eat more fruit and vegetables (for example, at home, at university, when eating out)"* and *"how to eat more fruit and vegetables (for example, to buy more fruit and vegetables, to cook with more vegetables, to choose options including fruit and vegetables when eating out)"*.

**Coping Planning (T1/ T3).** The coping planning measure began with *"I already have concrete plans..."*and was followed by three items (Cronbach's T1α =.90, T3α = .96) such as *"regarding what to do in difficult situations in order to stick to my intentions"*.

**Fruit and vegetable intake (T1/ T3).** Fruit and vegetable intake was assessed by two items, one for fruit and one for vegetables: *"In the (last two weeks* (T1) */last week* (T3)*) how many (pieces of fruit / portions of vegetables) did you eat every day?"*, followed by some examples of what could be considered a portion of vegetables (e.g., a soup or one bowl of salad) and a portion of fruit (e.g., medium sized fruit, or freshly squeezed and 100% fruit juice), as in Wiedemann and collaborators (2012). Responses were given on a 6-point scale that ranged from 0 (*less than a portion per day*) to 5 (*four or more portions a day*). A FV intake index was created by summing up the number of fruit portions and the number of

vegetable portions consumed daily. A similar measure has been previously validated against a food frequency questionnaire and dietary biomarkers (Steptoe at al., 2003).

**Stage.** Participants´ stage was derived according to the World Health Organization criterion of eating at least 5 portions of fruit and vegetables a day. An algorithm was used, similar to others used in previous studies (e.g., Godin et al., 2004) combining information from participants' level of actual FV intake and their answer to the question: *"In the next week do you intend to eat, on average, at least five portions of fruit and vegetables every day?"*. If the answer to the actual FV intake level was "five or more portions a day", participants were classified as actors; if the answer was below five portions a day and a) they intended to eat five or more portions a day, they were classified as intenders, b) they did not intend to eat five or more portions a day, they were classified as non-intenders.

## Data Analysis

**Intervention effects within stages**. Paired sample t-tests, comparing baseline measures of each of the manipulated variables and Time 2 measures of risk perception, outcome expectancies, self-efficacy among non-intenders, and Time 3 measures of action planning and coping planning and Time 2 self-efficacy among intenders were performed for each experimental condition. The reason for the first three comparisons being made between baseline and Time 2 and the other two between baseline and Time 3 is that it was anticipated that the manipulation could have immediate effects on the determinants of intention whereas changes in planning variables (i.e., action planning and coping planning) require time for elaboration, and, therefore, no changes were expected to occur immediately after message exposure.

Moreover, it was assumed that treatment by baseline levels of the various determinants would occur (see Lippke et al., 2010; Wiedemann et al., 2011). Thus, the effects of the risk and resources message on target determinants were only evaluated among non-intenders, given that intenders already had, as expected, higher levels in these determinants, leading to a ceiling effect. On the contrary, the effects of a strategic planning message were only evaluated among intenders, given that non-intenders might not have a sufficient amount of motivation to change that could allow for changes in post-intentional determinants (see Hagger & Luszczynska, 2014).

**Match-mismatch effects on social cognitive determinants and FV intake.** A total of seven mixed design ANCOVA´s were run, with stage and message condition as independent factors, and risk perception (T2), outcome expectancies (T2), self-efficacy (T2), intention (T2), action planning (T3), coping planning (T3) and FV intake (T3) as dependent variables. The baseline level of each variable was included as a covariate.

**Stage transitions.** Stage transitions were analyzed by Chi-square tests, comparing the progression percentages in each of the six experimental conditions. Baseline stages were subtracted from Time 2 stage for non-intenders and from Time 3 stage for intenders. The rationale for different time spans is that immediately after the intervention (i.e., after message presentation) some changes in intention but not in behavior might occur, as post-intentional variables need to be put in action before behavior change. The new computed variable assumed the values of 0 for stage maintenance (or regression, in the case of intenders) and 1 for progression.

**Intervention mechanisms.** The hypothesized mediations were estimated through structural equation modeling (SEM) with AMOS 20. Two contrast coding variables were created in order to estimate the effects of message content. Contrast 1 (C1) compared the risk and resources message with the pooled strategic planning and control messages, while contrast 2 (C2) compared the pooled risk and resources and strategic planning messages with control messages. With the exception of these two variables, which were specified as observed variables in the model, all the others were specified as latent variables. Baseline levels of intention, action planning and coping planning were included as predictors and allowed to inter-correlate with the contrast coding ones. Residualized change scores from Time 1 to Time 2 for risk perception, outcome expectancies and self-efficacy were specified as mediators between message content and intention at Time 2, and intention at Time 2 was specified as a mediator between experimental conditions and action planning and coping planning at Time 3. All parameters were estimated by bootstrapping, generated from 5,000 samples.

## 4. Results

### Preliminary Analysis

Fifteen participants dropped out between Time 1 and Time 2 and only two participants dropped out between Time 2 and Time 3. Dropout analysis revealed no differences in age, gender, baseline level of social-cognitive determinants and FV intake between participants who completed all measurement points in time and those who dropped out (all *p´*s > .10). Also, as expected from random assignment, there were no significant differences in age, gender, levels of HAPA determinants at Time 1 or FV intake across the three message conditions.

### Descriptive statistics

Before the intervention (i.e., at Time 1) 123 participants (60.0%) were classified as non-intenders (39.8% of whom were assigned to the "risk and resources" condition, 35.0% to the "strategic planning" condition, and 25.2% to the control condition) and 82 (40.0%) were classified as intenders (41.5% of whom were assigned to the "risk and resources" condition, 41.5% to the "strategic planning" and 17.2% to the control condition)[2]. There were no age or gender differences across stages ($p > .10$).

Among non-intenders the average FV intake was 1.63 (*SD* = 1.25) portions a day at baseline and 1.60 (*SD* = 1.45) at Time 3. Among intenders, the FV intake average was 2.52 (*SD* = 1.43) at baseline and 3.10 (*SD* = 1.84) at Time 3. At Time 3, 9.4% of the sample attained the criterion to be classified as an actor (i.e., consumed at least 5 portions of FV a day).

[2]The software was set to assign approximately half of the number of participants assigned to the experimental conditions to the control condition.

**Intervention effects within stages**

Sixteen (88.9%) of the 18 assumptions regarding the intervention effects within stages were confirmed (see Table 7).

**Non-intenders.** As expected, non-intenders assigned to the *risk and resources* message increased their levels of positive outcome expectancies from baseline ($M$ = 5.64; $SD$ = 0.83) to Time 2 ($M$ = 5.85; $SD$ = 0.71), $t(48) = 2.00$, $p = .051$, Cohen´s $d = 0.27$, and self-efficacy from baseline ($M$ =4.23; $SD$=1.29) to Time 2 ($M$ = 5.11; $SD$=0.97), $t(48) = 5.76$, $p < .001$, Cohen´s $d = 0.77$, whereas non-intenders who were assigned either to the *strategic planning* message or the *control* message maintained their levels for each variable from baseline to Time 2 (all $p$´s > .10). Furthermore, non-intenders in the *risk and resources* message condition reported higher risk perception at Time 2 ($M$= 4.10; $SD$=1.09) than at baseline ($M$= 3.59; $SD$= 1.09), $t(48) = 5.56$, $p < .001$, Cohen´s $d = 0.47$, whereas non-intenders in the *control* message condition maintained their levels of risk perception from baseline to Time 2 ($p > .10$). Contrary to our hypotheses, non-intenders in the *strategic planning* message condition also increased their risk perception from baseline ($M$= 3.64; $SD$=0.91) to Time 2 ($M$= 3.87; $SD$= 0.93), $t(42) = 2.41$, $p = .02$, Cohen´s $d = 0.25$.

**Intenders.** As predicted, intenders assigned to the *strategic planning* message increased their levels of self-efficacy from baseline ($M$ = 4.75; $SD$= 1.32) to Time 2 ($M$ = 5.54; $SD$= 0.93), $t(33) = 2.50$, $p$ =.018, Cohen´s $d = 0.69$, and coping planning from baseline ($M$ = 3.70; $SD$= 1.54) to Time 3 ($M$ = 4.49; $SD$ = 1.39), $t(33) = 2.66$, $p = .012$, Cohen´s $d = 0.54$, whereas intenders assigned to either the *risk and resources* message or the *control* message maintained their levels for those variables (all $p$´s > .10). However, contrary to our expectations, no increases were found in action planning from baseline to Time 3 among intenders in the *strategic planning* message condition.

**Match-mismatch effects on social cognitive determinants and FV intake**

Table 8 presents the mean levels of each construct in the matched, mismatched and control conditions. As expected, non-intenders exposed to the risk and resources message (matched condition) showed higher risk perception after message exposure than non-intenders in the mismatched ($M_{dif}$= 0.28, $SE$ =0.13, $p$ = .038) and in the control conditions ($M_{dif}$= 0.30, $SE$ = 0.15, $p$= .041). Outcome expectancies were also higher for non-intenders in the matched than in the control condition ($M_{dif}$= 0.29, $SE$ = 0.15, $p$ = .041).

Also in line with what was expected, a significant interaction effect emerged between message content and stage for self-efficacy, $F(2,198) = 4.49$, $p = .01$, $\eta^2 = .04$. Breaking this effect down, immediately after message exposure, non-intenders in the risk and resources (i.e., matched condition) showed higher self-efficacy than in the mismatched ($M_{dif} = 0.43$, $SE = 0.18$, $p = .015$) or control conditions ($M_{dif} = 0.62$, $SE = 0.20$, $p = .002$), whereas intenders in the strategic planning (i.e., matched condition) showed higher self-efficacy than in the mismatched ($M_{dif} = 0.38$, $SE = 0.21$, $p = .066$) or control conditions ($M_{dif} = .55$, $SE = 0.27$, $p = .044$) (see Figure 7a).

For intention, a significant interaction emerged between stage and message content, when comparing matched and mismatched conditions, $F(1,155) = 5.06$, $p = .03$, $\eta^2 = .03$. However, differences between those conditions were only obtained among non-intenders. Non-intenders in the risk and resources message condition (i.e., matched condition) showed higher intentions to increase their levels of FV intake immediately after message exposure than in the mismatched ($M_{dif} = 0.56$, $SE = 0.21$, $p = .008$) or control condition ($M_{dif} = 0.99$, $SE = 0.23$, $p < .001$) (see Figure 7b). For action planning, no interaction between message content and stage was found, $F(1,153) = 1.89$, $p = .17$, $\eta^2 = .01$. However, non-intenders in the risk and resources message (i.e., matched condition) showed higher levels of action planning compared to non-intenders in the mismatched condition ($M_{dif} = 0.57$, $SE = 0.30$, $p = .061$), although their levels did not differ from non-intenders in the control condition ($M_{dif} = - 0.25$, $SE = 0.33$, $p = .443$) (see Figure 7c).

Table 7. *Predictions and variation from Time 1 in the mean level (and standard deviation) of specific determinants in each message condition.*

| Baseline Stage | | | Message Content | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Risk & Resources | | | Strategic Planning | | | Control Message | | |
| | | ***Outcome Variable*** | | **Prediction** | **Result** | | **Prediction** | **Result** | | **Prediction** | **Result** | |
| **Non-Intenders** | | *Risk Perception* | T1-T2 | ↑ | 0.52 (0.66)*** | ✓ | ≈ | 0.23 (0.63) * | × | ≈ | 0.23 (0.75) | ✓ |
| | | *Outcome Expectancies* | T1-T2 | ↑ | 0.20 (0.71)* | ✓ | ≈ | 0.03 (0.78) | ✓ | ≈ | -0.14 (0.76) | ✓ |
| | | *Self-Efficacy* | T1-T2 | ↑ | 0.88 (1.07)*** | ✓ | ≈ | 0.27 (1.10) | ✓ | ≈ | 0.02 (1.03) | ✓ |
| **Intenders** | | *Action Planning* | T1-T3 | ≈ | -0.15 (1.50) | ✓ | ↑ | -0.20 (1.41) | × | ≈ | -0.40 (1.51) | ✓ |
| | | *Coping Planning* | T1-T3 | ≈ | 0.42 (1.53) | ✓ | ↑ | 0.79 (1.74) * | ✓ | ≈ | 0.33 (1.37) | ✓ |
| | | *Self-Efficacy* | T1-T2 | ≈ | 0.28 (0.85) | ✓ | ↑ | 0.78 (1.23) *** | ✓ | ≈ | 0.04 (0.72) | ✓ |

*Note.* ↑ = prediction of increase; ≈ = prediction of maintenance; ✓ = confirmed hypothesis; × = unconfirmed hypothesis. $^{*}p < .05$, $^{**}p < .01$ or $^{***}p < .001$

*Figure 7 a.*

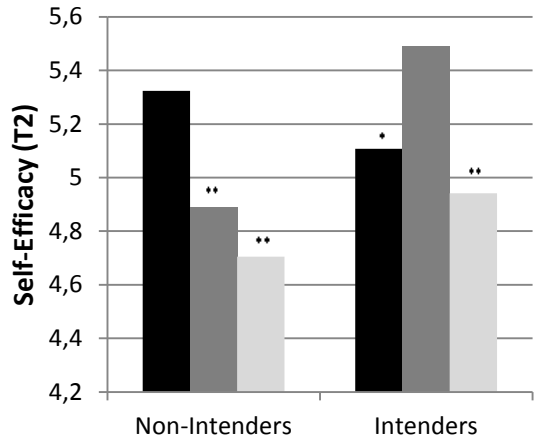
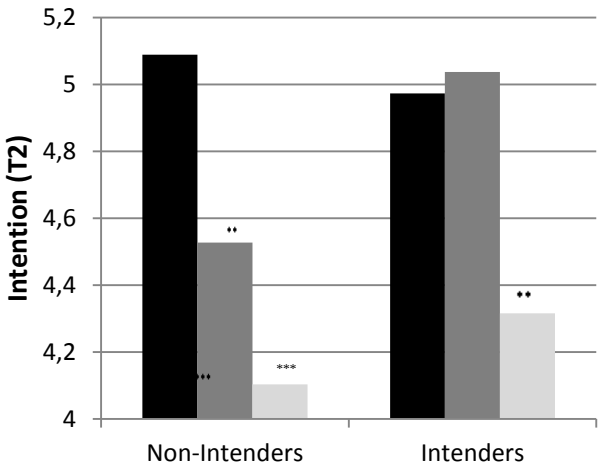



*Figure 7 b.*



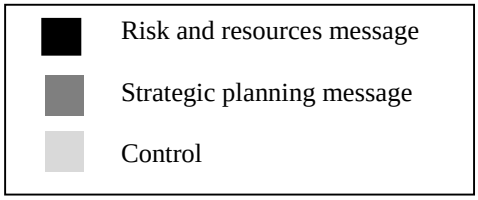




*Figure 7 c.*

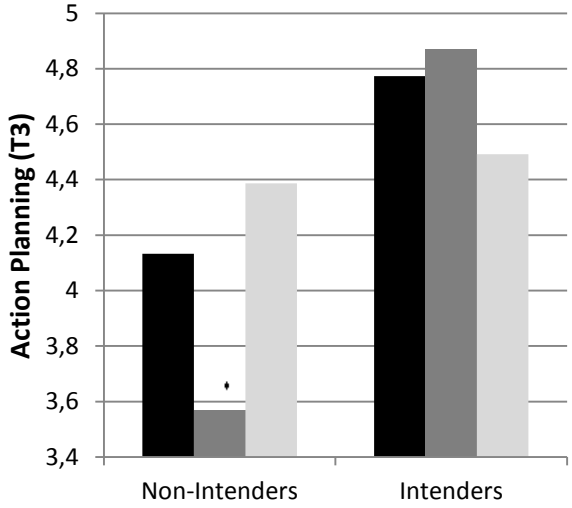



*Figure 7 d.*

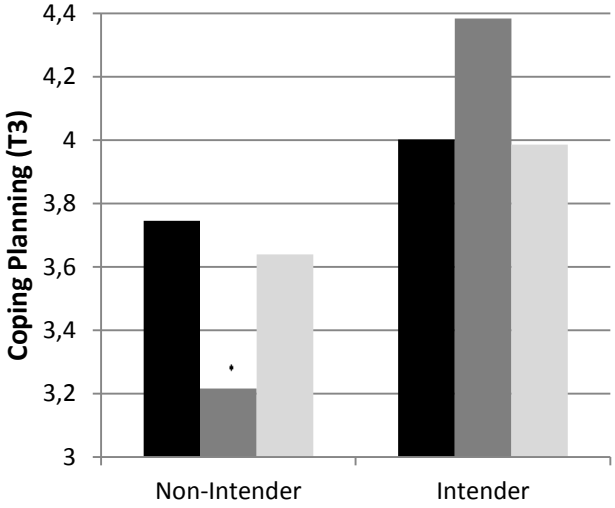



*Figure 7.* Self-efficacy (7a), intention (7b), action planning (7c), and coping planning (7d) levels immediately after message exposure as a function of the baseline stage and message content conditions. Self-efficacy (7a), intention (7b), action planning (7c), or coping planning (7d) level at baseline was included as a covariate. Matched (vs. mismatched) conditions correspond to non-intenders in the risk and resources (vs. strategic planning) condition and to intenders in the strategic planning (vs. risk and resources) condition. *Note.* $^{*}p < .10$, $^{**}p < .05$ or $^{***}p < .01$

A significant interaction effect between stage and message content was also obtained for coping planning for matched and mismatched conditions, $F(1,153) = 4.41$, $p = .04$, $\eta^2 = .03$. Non-intenders in the risk and resources (i.e., matched condition) showed higher levels of coping planning one week later than non-intenders in the mismatched condition ($M_{dif} = 0.53$, $SE = 0.29$, $p = .065$), but not higher than non-intenders in the control condition ($M_{dif} = 0.11$, $SE = 0.31$, $p = .734$) (see Figure 7d). This pattern of results for action planning and coping planning reveals that, among non-intenders, the mismatched treatment led to lower levels of planning, whereas the matching did not contribute to higher levels of planning. No significant interaction effect was found between message content and stage for FV intake.

**Stage progression**

Sixty-three of the 205 participants (30.7%) progressed to the next stage (i.e., from the non-intentional to intentional stage, and from the intentional to action stage). Among non-intenders progressing to the next stage, 22 (46.8%) were in the matched, 14 (29.8%) in the mismatched and 11 (23.4%) in the control condition. Among intenders, 8 (50.0 %) were in the matched, 6 (37.5%) in the mismatched and 2 (12.5%) in the control condition. Thus, in the *risk and resources* message condition, 17% *more* non-intenders progressed to the intentional stage (i.e., in the matched condition) when compared to the *strategic planning* message condition (i.e., in the mismatched condition), $\chi^2 (3) = 8.15$, $p = .043$, and 23.4% *more* when compared to the *control* message condition, $\chi^2 (3) = 9.15$, $p = .027$. Differences in stage progression across conditions were not significant for intenders.

Table 8. *Estimated marginal means and (standard errors) of the social cognitive predictors and fruit and vegetable intake for each experimental condition, controlling for the baseline levels (T1) of each variable.*

| | Non-Intenders | | | | Intenders | | | |
|---|---|---|---|---|---|---|---|---|
| **Outcomes** | **Risk and Resources** ***(Match)*** | **Strategic Planning** ***(Mismatch)*** | **Control** | **$\eta^2$** | **Strategic Planning** ***(Match)*** | **Risk and Resources** ***(Mismatch)*** | **Control** | **$\eta^2$** |
| **Risk perception** (T2) | 4.05 (0.09)$^{a}$ | 3.78 (0.10)$^{b**}$ | 3.75 (0.12)$^{b**}$ | .05 | 3.74 (0.11)$^{a}$ | 4.02 (0.11)$^{a}$ | 3.70 (0.18)$^{a}$ | .05 |
| **Outcome expectancies** (T2) | 5.93 (0.09)$^{a}$ | 5.81 (0.10)$^{ab}$ | 5.64 (0.12)$^{b**}$ | .03 | 6.06 (0.11)$^{a}$ | 5.90 (0.11)$^{a}$ | 5.72 (0.17)$^{a}$ | .03 |
| **Self-efficacy** (T2) | 5.32 (0.12)$^{a}$ | 4.89 (0.13)$^{b**}$ | 4.71 (0.15)$^{b***}$ | .08 | 5.49 (0.15)$^{a}$ | 5.11 (0.15)$^{b*}$ | 4.94 (0.23)$^{b**}$ | .07 |
| **Intention** (T2) | 5.09 (0.14)$^{a}$ | 4.53 (0.16)$^{b***}$ | 4.10 (0.18)$^{b***}$ | .14 | 5.04 (0.18)$^{a}$ | 4.97 (0.17)$^{a}$ | 4.32 (0.27)$^{b**}$ | .08 |
| **Action Planning** (T3) | 4.13 (0.21)$^{a}$ | 3.57 (0.22)$^{b*}$ | 4.39 (0.26)$^{a}$ | .05 | 4.87 (0.24)$^{a}$ | 4.77 (0.24)$^{a}$ | 4.49 (0.38)$^{a}$ | .01 |
| **Coping Planning** (T3) | 3.75 (0.20)$^{a}$ | 3.22 (0.21)$^{b*}$ | 3.64 (0.24)$^{ab}$ | .03 | 4.38 (0.23)$^{a}$ | 4.00 (0.23)$^{a}$ | 3.99 (0.36)$^{a}$ | .02 |
| **FV Intake** (T3) | 1.83 (0.20)$^{a}$ | 1.69 (0.22)$^{a}$ | 2.06 (0.25)$^{a}$ | .01 | 2.60 (0.24)$^{a}$ | 2.94 (0.24)$^{a}$ | 2.58 (0.38)$^{a}$ | .02 |

*Note.* Means in the same row that do not share subscripts differ at $^{*}p < .10$, $^{**}p < .05$ or $^{***}p < .01$. No differences among matched, mismatched and control conditions were expected for the shaded cells.

**Working mechanisms**

The estimated model with the non-intenders sub-sample presented a satisfactory fit: $\chi^2(408) = 704.38$, $p < .001$, $\chi^2/df = 1.73$, CFI = .90, TLI=.89, RMSEA= .077, 90% CI [.067; .087] (Figure 8). The estimated parameters showed that the effect of risk and resources message condition on intention at Time 2 dropped from $\beta = .28$, $p < .001$, to $\beta = .14$, $p = .02$, when the effects of mediating variables were taken into account. By considering the mediating variables in the model, it was possible to explain the further16% of variance in intention. However, neither changes in risk perception nor changes in positive outcome expectancies were found to mediate this relationship. The only observed significant indirect effect was through changes in self-efficacy, $\beta_{\text{Indicted effect}} = .12$, 95% CI [.02; .24]. Moreover, the indirect effects of the risk and resources message by intention on both action planning, $\beta_{\text{Indirect effect}} = .13$, 95% CI [.05; .21], and coping planning at Time 3, $\beta_{\text{Indirect effect}} = .12$, 95% CI [.05; .19], were significant and enabled the explanation of the further 10% and 12% variance in each variable, respectively. Since no differences were found between intenders in the matched vs. mismatched conditions in FV intake, specific change mechanisms were not tested in this group.

*Figure 8 a.*

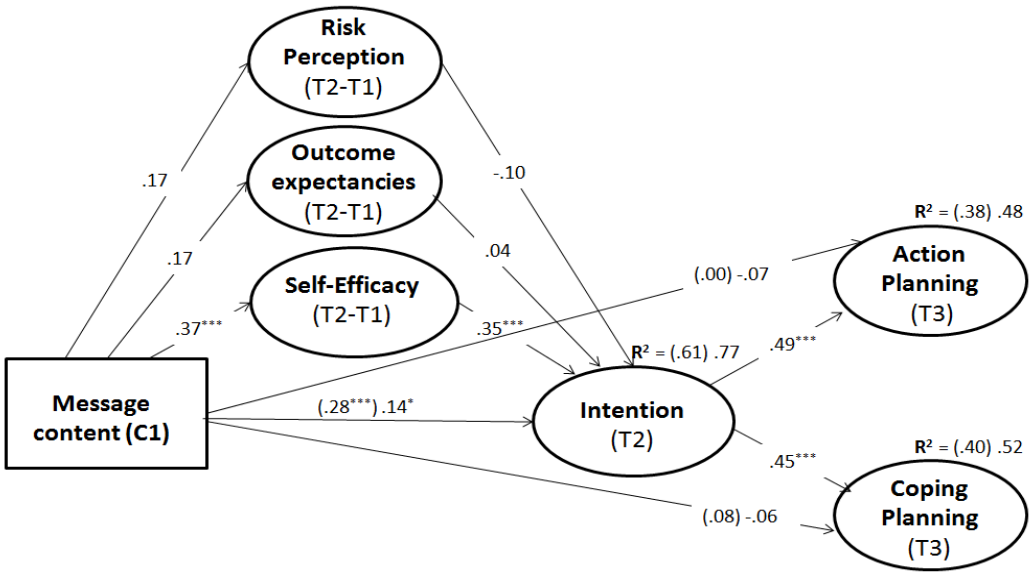



*Figure 8 b.*

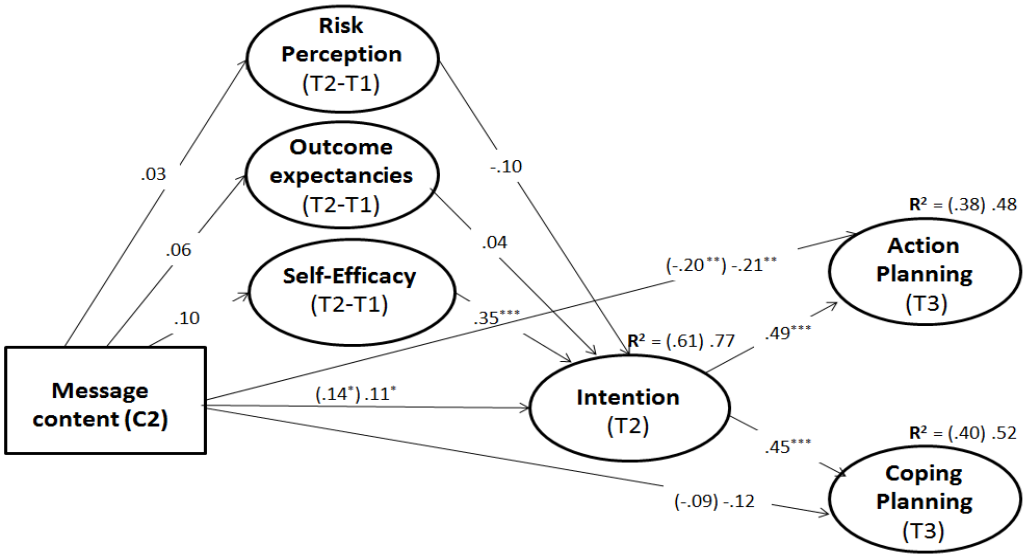



*Figure 8.* Intervention effects model for non-intenders on intention via changes in risk perception, outcome expectancies and self-efficacy, and on action planning and coping planning via intention. Both contrast variables (C1 compares risk and resources with strategic planning and control conditions; C2 compares risk and resources and strategic planning with control condition) were simultaneously included in the model, only for simplification of presentation they are represented separately. Baseline levels of intention, coping planning and action planning were included as covariates. The presented coefficient estimates are standardized. *Note.* $^{*}p < .05$, $^{**}p < .01$ or $^{***}p < .001$

## 5. Discussion

Experimental designs of matched-mismatched interventions offer the most powerful evidence for the validity of stages in health behavior change (Weinstein et al., 1998). The present randomized controlled trial tested the effects of health communication interventions targeting the predictors relevant for stage transitions for non-intenders and intenders in a complete match-mismatch design.

We hypothesized that increases in the relevant predictors of change would only occur when the messages were matched to participants' stage. Practically all these hypotheses were confirmed, as in previous similar studies (e.g., Lippke et al., 2010). Furthermore, participants in the matched conditions were expected to show higher levels of FV intake and on the corresponding social cognitive determinants, when compared to the mismatched and control conditions. In line with these hypotheses, non-intenders in the matched condition showed higher levels of risk perception, outcome expectancies, self-efficacy and intention than non-intenders in the mismatched and in the control condition. Moreover, non-intenders
in the mismatched condition showed comparatively less action planning and coping planning than non-intenders in the matched or control conditions, revealing that the mismatch condition had a detrimental effect, possibly caused by reactance of non-motivated individuals being encouraged into formulating plans for changing a behavior they did not intend to change (Wiedemann et al., 2011).

Importantly, a crossover interaction effect was found between stage and message content for self-efficacy, meaning that both non-intenders and intenders exposed to a message that matched their stage showed higher confidence in their ability to consume at least five portions of fruit and vegetables a day. This is an important validation of the assumptions of the stage theories, revealing that it was not the content *per se*, but the matching of it to the stage that led to increased changes.

Stage progression is the main outcome when conceptualizing health behavior change in terms of stages (Weinstein et al., 1998) and again in line with the hypotheses, non-intenders in the matched condition showed greater stage progression than non-intenders in the other experimental conditions. Moreover, identification of the intervention mechanisms is relevant for unveiling the processes involved in content matching (Hawkins et al., 2008). In this regard, a stage-specific multiple mediator model showed that, among non-intenders, intervention effects on intention were explained by

changes in self-efficacy beliefs, and that effects on intention subsequently explained action planning and coping planning levels a week later, similarly to results of previous studies on dietary behaviors (Scholz et al., 2009). Thus, the overall pattern of results, obtained with a very brief intervention, is suggestive that, at least among non-intenders, matched health messages are more effective in promoting changes in relevant predictors of fruit and vegetable consumption and for stage progression than mismatched ones.

The nature of the intervention used, a very short persuasive health message, may, nonetheless, explain why no differences were found for behavior. Furthermore, it is clear that overall the intervention had better results for non-intenders than for intenders. Several reasons may explain these findings, firstly the intervention format. Health messages may be more suitable for conveying information related to risks and positive consequences of behavior rather than to stimulate planning efforts. Other studies showing good results for planning tended to use more active interventions, with planning prompts to instigate individuals to establish their own action and/or coping plans (e.g., Hagger & Luszczynska, 2014; Luszczynska et al., 2007; Reuter et al., 2008). Secondly, it may also be a matter of dosage. There is abundant research showing that moderate to large effects on intention have only a small to moderate effect on behavior (Webb & Sheeran, 2006). In other words, it is easier to change intentions than actual behavior and, therefore, it seems relatively easier to make a non-intender progress to the intentional stage than making an intender progress to the action stage. Thus, it may be the case that a more prolonged and/or frequent exposure to health messages is required in order to have an impact on behavior. Lastly, these results may also be explained by the chosen time frame. Unlike changes in intentions, which may be more immediate, changes in behavior require that certain prior conditions are met, such as, for example, buying fruit and vegetables in advance. Therefore, the chosen time frame (one week) may not have afforded enough time for self-regulatory processes to be put in action, therefore contributing to the lack of results for behavior change. All these possibilities constitute avenues for future research.

The present findings, obtained with a theory-guided intervention underline that the psychological characteristics of the message recipient, here conceptualized as the stage, matter for the designing and delivery of health messages that can effectively impact populations´ health. In the era of communication and with the advent of the internet, tailoring messages according to the audience's characteristics has become easier and less expensive to implement. Thus, assessing individuals´ stage prior to health interventions

and adjusting them accordingly is recommended, not only because matched interventions are more effective, but also because mismatched interventions may backfire.

Some limitations should be addressed, namely, the fact that the sample was mostly composed by women with a high education level, which constrains the generalizability of the findings for more heterogeneous populations. The stage was assessed one week prior to the intervention in order to prevent mere measurement effects over the outcome variables of interest. However, some changes are likely to have occurred in that period, resulting in stage misclassifications. Also, more sophisticated methods of stage allocation, such as those using latent class approach (e.g., Richert et al., 2013) may be more adequate and a good option for future studies. Notwithstanding, misclassifications that might have occurred in stage allocation in the present study could only have contributed to undermine the ability to find stronger match-mismatch effects.

Through the use of a complete match-mismatch design with a control group, hypothesized effects and changes over relevant social-cognitive determinants were obtained and the explanatory mechanisms for these changes were revealed. This study submits contributions at a theoretical and applied level by offering evidence for the relevance of considering the HAPA stages in health behavior change, and by supporting the claim that interventions should be matched to the individuals´ stage.

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# 5

# Situational and individual moderators of framed messages to promote fruit and vegetable intake

**This chapter is based on the paper**

Godinho, C. A., Alvarez, M.J., & Lima, L. (submitted). Emphasizing the losses or the gains: Comparing situational and individual moderators of framed messages to promote fruit and vegetable intake

## 1. Abstract

*Objective:* This study examines predictions based on two prominent message framing moderators - the function of health behaviour and dispositional motivational orientation - and further explores the role of baseline intentions for the effects of gain and loss-framed messages promoting fruit and vegetable (FV) intake. *Design:* Undergraduate students (n= 180) completed the three assessment points in time. *Measures:* At baseline, individual moderators (motivational orientation and intentions) were assessed. One week later, participants were randomly assigned to the loss or gain-framed message and indicated their intentions for FV intake the following week. A week later, FV intake over the previous week was assessed. *Results:* Contrary to the function of the health behaviour hypothesis, the gain-frame was not conducive, per se, to higher intentions or behaviour. Only baseline intentions moderated the effects of message frame over intention after message exposure. Both motivational orientation and baseline intentions moderated the effects of message frame on FV intake, with the loss-frame promoting higher FV intake among prevention-oriented and higher baseline intentions individuals. *Conclusion:* Findings suggest that the success of framed messages for FV intake depends upon the message recipient characteristics, such as motivational orientation, baseline intentions, and cultural background with implications for health communication interventions.

*Keywords:* health communication, message framing moderators, fruit and vegetable intake, behavioural intentions, behaviour change

## 2. Introduction

Should emphasizing either the costs of non-performing a health behaviour or the benefits of performing it make a difference when it comes to persuading people to adopt healthy behaviours and lifestyles? Indeed, two decades of research on message framing support the claim that, even when communicating exactly the same consequences, the particular frame that is used in a message may have a major influence on behavioural outcomes (Gallagher & Updegraff, 2012; Rothman & Salovey, 1997).

The question about which frame might be more helpful in fostering health behaviours has been rapidly transformed into when (i.e., under which conditions) a loss- or a gain-frame is particularly effective. The range of framing effect moderators proposed in the literature up to now have been either tied to the particular health behaviour and context (situational moderators) or to the personal characteristics of the individual (dispositional moderators). By far, the two most scrutinized moderators are the perceptions regarding the function of a particular health behaviour (a situational moderator) and the motivational orientation of the recipient of the framed message (a dispositional moderator).

However, by and large, both bodies of the literature have developed separately, and up to now few studies have made an explicit attempt to examine how these different classes of moderators might interact (Rothman & Updegraff, 2011). The present study integrates predictions from these two theoretical perspectives for a single health behaviour – fruit and vegetable (FV) intake - and further explores the role that behavioural intentions might also play as a moderator of framing effects.

### A situational moderator: Perceived function of the health behaviour

The first framing studies applied to health issues were derived from the Prospect Theory (Tversky & Kahneman, 1981), which sustains that people are risk aversive when contemplating possible gains, but are risk-seeking when confronted with possible losses. The same rationale was applied to the health domain by Rothman and Salovey (1997), who proposed that when thinking about the consequences of performing (or not performing) a health behaviour, people should be more responsive to appeals that emphasize the gains of performing it, as long as the behaviour itself is perceived as 'safe' (i.e., not risky). On the contrary, if performing a health behaviour is perceived as being

'risky', as might be the case of undergoing a screening test, given that one 'risks' the possibility of finding out that one has a disease, a loss-frame would be more effective. The function of the health behaviour, whether related to illness prevention (e.g., eating a balanced diet) or illness detection (e.g., doing a HIV test) was proposed to work as a heuristic people use to infer the risk of a certain behaviour and should, therefore, be a moderator of framing effects.

Many studies have demonstrated a relative effectiveness of loss-framed messages in the promotion of detection behaviours (e.g., Kalichman & Coley, 1995; Rivers, Salovey, Pizarro, Pizarro, & Schneider, 2005) and the use of gain-framed messages in the promotion of prevention behaviours (e.g., Detweiler, Bedell, Salovey, Pronin & Rothman, 1999; Kiene, Barta, Zelenski, & Cothran, 2005). Only a few studies (e.g., Bannon & Schwartz, 2006; Dijkstra, Rothman, & Pietersma, 2011) have tested the predictions derived from the Prospect Theory specifically for FV intake in response to framed messages. Results of these studies did not yield a clear advantage of the gain-frame condition for the promotion of FV intake, except for when the message was personalized in order to be more self-relevant and, therefore, more threatening (Dijkstra et al., 2011).

**A dispositional moderator: Motivational orientation**

The recipients´ characteristics, such as differences in motivational orientation, have also been shown to moderate the effects of framed health messages, in what has been called the 'congruency effect' (Mann, Sherman, & Updegraff, 2004). Motivational orientation refers to the dominant motivational system involved in the regulation of behaviour, and the existence of important individual differences towards gains and losses has been demonstrated (Higgins, 1997). Promotion-focused individuals are motivated by opportunities of accomplishment (e.g., eating fruit and vegetables in order to have more energy and feel good), while prevention-focused individuals are motivated by the prospect of preventing negative things from happening (e.g., eating fruit and vegetables to prevent cancer or cardiovascular diseases).

Studies with different health behaviours have shown a clear advantage of the use of gain-framed messages for promotion-focused individuals and of loss-framed messages for prevention-focused individuals (e.g., Gerend & Shepperd, 2007; Latimer et al.,

2008a). Furthermore, in a study on fruit and vegetable intake an interaction between frame and motivational orientation was found, in the expected direction (Latimer et al., 2008b). Nevertheless, the results of this study are not readily comparable to those following the Prospective Theory perspective on framing for FV intake, since the intervention consisted of several materials other than just the framed health messages. In a somewhat comparable study, individuals with high autonomy (i.e., who act in accordance with their inner values or ideals, rather than by pressure of others or 'oughts') were found to increase their FV intake after being exposed to a gain-framed rather than a loss-framed message (Churchill & Pavey, 2012).

**Exploring a new moderator: The role of behavioural intention**

Behavioural intention is a key predictor in most of the social-cognitive models of health behaviour (Armitage & Conner, 2000) and it has also been conceptualized as an important marker of individuals´ mindset and their readiness for change (Schwarzer, 2008). Most stage models of health behaviour change use intention as an indicator of the stage at which individuals find themselves (Schüz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009), distinguishing motivational processes, leading to intention formation, from volitional ones, leading to behavioural enactment. Considering the recommendation to tailor health messages´ content according to the individuals´ stage of change (Weinstein, Lyon, Sandman, & Cuite, 1998), and given the importance of intention as a turning point in the health behaviour change process, one might ask what type of message frame would be more suitable for individuals at different levels of intention.

Despite the prominence of intention among other social cognitive variables, to the best of our knowledge, it has never been explored as a moderator of message framing effects. Research has, nonetheless, shown that loss frames are more effective when the topic is highly relevant to the receiver of the message and that gain frames are more effective when the topic is lowly relevant to the receiver (Maheswaran & Meyers-Levy, 1990). To the extent that individuals who hold the intention to increase their FV intake consider health messages related to FV intake as being more personally relevant than individuals without the intention to increase FV intake, the same moderating pattern for intention may be expected.

The moderating effects of issue involvement can be explained by models of attitude change. According to these models, issue involvement should promote a systematic processing of the information contained in the message (Petty & Cacioppo, 1986) and under conditions of systematic information processing, negative information receives greater weight and attention than positive information, due to a 'negativity bias' (Dijksterhuis, & Aarts, 2003). On the contrary, when processing messages using the peripheral route, positive information is used as a heuristic, and it may generate more positive associations with the topic and, therefore, be conducive to higher attitudinal and/or behavioural change (Maheswaran & Meyers-Levy, 1990).

**Outcome measures of framing effects**

Besides differences in the adopted theoretical perspectives, framing studies often report on different outcome measures for the framing effects. Some studies report the effects of framing on intentions to perform a given health behaviour (e.g., Dijkstra et al., 2011), while others report framing effects on actual behaviour (e.g., Latimer et al., 2008b). Such differences imply that results might not be readily comparable. While a meta-analysis examining the role of framing in intentions to perform prevention behaviours did not offer much support for the use of gain- over loss-framed messages other than for the promotion of dental hygiene behaviours (O´Keefe & Jensen, 2007), when using behaviour as the outcome measure, gain-framed messages were shown to be more effective in the promotion of illness-prevention behaviours such as physical activity, smoking cessation and skin cancer prevention (see Gallagher & Updegraff, 2012).

**Aims and hypotheses**

Several studies have already been conducted on the moderators of health message framing, namely on the function of behaviour and motivational orientation, however their interplay has seldom been studied. Likewise, to our knowledge, no prior study has examined the potential role of intention as a moderator of framing effects. Furthermore, framing studies are not always comparable in the sense that some use intention as the main outcome variable while others use behaviour (either objectively assessed or by

means of self-report). Thus, the aim of this longitudinal study on fruit and vegetable intake is three-fold: 1) to compare predictions based on both theoretical perspectives on framing moderators (i.e., function of health behaviour and motivational orientation); 2) to explore the role of behavioural intentions as a potential moderator of framing effects; 3) to use both intention after message exposure and behaviour over the following week as the outcome variables.

Drawing from the Prospect Theory and considering that fruit and vegetable consumption is essentially a non-risky behaviour, the first hypothesis is that a gain-frame will be more effective for the promotion of both intentions and actual fruit and vegetable intake. On the basis of the congruency effect, the second hypothesis is that frame and motivational orientation will interact in the prediction of fruit and vegetable intake one week later, in the sense that loss-framed messages will be more effective for prevention-focused individuals and gain-framed messages will be more effective for promotion-focused individuals. Finally, the third hypothesis is that for individuals already holding an intention to change, a loss-frame will be more effective than a gain-frame, whereas for individuals who do not have the intention to change, a gain-framed message will be more effective.

## 3. Method

### Participants

One hundred and ninety five undergraduates were enrolled in the study, fifteen of whom did not participate at all points of the study and were, therefore, excluded from the analyses. The longitudinal sample consisted of 180 participants, 28 men (aged 18-50; $M$ = 24.4; $SD$ = 8.54) and 152 women (aged 18-48; $M$ = 23.0; $SD$ = 4.94) from three different Portuguese universities. At the end of the study, participants were granted a course credit or a 5€ voucher. None of the participants had any allergies or restrictions regarding the consumption of FV.

### Procedure

During short breaks in the classes and/or through mailing lists of the students´ associations, students were told that the aim of the study was to find out what the best

ways to communicate the results of scientific research to the general public were. Those who agreed to participate provided their e-mail addresses to receive an initial online questionnaire (Time 1) which started by explaining the study in more detail and assured data confidentiality. Participants then provided their informed consent, in accordance with the ethical standards of the three universities. This first questionnaire assessed motivational orientation, baseline fruit and vegetable intake, intention towards the eating of at least five portions of FV a day, and some demographic data as well as specific questions on food restrictions and allergies. All moderator variables as well as baseline levels of fruit and vegetable intake were measured one week before exposure to the framed messages, so as to discard the possibility that this measurement might have an effect on the dependent variables.

The experimental session (Time 2) was held at the same university to which the participants belonged, approximately one week after completion of the first questionnaire. The reason behind having the participants come to the lab was to ensure they would all see the framed message in very similar conditions. At the beginning of the session, participants were randomly assigned by the software to either the gain- or loss-framed message. They were then asked about their intention to increase their FV intake in the following week and completed the manipulation check. A further week later (Time 3), participants received the last online questionnaire to assess their FV intake.

**Materials**

On the basis of the Regulatory Focus Theory (Higgins, 1997), and as previously stressed (Dijkstra et al., 2011; Yi & Baumgartner, 2009), both the presence of a positive and rewarding outcome and the absence of a negative and aversive outcome might be considered a 'gain' and both the presence of a negative and aversive outcome or the absence of a positive and rewarding outcome might be considered a 'loss'. In order to disentangle the notion of gain vs. loss from the presence vs. absence of the outcomes, message framing was manipulated by presenting only the *presence* of gains as a result of compliance (gain-framed message) vs. the *presence* of losses as a result of non-compliance (loss-framed message), while referring in both versions to exactly the same outcomes (i.e., *same consequences* framing). Also, according to the Regulatory Focus Theory, some outcomes are intrinsically promotional (e.g., having more energy), whereas

others are intrinsically preventive (e.g., having better health). Therefore, to control for such confoundedness, both types of outcomes (promotional and preventive) were presented in both loss- and gain-framed messages.

The gain-framed message (412 words) explained the positive effects of eating at least 5 portions of FV a day, whereas the loss-framed message (417 words) presented the negative effects of not eating this same amount of FV (see Appendix A). The framed messages were presented in a video format, where participants could read the text presented in white font on a black screen, while simultaneously listening to a voice over reading the text aloud. This presentation format intended to control for the effects of other stimuli besides the message content and ensure that – even whenever not reading the message carefully – all participants would at least hear it. The video presentation lasted approximately two minutes in both message conditions.

**Measures**

**Motivational Orientation.** Motivational orientation was operationalized through the Promotion/Prevention Scale by Lockwood, Jordan and Kunda (2002), which enables assessment of both general and context-specific (i.e., academic) motivational orientation. Since the interest here was to evaluate general motivational orientation, the four items specifically related to academic motivations were excluded from the questionnaire. The promotion sub-scale was composed of seven items related to the prosecution of aspirations and an ideal self (e.g., *'I frequently imagine how I will achieve my hopes and aspirations', 'I often think about the person I would ideally like to be in the future'*), whereas the prevention subscale was originally composed by seven items related to the avoidance of negative events and a feared self (e.g., *'I often think about the person I am afraid I might become in the future', 'I often imagine myself experiencing bad things that I fear might happen to me'*). Responses were given on a 9-point scale ranging from 1 ('not at all true of me') to 9 ('very true of me').

In order to examine the underlying structure of the scale in our sample, an exploratory factor analysis was conducted using the principal components method of factor extraction followed by varimax rotation. Considering that the final goal was to extract only two factors – one for prevention and one for promotion - this was used as an *a priori* criteria for the number of factors to be extracted (Hair, Black, Babin, & Anderson,

2010). Results showed that communalities were very low (< .40) for items 1 and 15 of the original scale. Therefore, both items were removed, and the procedure was repeated. In this second solution, there was still one item (item 2) that showed a rather low communality (<.50) and was, therefore, removed. The final solution comprised all the original seven items for the promotion sub-scale (loadings >.59), and four items for the prevention sub-scale (loadings >.69), and enabled explanation of 61.5% of the total variance.

The reliability of both sub-scales (Promotion Cronbach's α= .87; Prevention Cronbach's α= .82) was slightly higher than the original ones (see Lockwood et al., 2002). The motivational orientation index was created by subtracting the mean of prevention scores from the mean of promotion scores, so that positive values indicated a prevalence of promotion orientation, whereas negative values were indicative of prevention orientation predominance. The values of this index could vary between -8 and +8.

**Intention.** Three items were used to access intentions regarding FV intake: *'I intend to eat at least 5 portions of fruit and vegetables a day from today on', 'From now on, I have the goal of eating 5 or more portions of fruit and vegetables a day'* and *'I want to eat a minimum of 5 portions of fruit and vegetables a day, everyday'*. Answers were given on a 7-point scale ranging from 1 ('totally disagree') to 7 ('totally agree') and showed good reliability (T1 Cronbach´s α =.96; T2 Cronbach´s α = .95).

**Fruit and vegetable intake.** Two items, one for fruit and one for vegetables, assessed FV intake: *'In the (last two weeks* (T1)*/ last week* (T3)*) how many (pieces of fruit / portions of vegetables) have you eaten every day?'*. Some examples were provided to help define the concept of portion (e.g., a soup, one bowl of salad, a glass of freshly squeezed and 100% fruit juice) and it was clarified that potatoes should not be considered. A similar self-report measure of FV intake has been validated against dietary biomarkers and a food frequency questionnaire (Steptoe et al., 2003). Responses were given on a 6-point scale ranging from 0 ('less than a portion per day') to 5 ('four portions or more a day'). A fruit and vegetable intake index was created by summing the reported number of pieces of fruit and vegetable portions.

**Message involvement.** Six items (Cronbach's α = .94) similar to those used by Cox and Cox (2001) assessed participants´ evaluation of their involvement with the message:

*'I got involved in what the message had to say', 'The message seemed relevant to me', 'This message really made me think', 'This message was thought-provoking', 'The message was very interesting'; 'I felt strong emotions while reading this message'.* The response scale ranged from 1 ('totally disagree') to 10 ('totally agree').

**Perceived message quality.** A further two questions were used to create an index of 'perceived message quality' (Cronbach's $\alpha = .93$). The first was: *'In your opinion, how persuasive was the message?'* and answers were given on a 10-point scale ranging from 'not persuasive at all' to 'very persuasive'. The other question was: *'How would you rate the message?'* and the scale ranged from 1 ('not credible at all') to 10 ('extremely credible').

**Tone of information.** A question similar to the one presented in Rothman, Martino, Bedell, Detweiler and Salovey (1999) was used to ensure the success of the framing manipulation. Participants were asked to rate the tone of the information contained in the message on a 9-point scale ranging from 'mostly negative' (-4) to 'mostly positive' (+4).

**Analytic Strategy**

Prior to further analyses, the frame was dummy coded (with 0 corresponding to loss-frame and 1 to gain-frame) and all continuous variables were centered. Four linear hierarchical regressions were then performed with intention (measured at Time 2) and fruit and vegetable intake (measured at Time 3) as dependent variables. Baseline fruit and vegetable intake (measured at Time 1) was included in the first step to control for its effect on the outcome variables. In order to test whether the frame condition *per se* might have had an effect on the dependent variables, the dummy-coded frame variable was introduced in the second step. Motivational orientation (or baseline intention) was included in the third step to test whether there was a main effect of these variables on both intention and fruit and vegetable intake. Finally, to test whether motivational orientation (or baseline intention) was a moderator of framing effects, the interaction terms between frame condition and motivational orientation (or intention) were entered at the fourth step.

Whenever a significant interaction was found between the frame and a moderator, procedures by Aiken and West (1991) were followed, to test for differences across message frame conditions at low (i.e., mean minus one SD) and high (i.e., mean plus one SD) levels of the continuous moderator.

## 4. Results

### Manipulation checks

A difference was found between gain and loss conditions in the rating of the tone of the information presented. Considering that '5' corresponded to the 'neutral' point, participants in the gain-framed message rated the message as presenting mostly positive information ($M$ = 6.48; $SD$ = 2.18), whereas participants in the loss-framed message rated the message as presenting information that was slightly negative ($M$ = 4.92; $SD$ = 2.72), $F(1,178) = 18.31$, $p < .001$, attesting the success of the framing manipulation. Importantly, ratings of involvement with the message and the perceived quality of the message did not differ across message frame conditions ($p$´s > .25).

### Dropout analyses, randomization check and descriptive statistics

Analyses of variance (ANOVA´s) showed no significant differences regarding the levels of fruit and vegetable intake at baseline, intention, motivational orientation and age between the longitudinal sample and those who dropped out (all $p$´s > .47), and a chi-square test revealed no gender differences between the groups.

The descriptive statistics for both message conditions as well as the inter-correlations of the study variables, at the corresponding measurement time, are presented in Table 9. A randomization check showed no differences across framing conditions in age, gender, motivational orientation, intention for fruit and vegetable increase and actual fruit and vegetable intake at baseline (all $p$´s > .32).

**Function of behaviour as a moderator of framing effects on intention and fruit and vegetable intake**

Baseline fruit and vegetable intake was, as anticipated, a significant predictor of both intention at Time 2 (ß = .34, $p < .001$) and fruit and vegetable intake at Time 3 (ß = .57, $p < .001$). The message frame, as entered in the second step of the four hierarchical multiple regressions (Table 10), did not increase the amount of variance explained beyond what was already accounted for by the baseline FV intake (for intention, $\Delta R^2 < .001$, $F(1,177) = 0.08$, $p = .78$, and for FV intake, $\Delta R^2 = .001$, $F(1,175) = 0.16$ , $p = .69$). The first hypothesis was, therefore, not confirmed, given that the message frame was neither a significant predictor of intention to increase fruit and vegetable intake (ß = -.02, $p = .78$) nor of fruit and vegetable intake one week later (ß = -.03, $p = .69$).

Table 9. *Bivariate correlations between study variables and descriptive statistics by message frame condition*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | Gain-Frame *M* (*SD*) | Loss-Frame *M* (*SD*) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 1 | | | | | | | | | 22.12 *(4.57)* | 22.63 *(6.70)* |
| 2. Motiv. Orientation | .012 | 1 | | | | | | | | 1.34 *(1.50)* | 1.38 *(1.48)* |
| 3. Intention (T1) | .015 | .040 | 1 | | | | | | | 4.52 *(1.67)* | 4.28 *(1.50)* |
| 4. FV Intake (T1) | .026 | .064 | .312** | 1 | | | | | | 2.56 *(2.25)* | 2.70 *(2.09)* |
| 5. Intention (T2) | .007 | .108 | .670** | .336** | 1 | | | | | 4.97 *(1.37)* | 5.06 *(1.33)* |
| 6. M. Involvement (T2) | .106 | -.082 | .247** | .039 | .418** | 1 | | | | 6.81 *(1.79)* | 6.48 *(1.99)* |
| 7. M. Quality (T2) | .133 | -.075 | .245** | .042 | .427** | .746** | 1 | | | 6.51 *(1.80)* | 6.21 *(2.10)* |
| 8. Intention (T3) | .059 | .085 | .642** | .287** | .763** | .438** | .366** | 1 | | 4.63 *(1.61)* | 4.58 *(1.58)* |
| 9. FV Intake (T3) | .012 | .061 | .355** | .572** | .490** | .103 | .159* | .466** | 1 | 2.38 *(1.79)* | 2.54 *(2.06)* |

*Note.* * $p < .05$; ** $p < .01$.

Table 10. *Message frame and motivational orientation (or baseline intention) as predictors of intention (Time 2)and fruit and vegetable consumption (Time 3)*

| Outcome variable | Step | Variables entered | ß (Step 1) | ß (Step 2) | ß (Step 3) | ß (Step 4) | Semi-partial $R^2$ |
|---|---|---|---|---|---|---|---|
| Intention (T2) | 1 | Baseline FV intake | .336*** | .336*** | .329*** | .324*** | .103 |
| | 2 | Message frame | | -.020 | -.015 | -.015 | .000 |
| | 3 | MO | | | .114 | .074 | .003 |
| | 4 | Frame x MO | | | | .055 | .001 |
| | | $R^2$ | .113 | .114 | .127 | .128 | |
| | | $\Delta R^2$ | .113 | .000 | .013 | .001 | |
| | | $\Delta F$ | 22.72*** | 0.08 | 2.63 | 0.28 | |
| | 1 | Baseline FV intake | .336*** | .336*** | .136* | .152** | .020 |
| | 2 | Message frame | | -.020 | -.073 | -.074 | .005 |
| | 3 | BI | | | .633*** | .754*** | .240 |
| | 4 | Frame x BI | | | | -.166* | .012 |
| | | $R^2$ | .113 | .114 | .473 | .484 | |
| | | $\Delta R^2$ | .133 | .000 | .359 | .012 | |
| | | $\Delta F$ | 22.72*** | 0.08 | 119.90*** | 3.95* | |
| FV Intake (T3) | 1 | Baseline FV intake | .572*** | .571*** | .569*** | .553*** | .298 |
| | 2 | Message frame | | -.025 | -.023 | -.024 | .001 |
| | 3 | MO | | | .030 | -.098 | .004 |
| | 4 | Frame x MO | | | | .175* | .014 |
| | | $R^2$ | .327 | .327 | .328 | .342 | |
| | | $\Delta R^2$ | .327 | .001 | .001 | .014 | |
| | | $\Delta F$ | 85.41*** | 0.16 | 0.23 | 3.69* | |
| | 1 | Baseline FV intake | .572*** | .571*** | .508*** | .537*** | .253 |
| | 2 | Message frame | | -.025 | -.041 | -.042 | .002 |
| | 3 | BI | | | .197** | .411*** | .071 |
| | 4 | Frame x BI | | | | -.295** | .037 |
| | | $R^2$ | .327 | .327 | .362 | .399 | |
| | | $\Delta R^2$ | .327 | .001 | .035 | .037 | |
| | | $\Delta F$ | 85.41*** | 0.16 | 9.45** | 10.53** | |

*Note.* Message frame is a dummy variable (0 = loss-frame; 1= gain-frame); MO = motivational orientation; BI = baseline intention; Semi-partial $R^2$ are presented for each predictor in the final model (Step 4).

*$p$ <.05; **$p$ <.01; ***$p$ < .001.

**Motivational orientation as a moderator of framing effects on intention and fruit and vegetable intake**

Motivational orientation, entered at the third step, failed to increase the amount of variance explained for both intention (T2), Δ $R^2$= .013, $F$(1, 176) = 2.63, $p$ = .11, and for fruit and vegetable intake (T3), Δ $R^2$= .001, $F$(1, 174) = 0.23, $p$ = .64 (Table 10). Moreover, no interaction between motivational orientation and frame was found in the prediction of intention to increase fruit and vegetable intake (T2) at the fourth step, ß = .06, $p$ = .60, Δ $R^2$ = .001, $F$(1,175) = 0.28, $p$ = .60.

As expected, motivational orientation and frame interacted in the prediction of fruit and vegetable intake. When the interaction term was included at the fourth step, the overall amount of explained variance significantly increased, Δ $R^2$ = .014, $F$(1, 173) = 3.69, $p$ = .056, with the final model explaining a total of 34.2% of the variance (see Table 10). This interaction between the message frame and motivational orientation (ß = .175, $p$ = .056) in the prediction of FV intake (T3) is depicted in Figure 9.

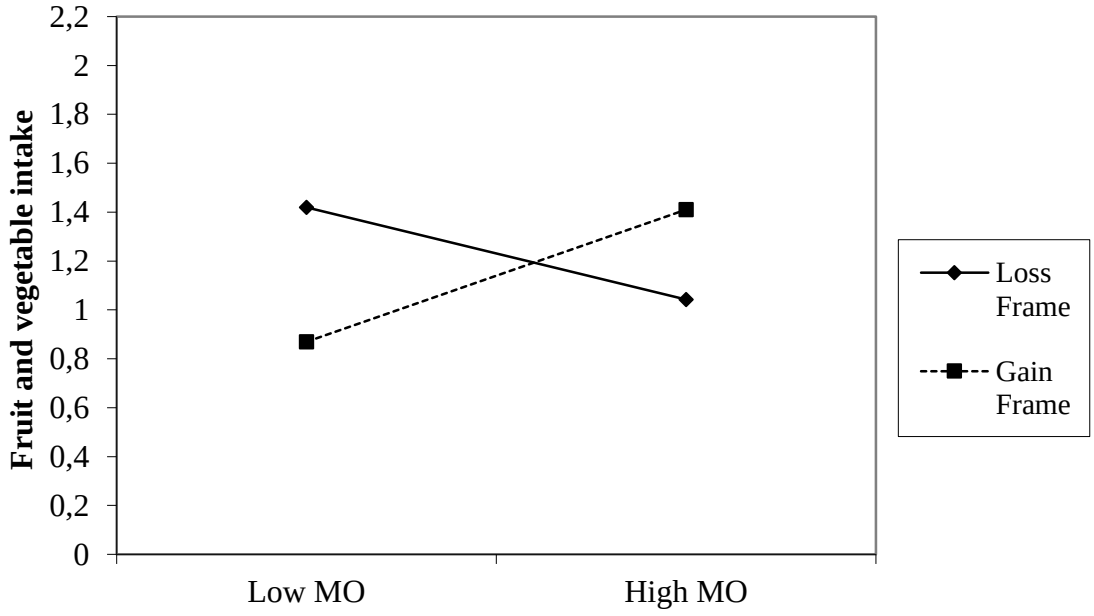


*Figure 9.* Regression of fruit and vegetable intake (T3) on motivational orientation (MO) for participants in the loss- and gain-framed message conditions, controlling for baseline fruit and vegetable intake.

At lower levels of motivational orientation, the message frame was found to be a significant predictor of FV intake (ß = - 0.23, $p$ = .03), meaning that for increasingly prevention-focused individuals, FV intake increased in response to a loss-framed message. However, at higher levels of motivational orientation, the message frame was not a significant predictor of FV intake (ß = .16, $p$ = .13), which means that for increasingly promotion-focused individuals, loss- and gain-framed messages were equally effective in the promotion of FV intake.

**Baseline intention as a moderator of framing effects on intention and fruit and vegetable intake**

Baseline intention introduced in the third step was a significant predictor of both intentions after message exposure, ß = .63, $p$ < .001, and of FV intake one week later, ß = .20, $p$ = .002, explaining 35.9% of the variance of intention (T2) and 3.5% of the variance of FV intake (Table 10).

The interaction term between baseline intention and frame entered at the fourth step also proved to be significant for both the prediction of intention after message exposure (T2), ß = -.17, $p$ = .049, and FV intake one week later (T3), ß = -.30, $p$ = .001, and both models were significant [$\Delta R^2$ = .012, $F$(1, 175) = 3.95, $p$ = .049, for intention, and $\Delta R^2$ = .037, $F$(1, 173) = 10.53, $p$ = .001, for FV intake] (see Table 10). The interaction between baseline intention and frame over intention (T2) is presented in Figure 10 and the interaction over FV intake (T3) is presented in Figure 11.

A further inspection of the effects of frame at low and high levels of baseline intention on intention after message exposure (T2) revealed that, at lower levels of baseline intention, the frame was not a significant predictor of intention after message exposure (T2), ß = .01, $p$ = .91. However, at higher levels of baseline intention, the frame was a significant predictor (ß = -.17, $p$ = .03), such that as baseline intentions increased, a loss-frame was conducive to higher intentions after message exposure (T2).

Exactly the same pattern was found for the effects of frame on FV intake, with results showing that at lower levels of baseline intention, the frame was not a significant predictor of FV intake (T3), ß = -.06, $p$ = .57, but with loss-frame being conducive to higher FV intake (T3) as baseline intentions increased, ß = -.192, $p$ = .058.

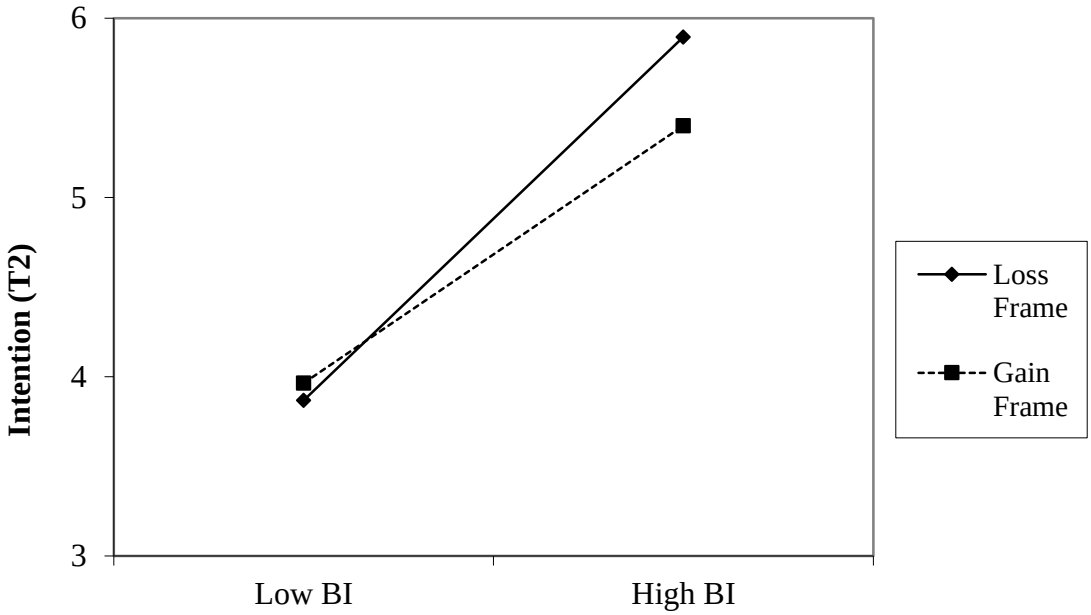


*Figure 10.* Regression of intention to increase fruit and vegetable intake after message exposure (T2) on baseline intention (BI) for participants in the loss- and gain-framed message conditions, controlling for baseline fruit and vegetable intake.

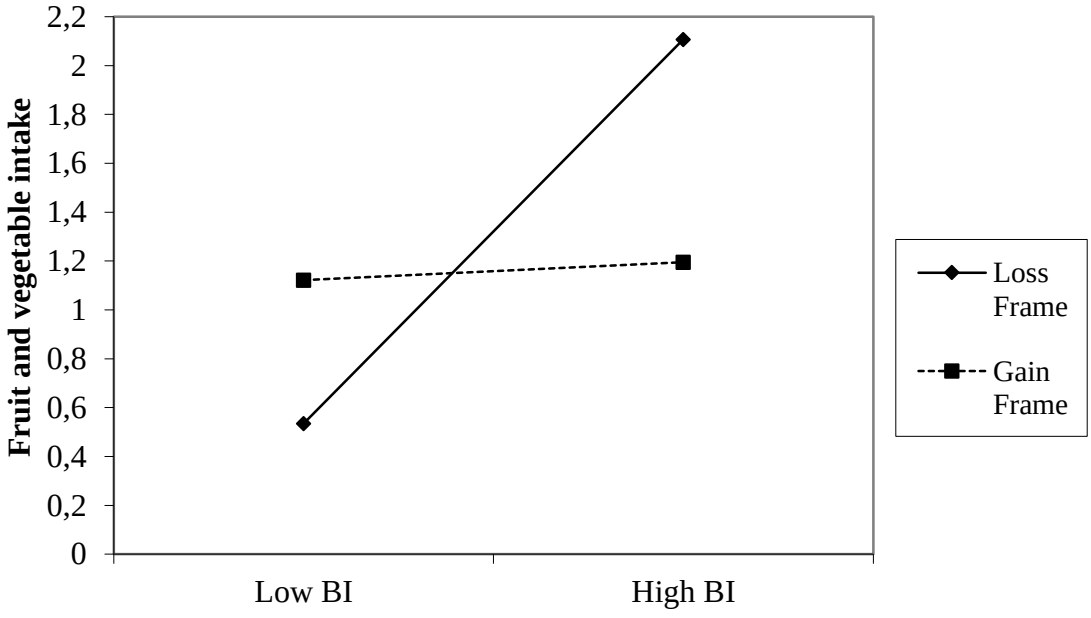


*Figure 11.* Regression of fruit and vegetable intake (T3) on baseline intention (BI) for participants in the loss- and gain-framed message conditions, controlling for baseline fruit and vegetable intake.

**Three-way interaction among frame, motivational orientation and baseline intention predicting fruit and vegetable intake**

Given that message frame interacted both with the individual´s motivational orientation and baseline intention for the prediction of FV intake at time 3, the full model, with all the previous predictors plus the three-way interaction among frame, motivational orientation and baseline intention was calculated. The new interaction term was not significant, ß = -.001, $p$ = .99, and failed to increase the explanatory value of model, Δ $R^2$ = .000, Δ $F(1, 169)$ = .075, $p$ = .79, revealing baseline intentions and motivational orientation work as independent moderators of framing effects over fruit and vegetable intake.

## 5. Discussion

The function of the health behaviour and motivational orientation are among the most studied moderators of health messages´ framing effects, but their interplay has seldom been examined (Rothman & Updegraff, 2011). In the present study, motivational orientation, but not the function of health behaviour, was found to moderate the effects of frame over FV intake, with the loss-framed message leading to higher FV intake among prevention-focused individuals. These results corroborate those of previous studies where an advantage of a gain-framed message for FV intake promotion was not found (e.g., Bannon & Schwartz, 2006; Van Assema, Martens, Ruiter, & Brug, 2001) and that of a study where an interaction between frame and motivational orientation was found for FV intake (Latimer et al., 2008b). As other authors have suggested (Rothman, Wlaschin, Bartels, Latimer, & Salovey, 2008), it might be the case that FV intake does not induce a very strong set of beliefs or that there is considerable variability regarding the way the behaviour is construed (i.e., either as health-promoting or illness-preventing), rendering the framing effects more dependent on the personal characteristics of the individuals.

Contrary to the results of Latimer and colleagues (2008b) and those of Churchill and Pavey (2012), where the framing effect was particularly salient for promotion focused individuals (or high in autonomy) when exposed to the gain-framed message, in the present study the reverse occurred, with the most clear framing effects being for prevention focused individuals when exposed to loss-framed messages. Such difference

might be due to cultural reasons. In fact, individuals from cultures where a promotion focus is more pervasive (i.e., individualistic cultures) were shown to be more persuaded by gain-framed messages, whereas individuals belonging to a more preventive focus type of culture (i.e., collectivistic cultures) were more persuaded by loss-framed messages (Uskul, Sherman, & Fitzgibbon, 2009). Given that the Portuguese culture has proven to be close to Eastern cultures in terms of collectivism (Gouveia & Ros, 2000), this might explain the obtained results, in the sense that there was a maximal effect of frame when it matched the individuals´ dispositions as well as the prevalent cultural background.

The fact that framing effects were found for behaviour one week later, but not for intentions immediately after message exposure is also worth noting, although it is not completely new. Framing effects for the adoption of prevention behaviours such as smoking cessation, skin cancer prevention and physical activity have been found on behaviour, but not necessarily on attitudes or intentions (Gallagher & Updegraff, 2012). This pattern of findings leads to the question of identifying the psychological processes that might mediate the observed effects, which clearly remains an important avenue for future research.

The role of a new moderator - baseline intentions - in the message frame was also demonstrated, with the loss-frame conducing to higher intention and behaviour among participants who already had the intention to change, as predicted. This finding is relevant for tailoring health messages according to the stage of change (Noar, Bénac, & Harris, 2007; Weinstein, Lyon, Sandman, & Cuite, 1998), suggesting that loss-frames are preferable when targeting volitional individuals. Nevertheless, it is advisable to replicate these findings for other behaviours and in other cultures, in order to attest their generalizability. For example, it would be important to test whether, in a more promotion-oriented type of culture, gain-frames might be more effective for individuals who do not yet intend to change their behaviour. Future research should also examine whether framing tailored messages according to the stage of change results in increased effectiveness.

Some aspects of the present study might limit the generalization of the above conclusions. The sample of the study was composed by well-educated and mostly female participants, and all measures were collected by self-report, including the assessment of FV intake, which might introduce some bias due to difficulties in recollecting and/or evaluating the required information. In spite of these limitations, disentangling gains and

losses from the presence vs. absence of outcomes in the framing manipulation, the inclusion of a manipulation check, the control of baseline behaviour, and testing the different predictions both for intentions and behaviour are strengths of this study that must be acknowledged.

To conclude, characteristics of the message recipient, rather than aspects of the health behaviour, were found to be relevant for the choice of frame in messages aiming to promote the increase of fruit and vegetable intake. In particular, when targeting prevention-focused individuals, a loss-frame is recommended. The pronounced framing effect for prevention focused individuals is attributed to the relevance of these individuals' disposition in a collectivist culture, and highlights the importance of considering the individual´s cultural background when evaluating the effects of message framing in health behaviour change. Moreover, the finding that for individuals already holding an intention to change, a loss-framed message is more effective, proved to be the most innovative result, and has practical implications for the targeting of health messages according to the individual´s readiness for change.

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# 6

# Interactive effects of frame, motivational orientation and perceived message quality on fruit and vegetable consumption

**This chapter is based on the paper**

Godinho, C. A., Updegraff, J., Alvarez, M.J., & Lima, L. (submitted). When is congruency helpful? Interactive effects of frame, motivational orientation and perceived message quality on fruit and vegetable consumption

## 1. Abstract

*Objective:* Health messages framed to match peoples´ motivational orientation are generally more effective in promoting health behavior change, but some inconsistencies have been found. This study aimed to test whether the perceived quality of a health message may be a moderator of the congruency effect. *Method:* Undergraduate participants ($N$ = 109) read a health message promoting fruit and vegetable (FV) intake in which the frame (gain vs. loss) was either congruent or incongruent with their motivational orientation. Perceived message quality and intention to increase FV intake were assessed after message exposure, and self-reported FV intake was assessed one week later. *Results:* Effects for congruency were not found, but significant interactions between congruency and perceived message quality were found for intention and FV intake. When messages were congruent, higher intentions and FV intake were observed when perceived message quality was high, but lower intentions and intake were observed when perceived message quality was low. Smaller or no associations were found between perceive message quality, intentions, and intake in incongruent conditions. A mediated moderation model suggested that intention mediated the interaction between congruency and perceived message quality on fruit and vegetable intake. *Conclusion:* Only when the quality of a message is strong does matching the frame of a message to the recipient´s motivational orientation increase adherence to health behaviors such as FV intake.

*Keywords*: Persuasive communication; Message framing; Motivational orientation; Perceived message quality; Fruit and vegetable intake

## 2. Introduction

Health communications intended to change health behaviors, such as fruit and vegetable intake, often emphasize the consequences of adherence or non-adherence (Michie et al., 2013). These consequences can be communicated with either a gain or a loss frame. A gain-framed message stresses the positive consequences of change, e.g., "*if you eat* five or more portions of fruit and vegetables a day you will be *protected against* several diseases", whereas a loss-framed message stresses the negative consequences of failing to implement such changes, e.g., "*if you do not eat* five or more portions of fruit and vegetables a day you will be *at risk for* several diseases".

A large body of research identifies the circumstances under which a certain frame is more effective in promoting healthy behavior (for reviews see Rothman & Updegraff, 2011; Updegraff & Rothman, 2013). One relatively robust finding is that individual differences in motivational orientation moderate the relative effectiveness of gain- and loss-framed messages (see Covey, 2014 for a review). Individual differences in motivational orientation include differences in approach or avoidance tendencies, i.e., predominance of behavioral activation system or the behavioral inhibition system (e.g., Mann, Sherman, & Updegraff, 2004; Updegraff, Sherman, Luyster, & Mann, 2007) and in the end-states to which people self-regulate their own behavior, i.e., promotion or prevention regulatory focus (e.g., Latimer et al., 2008). Among individuals who predominantly regulate towards favorable outcomes, a gain frame is generally more effective, whereas for individuals who tend to regulate away from unfavorable outcomes, a loss frame is generally more effective (e.g., Mann et al., 2004). This pattern has been called the *congruency effect*, as it refers to the increased effectiveness of a health message when the gain vs. loss frame is congruent with the recipient's motivational orientation.

The congruency effect has been demonstrated in the context of a variety of behaviors, including flossing (e.g., Mann et al., 2004; Uskul, Sherman, & Fitzgibbon, 2009) and human papillomavirus vaccination (Gerend & Shepherd, 2007), suggesting that using congruently-framed messages is a useful strategy for promoting adherence. Despite these generally supportive findings (see Covey, 2014 for review), some issues

remain unclear. For example, some studies have not found support for the congruency effect (e.g., Meyers, 2010), and the most robust evidence for the congruency effect comes from studies on dental flossing. Thus, research is needed to examine the congruency effect in other behavioral domains.

In the present study, we sought to test whether message quality might moderate the effect of congruency in the domain of fruit and vegetable intake. Fruit and vegetable intake is a critical aspect of a healthy diet, due to its association with a lower risk for cardiovascular diseases (He, Nowson, Lucas, & MacGregor, 2007), type II diabetes (Carter, Gray, Troughton, Khunti, & Davies, 2010) and certain types of cancer (Liu & Russell, 2008). Despite these benefits, many people fall short of recommended guidelines for daily intake (Hall, Moore, Harper, & Lynch, 2009). Thus, intervention strategies are needed to increase adherence to recommended levels of fruit and vegetable intake. We believe that fruit and vegetable intake is a domain in which congruency effects of message framing are likely to improve adherence. Specifically, it has been suggested that for health behaviors that do not elicit a strong set of beliefs related to risks and uncertainties – such as is the case for fruit and vegetables intake, compared to cancer screening, for example – framing effects should be primarily driven by the motivational orientation of the message recipient and less by the function of the health behavior (Godinho, Alvarez & Lima, submitted).

**Message quality and the congruency effect**

We propose that the effectiveness of using congruently-framed health messages rests on the message having perceived high quality. Most of the research conducted on message quality has used the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) as a theoretical backdrop. According to the ELM, high message elaboration occurs whenever the receiver is both motivated to process the content of the message and has the ability to do so (Petty, Barden, & Wheeler, 2002). It has been proposed that the effect of matching the content of a message to the individuals´ characteristics – such as presenting a message that is congruently framed with the recipient's motivational orientation – may

increase the recipient's ability and/or motivation to process the message more thoroughly (Dimmock, Jackson, Clear, & Law, 2013; Updegraff et al., 2007).

The ELM also predicts that when people are relatively thoughtful in their consideration of the information presented in the message (i.e., under high elaboration conditions), the quality of the message will influence the attitude towards the topic, with high quality messages leading to more persuasion than low quality messages (Petty, Cacioppo, & Goldman, 1981). In the context of nearly all ELM-based research, message quality has referred to the strength of a message's underlying arguments: high quality representing strong arguments, and low quality representing weak arguments.

One study in the domain of oral health showed that when people read health messages framed to be congruent with their motivational orientation, they were more sensitive to an argument quality (i.e., argument strength) manipulation than when the message frame was incongruent with motivational orientation (Updegraff et al., 2007). Thus, it was concluded that congruency should only promote persuasion and behavior change when message quality is high. When message quality is low, congruency may lead to reduced persuasion.

**Perceived message quality.** Research on health communication frequently uses measures of perceived message quality (or effectiveness) as an indicator of actual effectiveness. Since it may be difficult or impractical to assess the actual effectiveness of messages prior to the launching of a campaign, ratings of perceived quality or effectiveness are commonly used in formative communication research, and have been established as a valid way of estimating the message actual effectiveness in changing individuals´ attitudes or intentions (Dillard, Weber, & Vail, 2007). Some authors even claim that perceived effectiveness may actually *cause* actual effectiveness, and previous studies have explored the role of perceived message quality as mediator of persuasion (e.g., Dillard, Shen, & Vail, 2007). However, we contend that in the context of health message framing, perceived message quality may play a different and perhaps more important role. Specifically, we propose that perceived message quality should moderate the influence of framed messages on the outcomes that matter most in health behavior research: intentions to adhere, and subsequent adherence behavior.

Persuasion is often dependent upon the context, and it is hard to establish rules for developing arguments that will be systematically viewed as strong across contexts (Petty & Wegener, 1998). Message recipients may perceive a message as being high or low quality due to factors other than the strength of the underlying arguments. These factors include perceived identification, perceived informativeness, and perceived realism (Cho & Boster, 2008), and variability exists in the degree to which people may evaluate the quality of persuasive messages (e.g., Lavine & Snyder, 1996; Snyder & DeBono, 1985). To account for this variability, we advocate the relevance of assessing recipients' perceived message quality by asking participants to rate the overall quality of the message following exposure. We predict that when the message frame is congruent (compared to incongruent) with recipient's motivational orientation, higher perceived message quality will lead to higher intentions for FV consumption and, in turn, to higher subsequent FV consumption, but that low perceived message quality will lead to lower intention and, in turn, to lower fruit and vegetable consumption. In short, we predict that perceived message quality acts as a moderator of the influence of congruency on intention and behavior.

### Aims of the study

The purpose of this study was twofold. First, we sought to examine the utility of using congruently-framed messages to promote fruit and vegetable consumption, a health behavior for which the congruency effect has not yet been demonstrated. Second, we sought to resolve inconsistencies in the literature by examining the role that perceived message quality plays in message framing effects such as the congruency effect.

## 3. Method

### Participants

One hundred and twenty-seven university students enrolled in the study. Fourteen did not complete the follow-up questionnaire and another four were excluded from the

analysis for being allergic or having medical restrictions concerning the eating of fruit and/or vegetables. This resulted in a final, longitudinal sample of 109 students, who received course credit for participation. Participants´ age ranged from 16 to 46 years (*M* = 19.59; *SD* = 3.59) and 75 (70.1%) were women.

## Procedure

After providing informed consent, participants first reported whether they had any restrictions related to fruit and vegetable intake and replied to measures assessing their motivational orientation, and past fruit and vegetable intake in an online survey. At least one week later, participants came into the lab individually and were randomly assigned to read either a loss or gain framed message promoting fruit and vegetable intake. After the message, participants reported their intention towards eating more fruit and vegetables in the following week. Participants then completed the manipulation check measures, rated the message´s quality and provided some social-demographic information. One week after this experimental session, participants received an e-mail with a link to the final online questionnaire that assessed their fruit and vegetable intake over the previous week.

## Measures

**Motivational orientation.** The BIS/ BAS scale (Carver & White, 1994) was used to assess participants´ motivational orientation. The scale is composed of 20 items, 13 assessing approach motivations (BAS, i.e., the desire to approach positive occurrences; Cronbach's α = .80), and the other seven assessing avoidance motivations (BIS, i.e., the sensitivity and concern with the occurrence of unpleasant events; Cronbach's α = .75). Agreement to items was rated on a 4-point scale ranging from 1 ("very false for me") to 4 ("very true for me").

**Perceived message quality.** Perceptions about message quality were assessed by three items (Cronbach's α = .86) used by Updegraff and colleagues (2007): *"what is your overall opinion about the message", "how credible do you think the message was"* and

*"would you recommend that the message be used in a public service announcement"*. Answers were given on 7-point scale ranging from 1 ("very negative"/ "not credible at all" / "definitely not recommend") to 7 ("very positive" / "completely credible" / "definitely recommend").

**Intention.** Intention to eat daily recommended portions of fruit and vegetables was assessed by three items (Cronbach's α = .87) presented in Updegraff and colleagues (2007): *"Do you intend to eat five or more portions of fruit and vegetables a day?"*, *"Will you try to eat five or more portions of fruit and vegetables a day?"*, *"Are you planning to eat five or more portions of fruits and vegetables a day?"*. Response options ranged from 1 ("not at all") to 7 ("very much").

**Manipulation check.** Two items (Cronbach's α = .70) similar to those reported by Rothman, Martino, Bedell, Detweiler and Salovey (1999) were used to evaluate the success of the framing manipulation. The first item was *"How would you describe the message in terms of the tone of the information presented?"* with response options ranging from -4 ("mostly negative") to +4 ("mostly positive"). The second item was *"You would say that the message mostly emphasized…"* and answers were given on a scale ranging from -4 ("the problems of not eating fruits and vegetables") to +4 ("the benefits of eating fruits and vegetables").

**Fruit and vegetable intake.** Fruit and vegetable intake was measures with items described in Luszczynska, Tryburcy and Schwarzer (2007): *"Within the last two weeks (T1) / last week (T3), how often have you eaten a portion of fruit and / or vegetables (excluding potatoes)?"*. Several examples of what a portion of fruit and vegetables could be were given, such as *"one cup of raw leafy vegetables"* or *"one medium apple, banana, orange, pear"*. A similar measure has been validated against dietary biomarkers and food frequency questionnaires (Steptoe et al., 2003). Responses were given in a scale ranging from 1 ("once per day or less") to 7 ("more than four times a day").

**Materials**

The gain-framed message explained the positive effects of eating at least 5 portions of FV a day, whereas the loss-framed message presented the negative effects of not eating this same amount of FV (see Table 11)[3]. Messages were presented in a 2-minute video format, with the text presented on a computer screen accompanied by voice narration (see Appendix for full text).

[3] Although regulatory focus theory (Higgins, 1997) was not the focus of the present study, the messages were prepared in order to address some issues highlighted by the theory. One issue is the disentangling between the *presence* of a reward and the *absence* of an aversive outcome (both *gains*) and between the *presence* of an aversive outcome or the *absence* of a reward (both *losses*). To keep the presentation of information constant, the messages only referred to the *presence* of rewarding vs. aversive outcomes, while referring to the exact same consequences (i.e., same consequences framing). Moreover, the messages controlled for the fact that some outcomes might be considered intrinsically promotional (e.g., being attractive), while others may be considered intrinsically preventive (e.g., having better health), by balancing the number of each type of outcomes.

Table 11. *Outcomes related to eating (or not) the recommended amount of FV referred in each message frame type.*

| **Gain Frame** | **Loss Frame** |
|---|---|
| Eating fruits and vegetables… | *Not* Eating fruits and vegetables… |
| their **sufficient** daily consumption can **help prevent** major diseases | their **insufficient** daily consumption can **cause** major diseases |
| **Eating** fruit and vegetables **supplies** vitamins and minerals | **Not eating** fruit and vegetables **results in a lack of** vitamins and minerals |
| you will be **helping** the immune system | you will be **damaging** the immune system |
| which **works** to keep you healthy and safe from such diseases | which **will fail** to keep you healthy and safe from such diseases |
| resulting in **increased** energy | resulting in **decreased** energy, |
| **better** moods | **worse** moods |
| an **increased** sense of well-being | a **decreased** sense of well-being |
| **Having** an adequate supply of these nutrients in the bloodstream **is also important for maintaining attractive** hair and skin | **Not having** an adequate supply of these nutrients in the bloodstream **results in non-attractive** hair and skin |
| promotes an **active** metabolism | promotes an **inactive** metabolism |
| which **burns** fat | which **accumulates** fat |
| contributing to an overall **toned** and **attractive** body | contributing to an overall **untoned** and **unattractive** body |
| Substantial **positive** effect on test performance and academic achievements | substantial **negative** effect on test performance and academic achievements |
| you **will be proud of yourself** for **sticking to your goals** | you **will feel disappointed with yourself** for **withdrawing from your goals** |
| you will be **protected** against disease | you will be **unprotected** against disease |
| you will feel **good** about yourself | you will feel **bad** about yourself |
| you will have **better** health | you will have **worse** health |

**Analytic strategy**

In order to test whether perceived message quality would moderate the effect of congruency on intention and fruit and vegetable intake, two hierarchical regressions were performed. Baseline fruit and vegetable intake was included in the first step of both regressions to account for pre-existing differences in intake. As in prior studies (e.g., Mann et al., 2004), the congruency effect was represented as an interaction between message frame and motivational orientation. The hypothesized moderation of the congruency effect by perceived message quality was tested through the three-way interaction (i.e., message frame x motivational orientation x perceived message quality). Based on prior studies showing an association between perceived message quality and actual effectiveness (e.g., Dillard et al., 2007), it was predicted that higher perceived message quality could lead, by itself, to higher intention and fruit and vegetable intake. No specific hypotheses were held for the main effects of the other two predictors, or for the second-order interactions. Nonetheless, all were included in the model to ensure that the hypothesized three-way interaction was not dependent upon it.

Prior to analysis, the message frame variable was dummy-coded (with 0 for loss- and 1 for gain-frame). These three variables were entered at step two as independent predictors in the regressions. The two-way interaction terms were entered at step three and finally the three-way interaction at step four. Considering that reduced power is associated with higher-order interaction terms (Aiken & West, 1991), and that the direction of the 3-way interaction was theoretically predicted, the significance of this interaction was determined through a one-tailed test. All other reported *p*-values were two-tailed.

To simplify the interpretation of any significant three-way interactions, a categorical variable representing congruency (0 = incongruent; 1 = congruent) was created, referring to whether the message frame was congruent (vs. incongruent) with participants´ motivational orientation. Pairwise comparisons (LSD) were then performed, examining the simple effects of perceived message quality in the congruent vs. incongruent conditions, while controlling for baseline fruit and vegetable intake.

Finally, a mediated moderation model was tested using PROCESS macro (Model 7; Hayes, 2013). Intention was defined as the mediator between congruency (defined as

a categorical variable) and fruit and vegetable intake, with perceived message quality moderating the relationship between congruency and intention.

## 4. Results

### Manipulation and randomization check

As expected, the gain-framed message was perceived as being more positive in tone (*M*= 2.64; *SD*= 1.39) than the loss-framed message (*M*= 0.71; *SD*= 2.35), $F(1, 106) = 27.59$, $p < .001$, and as mostly emphasizing the benefits of fruit and vegetable consumption (*M*= 2.43; *SD*= 1.54), while the loss-framed message was perceived as mostly emphasizing the costs of not eating fruit and vegetables (*M*= -0.46; *SD*= 2.18), $F(1, 106) = 63.38$, $p < .001$. No other differences were between the gain vs. loss frame conditions in baseline fruit and vegetable intake, age and gender (all *p´*s > .10), attesting the success of the randomization procedures.

### Descriptive statistics and dropout analyses

Inter-correlations, means and standard deviations for all study variables are shown in Table 12. Analyses of variance (ANOVA´s) showed no significant differences on motivational orientation, perceived message quality, intention, baseline fruit and vegetable intake and age between the longitudinal sample and those who dropped out (all *p´*s > .27), and a chi-square test revealed no gender differences between the groups.

Table 12. *Bivariate correlations between study variables and descriptive statistics.*

| | (1) | (2) | (3) | (4) | (5) | (6) | *Mean* | *(SD)* |
|---|---|---|---|---|---|---|---|---|
| 1. Motiv. Orientation (T1) | 1 | | | | | | 0.15 | (0.62) |
| 2. P. Message Quality (T2) | .175 | 1 | | | | | 5.19 | (1.32) |
| 3. Intention (T2) | .172 | **.422**** | 1 | | | | 5.03 | (1.32) |
| 4. FV intake (T1) | -.088 | -.049 | **.266**** | 1 | | | 2.81 | (1.38) |
| 5. FV intake (T3) | .177 | .123 | **.384**** | **.518**** | 1 | | 2.91 | (1.44) |
| 6. Age (T1) | .180 | -.011 | .057 | **.209*** | **.234*** | 1 | 19.59 | (3.59) |

**Perceived Message Quality**

As shown in Table 12, perceptions of message quality were generally positive ($M$ = 5.19, $SD$ = 1.32) but ranged considerably (minimum = 1.67, maximum = 7). Message quality was not related to any baseline measures including motivational orientation (see Table 12). Participants perceived the gain-framed message to be of higher quality ($M$ = 5.62, $SD$ = 1.15) than the loss-framed message ($M$ = 4.76, $SD$ = 1.31), $p < .001$. However, there was no significant congruency effect on perceptions of argument quality, as the frame x motivational orientation interaction on message quality was not significant ($\beta$ = .03, $p$ = .83). Thus, perceptions of message quality were uncorrelated with congruency. If we were to assume that perceived message quality was a useful proxy for message effectiveness (cf. Dillard, Weber, & Vail, 2007), we would conclude from this finding that congruency would not be effective in improving adherence to fruit and vegetable intake. However, given that perceived message quality was unrelated to congruency, it allowed us to examine the extent to which message quality might moderate the influence of the congruency effect on intentions and behavior.

**Intention for fruit and vegetable intake after message exposure**

Baseline fruit and vegetable intake entered in the first step of the hierarchical regression was a significant predictor of intention after message exposure (β = .30, $p$ < .001), and explained 7.3% of its variance. In the second step, message frame, motivational orientation and perceived message quality explained 27.4% of the variance on intention, $\Delta F(3, 101) = 9.36$, $p < .001$. Inspection of the individual contributions of each variable revealed, as expected, a significant and positive effect of perceived message quality on intention (β = .42, $p$ < .001). However, the three-way interaction was also significant (ß = .29, $p$ = .02), suggesting that the joint influence of message frame and motivational orientation depended on perceived quality of the message. The inclusion of this third-order interaction contributed significantly for the prediction of intention, $\Delta R^2 = .03$, $\Delta F(1, 97) = 4.11$, $p$ = .046, explaining an additional 2.2% of variance (see Table 13).

Table 13. *Hierarchical regressions of intention (Time 2 )and fruit and vegetable consumption (Time 3) on message frame, motivational orientation and perceived message quality.*

| D.V. | Step | Variables entered | ß (Step 1) | ß (Step 2) | ß (Step 3) | ß (Step 4) | Semi-partial $R^2$ |
|---|---|---|---|---|---|---|---|
| Intention (T2) | 1 | Baseline FV intake | .269*** | .298 *** | .300 *** | .281 *** | .073 |
| | 2 | Message Frame | | -.083 | -.090 | -.123 | .012 |
| | | MO | | .138 | .139 | .167 | .009 |
| | | P. Quality | | .424 *** | .427 *** | .386 *** | .068 |
| | 3 | Frame x MO | | | -.045 | -.130 | .005 |
| | | P. Quality x MO | | | .091 | -.158 | .007 |
| | | Frame x P. Quality | | | .011 | .046 | .001 |
| | 4 | Frame x MO x P. Quality | | | | .330 ** | .029 |
| | | $R^2$ | .073 | .274 | .281 | .310 | |
| | | $\Delta R^2$ | .073 | .202 | .007 | .029 | |
| | | $\Delta F$ | 8.13*** | 9.36*** | 0.32 | 4.11 ** | |
| FV Intake (T3) | 1 | Baseline FV intake | .517*** | .546 *** | .535 *** | .519 *** | .248 |
| | 2 | Message Frame | | .024 | .018 | -.009 | .000 |
| | | MO | | .211 ** | .182 | .207 | .000 |
| | | P. Quality | | .095 | .042 | .006 | .014 |
| | 3 | Frame x MO | | | -.004 | -.080 | .002 |
| | | P. Quality x MO | | | .065 | -.157 | .007 |
| | | Frame x P. Quality | | | .089 | .124 | .007 |
| | 4 | Frame x MO x P. Quality | | | | .292 ** | .022 |
| | | $R^2$ | .267 | .330 | .338 | .360 | |
| | | $\Delta R^2$ | .267 | .063 | .008 | .022 | |
| | | $\Delta F$ | 38.23*** | 3.21** | 0.38 | 3.35 ** | |

*Note.* Message frame is a dummy variable (0 = loss-frame; 1= gain-frame); DV= dependent variable MO = motivational orientation; P. Quality = perceived message quality; Semi-partial $R^2$ are presented for each predictor in the final model (Step 3).
$^{*}p$ <.10; $^{**}p$ <.05; $^{***}p$ < .01.

Congruency, when represented as a categorical variable, was again unrelated to perceived message quality, $t(107) = 1.29$, p = .20. As hypothesized, this categorical congruency variable significantly interacted with perceived message quality to predict

intention (β = .26, *p* = .03). As Figure 12 shows, perceived message quality had an effect on intention for both congruent and incongruent groups. However, the difference between low and high message quality was more pronounced in the congruent (*M* = 5.91; *SE*= .37 vs. *M* = 3.71; *SE*= .40, *p* < .001) than in the incongruent conditions (*M* = 5.56; *SE*= .48 vs. *M* = 4.20; *SE*= .42, *p* = .04), suggesting that when the message frame is congruent with own motivational orientation, persuasion is more dependent on perceived message quality.

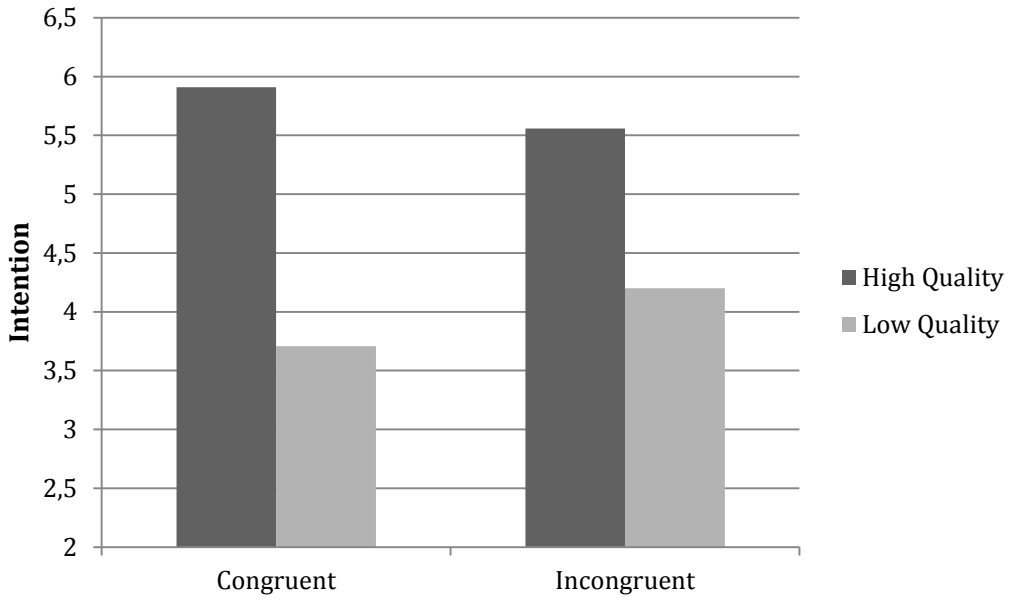


*Figure 12.* Estimated means of intention as a function of congruency and perceived message quality. Baseline fruit and vegetable intake was entered as covariate.

**Fruit and vegetable intake during the following week**

As would be expected, baseline fruit and vegetable intake significantly predicted intake at the one-week follow-up (β = .30, *p* < .001; 26.7% variance explained). Importantly, the three independent variables entered in step two jointly explained additional variance in follow-up intake, Δ*F*(3, 102) = 3.21, *p* = .03). Of these three predictors, only motivational orientation was a significant independent predictor (β = 0.21, *p* = .01), and the second-order interactions entered at step three did not significantly

explain fruit and vegetable intake, $\Delta F(3, 99) = 0.39$, $p = .76$. As hypothesized, the three-way interaction between message quality, frame and motivational orientation was significant and positive ($\beta = .29$, $p = .04$). With its inclusion, 36% variance of fruit and vegetable intake was explained, $\Delta R^2 = .02$, $\Delta F\ (1, 98) = 3.35$, $p = .07$ (see Table 13). Thus, the effect of congruency on fruit and vegetable intake depended upon perceived message quality.

When representing congruency as a categorical variable, its interaction with perceived message quality was likewise significant ($\beta = .28$, $p = .01$). Figure 13 depicts the interaction between congruency and perceived message quality. As hypothesized, when frame was incongruent with own motivational orientation, no effect of perceived message quality was found on fruit and vegetable intake ($M = 2.93$; $SE = .41$ vs. $M = 2.44$; $SE = .44$, $p = .42$). However, when frame was congruent, perceived message quality exerted a positive influence, with those perceiving higher quality reporting higher fruit and vegetable intake ($M = 3.45$; $SE = .36$) that those who perceived lower quality ($M = 2.18$; $SE = .39$), $p = .02$.

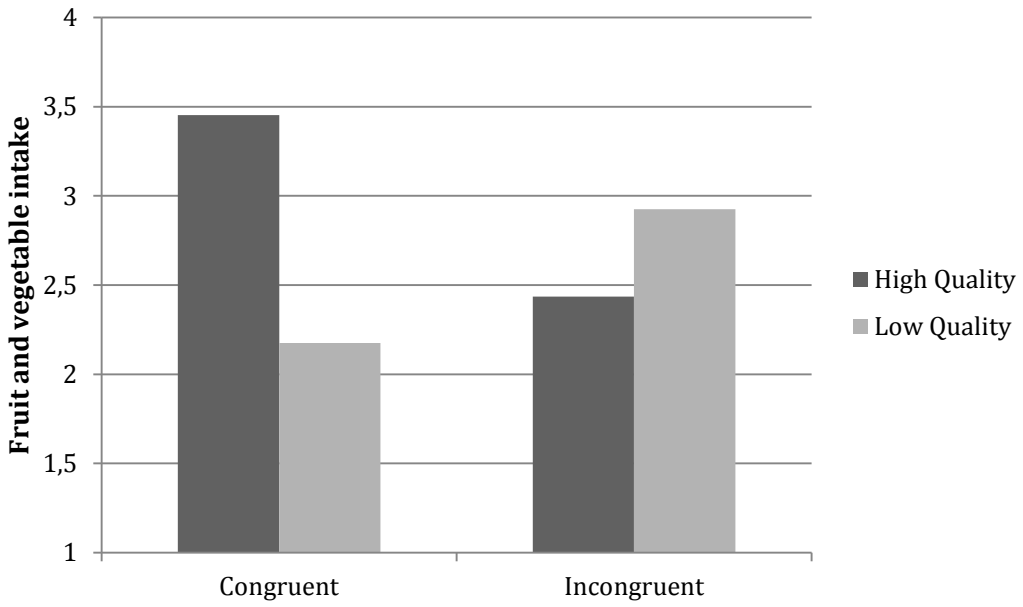


*Figure 13.* Estimated means of fruit and vegetable intake as a function of congruency and perceived message quality. Baseline fruit and vegetable intake was entered as covariate.

**Mediation analyses**

Findings thus show that message quality moderated the influence of congruency on the outcomes of both intentions and behavior, suggesting that intentions could plausibly have mediated the joint influence of message quality and congruency on behavior. Therefore, we specifically tested this mediated moderation model. At low levels of perceived message quality (i.e., values at one standard deviation below the mean), the hypothesized mediated moderation effect was found (Figure 14), with a negative significant indirect effect of congruency on fruit and vegetable intake through intention emerging, $\beta_{\text{Indirect effect}}$ = -.11, 95% CI [-.22; -.03]. Put simply, when people perceived the message as being of poor quality, the congruency effect was conducive to lower intentions and, consequently, to lower fruit and vegetable intake, as expected. However, at high levels of perceived message quality (i.e., values at one standard deviation above the mean) the indirect effect of congruency on fruit and vegetable intake through intention was non-significant $\beta_{\text{Indirect effect}}$ = .05, 95% CI [-.02; .15].

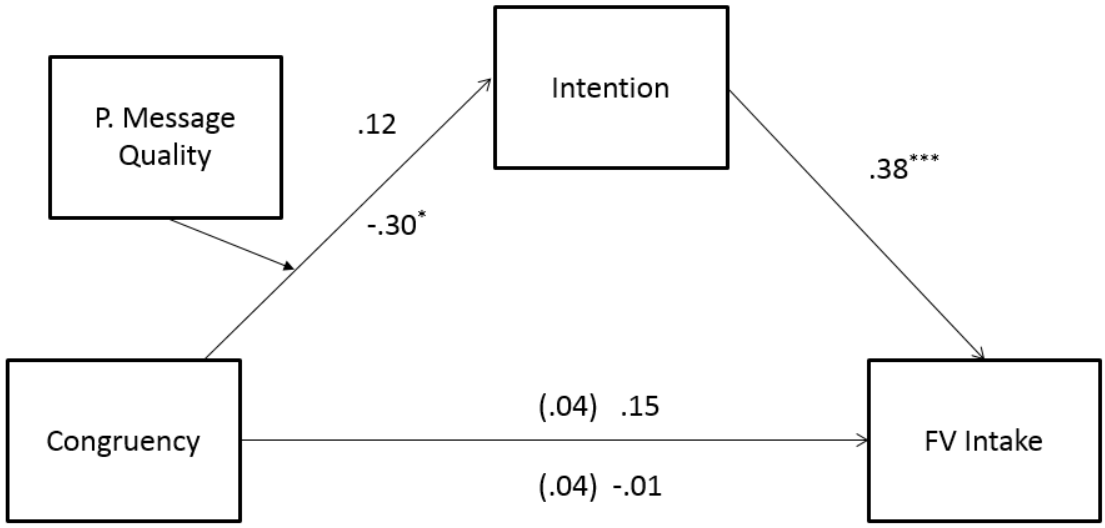


*Figure 14.* Moderated mediation model of the effect of congruency on fruit and vegetable intake through intention at high (values presented outside the figure) and low (values presented inside the figure) levels of perceived message quality.

## 5. Discussion

A growing body of literature attests the effectiveness of matching a health message's frame to individuals´ motivational orientation (Updegraff & Rothman, 2013). However, these congruency effects have not always been obtained (Covey, 2014), underscoring the need to identify boundary conditions of the congruency effect. The present study sought to test whether perceived message quality may impose limits to the effectiveness of congruently framed messages, while also examining the extent to which the congruency effect could apply to the domain of fruit and vegetable intake.

As hypothesized, perceived message quality had an impact on congruency, both for intention immediately after message exposure, as well as for fruit and vegetable intake a week further. When the message was congruent with recipients' dispositions, people appeared to be more sensitive to the perceived quality of the message, showing higher intentions and higher fruit and vegetable intake when they perceived the message to be of high quality. Conversely, lower perceived message quality led to lower intentions, which carried over to fruit and vegetable intake a week later. In other words, when the message was perceived of being of lower quality, congruency was *counterproductive*, leading to lower levels of fruit and vegetable intake. Furthermore, we found that this effect on behavior was mediated by intentions: congruency interacted with perceived message quality to determine peoples´ intentions after message exposure, that then translated into fruit and vegetable intake as reported a week later.

The major implication of the present findings is that attention should be paid to message quality when trying to predict congruency effects on intention and behavior. Even in cases where message quality is not explicitly manipulated as through an argument strength manipulation (cf. Updegraff et al., 2007), variability in peoples´ perceptions of message quality may be enough to augment or even reverse framing effects. Thus, measuring peoples´ perceptions about message quality may help to disentangle effects that may have been obscured in previous research.

These results may be due to several possible mechanisms. As suggested by Updegraff and collaborators (2007), the fact that people were more sensitive to message quality when messages were congruently framed supports the notion that the congruency effect may be driven, in part, by increased elaboration of a health message. Elaborating

on a strong message increases persuasion; elaborating on a weak message decreases persuasion. Alternately, it is also possible that people "feel right" (Cesario, Grant, & Higgins, 2004) about their reactions to congruently-framed messages, which in turn could lead to the observed effects. Feeling right about one's positive reaction to a message increases persuasion; feeling right about one's negative reaction to a message decreases persuasion. Thus, two theoretical perspectives support the observed role of message quality as a moderator of framing effects on adherence behavior, but further research is needed to test these possibilities against each other.

The fact that the gain framed message was perceived as being of higher quality is worthy of note. This may be explained by fruit and vegetable intake being possibly conceived by our young adult sample as a behavior that serves promotion-oriented concerns such as accomplishment or vitality more so than prevention-oriented concerns such as safety or reduction of long-term health risks. As stressed by Rothman, Wlaschin, Bartels, Latimer and Salovey (2008), for behaviors that reflect promotion-oriented concerns, gain-framed messages may be perceived as having better "fit" and general appeal than loss-framed messages, leading to a tendency to evaluate the gain frame more positively than the loss frame for fruit and vegetable intake promotion. Alternatively, the loss-framed message may have evoked a greater sense of threat (e.g., Shen & Dillard, 2007) which may have led to greater message derogation by some participants, particularly those low in perceived self-efficacy (cf. Witte, 1992; van 't Riet, Ruiter, Werrij, & De Vries, 2010). However, we emphasize that although gain-framed messages were perceived as being of higher quality than loss-framed messages, there was no overall difference in their effect on either intentions or subsequent intake, underscoring the limits of using perceived message quality solely as a proxy for message effectiveness.

Some limitations of this study need to be mentioned. First, the sample was composed by young adults, most of whom were women, which may impose some limitations to the generalization of the present findings. Also, although our measure of fruit and vegetable intake has been validated in prior research (Steptoe et al., 2003), fruit and vegetable intake was assessed through self-report and may be subject to errors in recall. Message quality was measured rather than manipulated, so our study does not identify which ingredients make young adults perceive a message as having higher or

lower quality. Nevertheless, the major contribution of our study is to show that, even when the underlying strength of the arguments is objectively the same, variation in peoples´ perceptions of quality is still meaningful, and influences framing effects in a manner consistent with explicit manipulations of argument strength (see Updegraff et al., 2007).

The present study makes two important contributions to the health communication and message framing literatures. First, it shows that matching the frame of a health message to people's motivational orientation is not a simple method that will always work, and reinforces the need to understand the exact circumstances under which congruency may improve adherence to health behaviors. Second, it shows that when the supporting message is perceived of generally high quality, congruency can promote increases in fruit and vegetable consumption. We also suggest that future researchers should evaluate peoples´ perceptions of message quality, as it may help to resolve inconsistencies present in the literature on health message framing.

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# 7

# GENERAL DISCUSSION

## General Discussion

Eating behavior is influenced by an array of different factors, including biological, cultural, socio-economic, educational, and many others, as illustrated in the first chapter. Social cognitive theories and models assume that all these factors exert their influence, to a large extent, through specific beliefs that individuals hold in regard to the target behavior (Conner & Armitage, 2002). Studies evaluating the effects of several types of external factors (e.g., social-demographic, environmental) on different health-related outcomes have generally supported this claim, with such effects being mediated through social cognitive factors (e.g., Sniehotta et al., 2013). Psychological theories on health behavior change have thus been used to understand dietary behaviors, such as fruit and vegetable intake, with a view to revealing the key variables that influence the behavior of interest, in order to provide information for the design of interventions targeting such variables (Bartholomew, Parcel, & Kok, 1998). However, volitional determinants of fruit and vegetable intake are still largely unaddressed, and neither has research been conducted to date on the effectiveness of stage-tailored and congruently framed messages for their promotion, nor on the factors that may limit their effectiveness.

The present dissertation aimed to bridge this gap in a number of ways. Firstly, by testing the psychological mechanisms that mediate between intention and fruit and vegetable intake, namely action control, which, to our knowledge, has not yet been explored for this behavior. Secondly, by developing health messages through rigorous, culturally-sensitive formative research and pre-testing, which has rarely been accomplished in similar studies. Thirdly, through the elaboration of an innovative study for the testing of interventions differing in content, while maintaining the same format (i.e., health message), and through a complete match-mismatch design, one of the most demanding and critical tests for proving the validity of stage-matched interventions. Little evidence is available from previous match-mismatch studies using the HAPA model and, in those studies, not only was the content manipulated, but the format also differed, making it impossible to disentangle whether the effects were driven mainly by the underlying targeted processes or if the intervention format had also been involved. Finally, factors that potentially interact with the effectiveness of framed messages, such as baseline intention (as a proxy for stage) and perceived message quality were explored, and the utility of congruently-framed messages in promoting fruit and vegetable intake,

a health behavior for which the influence of these factors has not yet been demonstrated, was examined.

In the present dissertation we set out to identify the relevant mechanisms through which key psychological antecedents affect fruit and vegetable intake, and to use this knowledge, in addition to theory, to provide information for the design of health messages and to evaluate their effectiveness in promoting this health behavior. First, the theoretically predicted relations between key psychological determinants were modeled, and post-intentional mechanisms were tested (*Chapter 2*). Secondly, qualitative and quantitative methods were used to identify relevant beliefs for the development of health messages targeting people at different stages (*Chapter 3*). These messages were used in subsequent studies in order to test our main hypothesis, that health messages are more effective when their content and frame match the specific mindset individuals hold throughout the change process (*Chapters 4 and 5*), as well as important dispositional characteristics, such as individuals´ motivational orientation (*Chapters 5 and 6*). Finally, one factor that may limit the effectiveness of matching the frame to the person´s motivational orientation, namely perceived message quality, was examined (*Chapter 6*).

Overall, the findings obtained in the different studies tended to support our general hypothesis, and specific maximal effectiveness conditions were identified. In the following sections we will briefly review the major findings obtained in each study by revisiting the initial questions presented in the introductory chapter. Major findings will then be discussed, with particular emphasis on their implications on both a theoretical and an applied level. The main limitations of the presented studies will then be summarized, and some guidelines for future research will be raised. Finally, and to conclude, observations on the contribution of the present work will be presented.

## 1. Summary of findings

The longitudinal study presented in Chapter 2 aimed to investigate whether two less examined psychological predictors in the context of fruit and vegetable intake, namely coping planning and action control, are volitional predictors of this eating behavior, and to explore their joint role in the translation of intentions into action. Our findings revealed that coping planning did not directly mediate the relationship between intentions and fruit

and vegetable intake a week later, however, a double mediation by coping planning and action control was found. Moreover, outcome expectancies and perceived self-efficacy were predictors of intention a week later and accounted for 30% of variance. Without past behavior, the considered social cognitive constructs enabled the explanation of 38% of variability in fruit and vegetable intake.

The two studies presented in Chapter 3, one qualitative, the other a survey-based study, made it possible to identify relevant beliefs for the development of health messages targeting people at a non-intentional or intentional stage of change. The most relevant beliefs for inclusion in health messages aiming to promote fruit and vegetable intake among people at different stages were identified and organized under five HAPA theoretical constructs: risk perception, outcome expectancies, action planning, coping planning and self-efficacy.

In terms of risk perception, different events across the life cycle were referred to as turning point moments for changing dietary habits. Lack of knowledge regarding the link between low fruit and vegetable intake and diseases such as cardiovascular disease and cancer was sometimes verified, in addition to an absence of knowledge on the recommended intake of fruit and vegetables. Under outcome expectancies, an array of different and mostly positive beliefs were identified, some of which helped to discriminate between non-intenders and intenders and/or were predictors of intention, such as improving health, preventing diseases such as cardiovascular disease and cancer, weight reduction and satisfaction and pleasure. The latter two predictors were the most frequently mentioned by actors. Action plans reflected the existing dietary patterns, with soup, for example, being identified as an important means of vegetable intake, unlike fruit juices.

The identification of barriers, under coping planning, differed across the groups. Non-intenders referred comparatively more to barriers such as lack of time and/or having a stressful life, whereas intenders referred to more barriers associated with the preparation of fruit and vegetables. Lack of options including fruit and vegetables when eating out were also frequently mentioned. However, barriers related to the self-regulation of behavior (e.g., forgetting, feeling tired) and preparation were precisely those that made it possible to differentiate between intenders and actors. Strategies, rated by intenders as the most important, were choosing healthier options, including fruit and vegetables when eating out, and buying fruit to have at work. With regard to self-efficacy, some intenders

and nearly all non-intenders expressed that it was not easy to achieve the five portion intake a day, since it would involve having to overcome already established habits and routines. For the maintenance of this level of intake, people tended to express strong self-efficacy beliefs, since they considered this behavior to be mostly a question of habit, and, therefore, its maintenance would be accomplished almost effortlessly.

Chapter 4 described an experimental study which set out to test whether matching health messages leads to higher changes in fruit and vegetable intake, its determinants and stage progression, than mismatched ones. Moreover, the psychological mechanisms that may account for the relative success of the stage-matched intervention were examined.

In this study, a series of hypotheses drawn from the HAPA model were tested. When contrasting baseline with post-intervention measures of the various constructs, the stage-specific effects of these interventions were found, where stage-matched health messages were generally capable of having an effect on the variables they were intended to influence (16 out of 18 hypotheses were confirmed). Secondly, a stage by content crossover interaction emerged, with participants showing higher self-efficacy immediately after message exposure, when health messages´ content and their stage of change were matched. After message exposure, non-intenders in the matched condition also showed higher intention and stage progression, whereas non-intenders in the mismatched condition revealed lower levels of action planning and coping planning a week later. Furthermore, mediational analyses confirmed the pivotal role of self-efficacy in explaining the positive effect of the stage-matched health message on intention among non-intenders. In turn, reduced intention affected the impact of the mismatched health message on action planning and coping planning among non-intenders a week later.

The experimental study described in Chapter 5 set out to compare predictions based on two prominent bodies of research on health message framing moderators - construal of behavior and motivational orientation - and to explore the role of baseline intentions as a possible moderator of health message framing effects. Findings revealed that the gain-frame was not conducive, *per se*, to higher intentions or to increased fruit and vegetable intake. However, motivational orientation and baseline intentions were found to independently moderate the effects of the message frame on fruit and vegetable intake, with loss framed messages being more effective for prevention focused individuals, as well as for those with stronger intentions to change. Moreover, baseline intentions also

moderated the framing effects on intentions following message exposure, whereby participants who had stronger intentions prior to message exposure showing higher intentions following message exposure when in the loss-framed message condition.

In Chapter 6 another experimental study was presented with a view to resolving some of the inconsistencies found in the literature regarding the effectiveness of matching the frame to the individual´s motivational orientation, by exploring the role of perceived message quality as a possible moderator of the congruency effect. In fact, the congruency effect, normally found in studies on flossing, was tested in another behavioral domain, namely fruit and vegetable intake. In this study, no main effect of congruency was found, but a significant interaction between message congruency and perceived message quality was observed in the prediction of fruit and vegetable intake. The findings showed that the effect of congruency on fruit and vegetable intake was dependent upon perceived message quality, with congruency only contributing to higher fruit and vegetable intake whenever message quality was perceived to be high. When message quality was evaluated as being low, congruency did not have an effect on fruit and vegetable intake. Moreover, the moderated effect of congruency on fruit and vegetable intake by perceived message quality was found to be mediated by intention.

## 2. Discussion of the findings and major implications

The following discussion will be guided by some general questions that will help us both stress and delimit the major implications of the present dissertation.

### *Do the relationships between different social cognitive constructs mirror what would be theoretically expected in the prediction of fruit and vegetable intake?*

The Health Action Process Approach (Schwarzer, 2008a) contends that positive outcome expectancies and self-efficacy are important predictors of intention, as do other continuum models, such as the Theory of Planned Behavior. Our results provide support for this claim, with positive outcome expectancies and self-efficacy regarding fruit and vegetable intake predicting intention for their consumption a week later, and explaining 30% of the total variance of intention. These results are in line with the meta-analyses

that attest the role of these factors for intention formation (e.g., Armitage & Christian, 2003; Floyd, Prentice-Dunn, & Rogers, 2000).

Although risk perception is also proposed by the HAPA as a predictor of intention, it is chiefly regarded as a more distal antecedent which, by itself, is insufficient to warrant intention formation (Schwarzer, 2008a). Moreover, its role is deemed to be less important in preventive health behaviors, as attested by evidence on fruit and vegetable intake (Schwarzer et al., 2007). The results obtained in the study described in Chapter 2 support this notion. Notwithstanding, Renner and Schwarzer (2005) found that objective risk, as indexed by cholesterol level, systolic blood pressure and body mass index predicted intentions to follow a healthy diet in a sample of Korean women. This result is in line with the descriptions made by some participants of our qualitative study, who became motivated to eat more fruit and vegetables after struggling with a health problem. However, in Renner and Schwarzer´s study (2005), despite objective risk predicting risk perception, the latter was not translated into an intention to follow a healthy diet. Thus, these findings highlight that, in some cases, risk perception can fuel the contemplation of dietary changes, and this is why a risk component was included in the messages targeted at non-intenders. However, this may not be enough for the establishment of intentions, especially when people do not perceive a clear link between fruit and vegetable intake and the prevention of specific diseases, as verified in some of the participants in the qualitative study.

However, in terms of modeling psychological mechanisms that tend to boost fruit and vegetable intake, in the present study, the post-intentional factors represented the most important contribution. According to the HAPA, planning and action control are both self-regulatory processes that are vital to goal-striving. Coping planning is considered a prospective self-regulatory strategy which prepares the individual to deal with forthcoming barriers, whereas action control is an *in situ* self-regulatory process that partially takes place during behavioral enaction. The fact that the overall model revealed a good fit to the data with measurements following this premise, i.e., with coping planning and intention being measured at the same time point, and action control being measured at the same time as behavior, is indicative of its validity. In other words, and as theoretically expected, there is converging evidence to support that action control is a more proximal determinant of behavior than coping planning.

Coping planning did not directly mediate the relationship between intention and behavior in our study, but a sequential mediation of the effect of intention on behavior through coping planning and action control was found. This result attests that coping planning and action control contribute jointly to the translation of intention into fruit and vegetable intake, and is in line with a study by Sniehotta, Scholz and Schwarzer (2005), where the relationship between another type of planning, namely action planning, and physical activity was mediated by action control. The major implications of these findings underline the need for planning to be conducive to closer monitoring of one's own behavior and to mobilize effort, in order to affect fruit and vegetable intake.

Although not explicitly included in the HAPA model, in our study, past behavior (i.e., behavior measured at Time 1) was also considered a direct predictor of fruit and vegetable intake, accounting for an additional 42% variance of fruit and vegetable intake at Time 3. By including behavior at Time 1, it was possible to evaluate the influence of social-cognitive factors over and above the influence of habit (see Ouellette & Wood, 1998). Moreover, by having included behavior measured at Time 1 as a predictor of behavior at Time 3, we believe the specified model enables one to envisage behavior from a dynamic perspective (see Renner, Hankonen, Ghisletta, & Absetz, 2012). Indeed, the included predictors, measured at Time 1, 2, and 3 successfully predicted behavior at Time 3, over and above what would be predicted by behavior being measured at Time 1 alone.

Although longitudinal designs are not sufficient to attest for causal relationships, they are commonly used to address the study of psychological processes in observational studies and, despite not providing an acidic test of causality, they do at least allow "causal thinking", offering a backdrop for intervention studies. Randomized controlled trials, such as that presented in Chapter 4, are the best way of testing whether these mechanisms are important targets, and if they should be used as intervention components.

### *Are stages of change valid and useful constructs for guiding intervention?*

The idea of tailoring interventions according to individuals´ stage of change is appealing and has attracted much attention in recent years, mainly due to the fact that it holds the promise of creating parsimonious, less time-consuming and potentially more effective interventions. This promise, however, is dependent on the extent to which the validity and, thus, the usefulness of stage theories are confirmed. The most important

assumptions of stage theories are that individuals may be classified into different stages of change; that stages follow a specific order, implying that interventions should follow a certain sequence and that stage progression is, in itself, a valuable intervention goal; and that people in the same stage face the same barriers, and, therefore, can be helped by similar interventions, whereas people at different stages face different barriers, rendering the same intervention unsuitable for different stages (Schwarzer, 2008a; Weinstein, Rothman & Sutton, 1998).

Methodologically, the most robust way of testing such assumptions, and hence, sustaining the validity of stage theories, is by using match-mismatch experimental designs, as employed in one of the presented studies. Stage theories may thus be considered valid and useful if stage-matched treatments outperform mismatched ones (see Schwarzer, 2008b). We will now go on to discuss the evidence obtained regarding the existence of qualitative differences between the stages, the superiority of stage-matched treatments, supporting the validity and usefulness of the stage construct, and finally offer some considerations on the measurement of the stage as a theoretical construct.

An important tenet of stage theories is that behavior change is a process, involving qualitatively different stages or mindsets (Weinstein et al., 1998). Our qualitative study data provided interesting insights along these lines. The nature of the most commonly mentioned outcome expectancies at each stage differed, progressively moving from long-term and extrinsic outcomes, such as health and appearance, to become centered around more immediate and intrinsic outcomes, such as satisfaction and pleasure derived from the eating of fruit and vegetables (see Ryan & Deci, 2000). This finding is in keeping with others, showing that adherence to health behaviors, such as exercise, is mediated by enjoyment motives (e.g., Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997), and may imply that while the anticipation of future positive consequences is more relevant for motivating those who do not obtain an immediate gratification from eating fruit and vegetables, the inherent rewarding side may be more closely related to the maintenance of this behavior.

The type of barriers that were more commonly cited by non-intenders and intenders also diverged. The barriers changed from issues such as lack of time, lack of options when eating out and not trusting the quality of the available fruit and vegetables, which are more external and may possibly compromise setting the goal of increasing fruit and

vegetable consumption, to reasons such as the preparation and self-regulatory failure (e.g., being tired, forgetting), which are more internal and constitute relevant barriers in the goal-striving phase (Carver & Scheier, 1998), revealing an implementational mindset (see Heckhausen & Gollwitzer, 1987).

Some of the criticism regarding the validity of stage theories stemmed from reviews showing that interventions matched to the TTM stages had little, if any, advantage (Bridle et al., 2005; Riemsma et al., 2003). It is important to note, however, that the success of these interventions largely depends on the targeted variables, which are, in the case of TTM, poorly defined. Unlike TTM, the HAPA model is clear as to the specific factors that predict stage transitions and which should, therefore, be targeted at each stage. Our health messages targeted factors that have been identified in prior research as being associated with stage transitions (Schuz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009; Wiedemann et al., 2009). We were able to find that the stage interacted with the health message content to predict the effects on different determinants, thus indicating the relative success of stage-matched treatment.

Questions regarding the validity of stages have also emerged in a few studies suggesting that planning interventions may exert positive effects on behavior regardless of intentions, implying that the beneficial effects of planning would not be circumscribed to those in a volitional phase (e.g., Schüz et al., 2009; Sniehotta, Soares, & Dombrowksi, 2007). Notwithstanding, other research studies have pointed to reduced effectiveness of planning interventions among individuals with low intentions (e.g., Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012; Sheeran, Webb, & Gollwitzer, 2005), and to the ineffectiveness of other intervention types suited to the volitional stage, such as self-monitoring tools, for individuals at a non-intentional stage (Schüz, Sniehotta, & Schwarzer, 2007). The evidence is, therefore, somewhat mixed, stressing a sore need for specification of the conditions under which volitional treatments may be beneficial for individuals with low intentions. Nevertheless, no study has been found to attest the efficacy of planning interventions in the total absence of an intention (Hagger & Luszczynska, 2014), and we contend that interventions prompting individuals to formulate plans to change a behavior they have not set out to modify are unlikely to be effective at all. An important finding in our results revealed that providing a volitional type of intervention for non-intenders may even be counterproductive, leading to lower levels of important behavior change determinants. In fact, reduced action planning and

coping planning were observed among non-intenders who received the strategic planning message (matched to intenders), thus, raising concerns as to the provision of mismatched treatments.

The most relevant evidence for the validity of stages in our study was obtained for self-efficacy. In our randomized controlled trial, a crossover interaction effect between stage and message content was found for self-efficacy, which lends support to the validity of stages. When the message was matched to the stage, individuals expressed more confidence in their own ability to eat more fruit and vegetables. It is worth noting that it was not the content of the message per se, but rather the match between the content and stage that led to increased self-efficacy. Self-efficacy plays a crucial role at all stages (Bandura, 1997; Schwarzer, 2008a), exerting not only a direct but also an indirect influence on behavior, through its effect on intention. Self-efficacy influences the goals individuals select for themselves and the initiation of health behavior, the amount of effort to be invested in attempts to change and persistence when confronted with failures and barriers (Bandura, 1977; Schwarzer & Renner, 2000). Thus, changing self-efficacy beliefs is a valuable intervention outcome alone.

Since self-efficacy was an intervention component in both messages, the other intervention components must have played a role in this result. Considering that the information contained in stage-matched messages is tailored to the needs individuals have at a certain stage of their change process, providing relevant information for individuals at that particular stage, this is likely to have contributed to individuals subsequently experiencing feelings of more confidence in their own ability to attain an intake of five portions of fruit and vegetables a day, whenever they received stage-matched information.

Stage theories also tend to consider stage progression as a valid outcome measure of intervention effectiveness (Sutton, 2005; Weinstein et al., 1998). In one of our studies, non-intenders were significantly more likely to progress to the following stage when in the matched condition, which is also indicative of the relative success of matching the content to the stage. Although this result is a positive indicator of the effectiveness of stage-matched interventions, we consider that the gold standard of any intervention, especially when targeting intenders, should be behavior change. However, no differences were found for behavior in our study. The fact that the intervention was very brief may help to explain this result, but most importantly, it seems that overall, the intervention

worked better for non-intenders than for intenders. Several reasons may explain such findings, namely the intervention format and dosage, which will be analyzed in more detail in the next section, as well as the specific measurement time frames used in the present study. Unlike changes in intention, which may be more immediate, changes in behavior may require certain prior conditions being met or the individual engaging in preparatory behaviors, such as buying fruit and vegetables, possibly needing more time to be put into action. Therefore, having our follow-up only one week after the intervention might not have afforded enough time to detect differences in behavior. Accordingly, in one study using health messages to promote fruit and vegetable intake, significant differences attributable to manipulation were found at a four month follow-up, but not after one month (Latimer et al., 2008).

A fundamental step for applying and evaluating stage-matched interventions is the correct allocation of individuals in the corresponding stage. Overcoming the arbitrary cut-off point problem pointed out in the literature (e.g., Weinstein et al., 1998), a dichotomous stage measure was applied, based on the assessment of intention and behavior, similar to measures validated in prior studies (e.g., Lippke, Ziegelmann, Schwarzer, & Velicer, 2009). The criterion used for stage allocation was based on whether participants consumed (or intended to) five or more portions of fruit and vegetables a day. This is an externally imposed criterion, which may not reflect the individuals´ actual goals and mindset. In fact, contrary to other behaviors, such as getting a vaccine, which is, in itself, dichotomous, fruit and vegetable consumption varies along a continuum and, therefore, the specific criterion used for the dichotomization is debatable (Richert, Lippke, & Schwarzer, 2010). Nonetheless, the criterion that was used (i.e., 5 a day) tended to be stricter, on average, than the subjective criteria used by participants, and has been shown to have a higher diagnostic accuracy, in terms of sensitivity and specificity, for the assignment of stage relative to fruit and vegetable intake, than a lower criterion (e.g., 3 a day) (Lippke et al., 2009). Furthermore, using external criteria makes sense from a public health perspective, helping to identify and include as potential intervention targets individuals who, despite already having what they consider to be an adequate intake, are not yet attaining the cut-off value for the minimum intake that is recommended for health benefits. In either case, these measurement issues do not diminish our findings; quite on the contrary, misclassifications that may have occurred will have only possibly contributed to undermining our ability to find even stronger match-mismatched effects,

due to possibly having regarded a treatment as matched when, in fact, it was mismatched, or vice-versa.

Thus, despite some of the aforementioned issues requiring further refinement, such as using improved methods for stage assessment (e.g., Richert, Schüz, & Schüz, 2013) and extended follow-ups, our findings revealed the existence of qualitative differences between the stages, and the superiority of stage-matched messages in instilling self-efficacy, as well as intention and stage progression among non-intenders. Thus, tailoring / targeting interventions to the stage still holds the promise of delivering more parsimonious and effective interventions, with a lower risk of causing reactance due to mismatched information, as suggested by our results.

### *Are health messages an important intervention strategy?*

The findings obtained in the study presented in Chapter 4 clearly demonstrate that the health messages were, in general, more effective among non-intenders than intenders. This raises questions as to the use of this intervention format - health messages - for promoting changes in behavior and in its proximal determinants, at least when targeting intenders. Two possible conclusions could be drawn from these findings, one being more general in scope - that health messages may be suitable for fostering changes in intention, but not behavioral changes - and another more restricted conclusion - that health messages may not be a suitable format to instigate planning. The former conclusion is, however, not only too broad to be addressed by our studies, but also - as we will demonstrate - inaccurate. Thus, we defend a more stringent interpretation of these findings, along the lines of the latter possibility, as we will explain.

The first conclusion is too broad to be addressed by our studies, given the specificity of the "health messages" that were used. The health messages used in our experimental studies specifically targeted deliberate health behavior change processes, doing so in the total absence of image presentation. Thus, while gaining internal validity, by having greater control of the manipulated underlying processes, our messages have lower ecological validity, since they are unlike those used in real campaigns, where images are typically used. Therefore, our results cannot be generalized to infer the effects of real health messages that may also promote behavior change by means of other less conscious or non-deliberate processes. For example, a previous study demonstrated that real

advertisements may work as powerful consumption cues, acting as real world primes that influence eating behaviors. Children exposed to food advertisements ate subsequently 45% more snacks that were made available to them, even if they were not the ones advertised, than children exposed to non-food advertisements (Harris, Bargh, & Brownell, 2009). In another experiment by the same authors, snack advertisements also contributed to an increase in the consumption of healthier food snacks among adult participants, including vegetables. In contrast, food advertisements with a nutritional message, more in line with those used in the present dissertation, appeared to inhibit automatic consumption. Automatic effects on eating behavior were attributed to exposure to images and thoughts of palatable foods rather than to the nutritional benefits presented in the advertisements. Thus, this experiment confirms that there may be automatic advertisement influences on eating behaviors, but it is unlikely that the messages used in our studies may have triggered such processes. Moreover, real-world messages may instigate behavioral changes not only through a direct path, but also indirectly (Wakefield, Loken, & Hornik, 2010), by promoting changes in social norms, or by instigating a public debate on health issues, for example, which cannot be evaluated through designs such as those used in the presented studies.

The first conclusion, that health messages may not be suitable to instigate behavioral changes, may also be considered inaccurate in light of the studies presented in Chapters 5 and 6, where results from manipulating the frame of the message were found, using behavior as an outcome measure. Moreover, health messages have already proved to have an impact on the practice of health behaviors, including fruit and vegetable intake (see Snyder, 2001; Snyder et al., 2004, for meta-analyses).

The second possible conclusion, that health messages may not be a suitable format to instigate planning, is more plausible and may be drawn from the results of the study presented in Chapter 4. In fact, contrary to the results for the other determinants, we verified that the strategic planning message failed to increase the amount of planning, supporting the view that health messages may be a more adequate format to promote changes in beliefs regarding risks and benefits than for stimulating people to formulate plans for changing their behavior. In fact, interventions aiming to stimulate planning have resorted to the use of prompts, asking people not only to think about, but also to write down specific plans for changing the target health behavior (Hagger & Luszczynska, 2014). This kind of intervention requires a more active engagement of participants than

mere exposure to a health message, and may explain the unsuccessfulness of our health messages in fostering planning. Along the same lines, a previous study demonstrated the relevance of intervention-engagement in the promotion of physical exercise (Richert, Lippke, & Ziegelmann, 2011).

Planning has proven helpful to break habitual responses (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011) and may, thus, be vital for changing eating behaviors, which tend to be routine and enacted with little conscious thought, often stemming from responses to situational cues that are maintained through long-term repetition (Verplanken & Faes, 1999). The inability of our intervention to influence planning may, therefore, explain why no differences were found for behavior.

A further feature relative to why our manipulation is distinct from real-world campaigns is that real messages are normally repeated over again, leading to repeated exposure to the message content. Repeated exposure to a message may increase a liking for the content resulting from a mere exposure effect (Zajonc, 1968) or affect the elaboration likelihood by providing more opportunities for argument scrutiny (e.g., Cacioppo & Petty, 1979). Thus, since our manipulation consisted of a single-exposure to a very brief (two minutes) health message, the lack of effects on behavior may also be explained by the small "dosage" of the intervention.

In discussing whether health messages may be an important intervention method, we cannot help but mention, as outlined in the introductory chapter, that health messages are one of several other possible methods. The general rationale behind the use of health messages is that providing people with information and helping them to acquire the necessary skills for health behavior enaction is a way of promoting change. However, the underlying notion that humans are essentially self-determined agentic beings, whose behaviors are guided by intentionality, forethought and self-reflectiveness (Bandura, 2001) contrasts with the observation that many eating behaviors are performed mindlessly (Wansink & Sobal, 2007), on impulse (Hofmann, Friese, & Wiers, 2008) or by habit (Verhoeven, Adriaanse, Evers, & De Ridder, 2012). Thus, despite the focus of the present dissertation on the deliberate processes underlying health behavior change, we acknowledge that much of human behavior is automatically driven, being prompted by environmental stimuli and conducted, to a large extent, without conscious reflection. Therefore, other possibilities certainly exist besides trying to persuade people to change their behavior through deliberate processes. Subtle changes in the physical (e.g.,

Wansink, Painter, & Lee, 2006) or social environment (e.g., Prinsen, de Ridder, & de Vet, 2013; Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014) may engender important changes in eating behaviors. It is, however, not uncommon of health campaigns to articulate more than one strategy in an attempt to change people´s health behaviors (Salmon & Atkin, 2003). Thus, complementing health communication with other types of interventions, more suitable to incentive planning or targeting these automatic behavioral bases, may be ideal.

Another equally important issue is whether health messages may contribute to sustained changes in fruit and vegetable intake. Although the focus of our studies was on initiation rather than on maintenance, in order to have an impact on health, an adequate amount of fruit and vegetable intake must be maintained over a prolonged period of time (Conner & Norman, 2005). As stage theories highlight, the factors that predict and determine behavioral maintenance may differ from those which promote initiation (Armitage & Conner, 2000). The HAPA model proposes coping planning, action control, recovery self-efficacy and social support as the proximal factors which contribute to the maintenance of health behaviors (Schwarzer, Lippke, & Luszczynska, 2011).

Much less research has been conducted on health message interventions promoting the maintenance of health behaviors. A few studies on community-based intervention programs promoting dietary changes, including the use of health messages to promote fruit and vegetable intake, indicate that these interventions may contribute to small effects on a large number of individuals that are sustained over large periods of time (Havas et al., 1998; Kumanyika et al., 2000). These programs included the application of multiple intervention types, a known contributory factor in the success of campaigns (Wakefield et al., 2010), but which, therefore, do not permit the disentanglement of the relative contribution of each intervention type.

***Are stage tailoring and framing relevant and effective communication strategies?***

It has been suggested that tailored messages may provide a more efficient approach to health communication, combining the advantages of a more personalized intervention with a wider reach. We have sustained that both the specific barriers and challenges people face at different stages of their change process, as well as their dispositional characteristics, have an impact on their needs and preferences towards specific message

content and framing. Our central hypothesis was that health messages should be more effective when their content or frame is matched to these situational (i.e., stage of change) or dispositional individual differences (i.e., motivational orientation).

The studies presented in Chapters 4, 5 and 6 helped to confirm this general hypothesis. In Chapter 4, significant interactions between message content and stage were obtained for self-efficacy, intention and coping planning. In Chapter 5, a significant interaction was obtained between the message frame and motivational orientation for fruit and vegetable intake, and between the message frame and baseline intentions for intention after message exposure and fruit and vegetable intake. In Chapter 6, a significant 3-way interaction effect was obtained among the message frame, motivational orientation and perceived message quality for intention and fruit and vegetable intake.

All these effects were significant, although modest in size. This should not be surprising if we recall that our aim was to change a very complex behavior that is influenced by a myriad of different factors, through a minimal and very brief intervention consisting of a single exposure to a health message. Moreover, the comparison we are establishing is not between an intervention and a non-intervention control group; we are contrasting the effect of a matched intervention with the effect of a mismatched one, which although theoretically less effective for a specific audience segment, provides, nonetheless, persuasive information for changing fruit and vegetable intake. More importantly, our effects were equal to or above those reported for other health communication interventions promoting fruit and vegetable intake ($r$ =.12; Snyder, 2001). We contend that, despite their relatively modest size, they may still be considered important effect sizes. From an epidemiological point of view, as explained in the first chapter, small effects in a risk factor among a large group of people tend to lead to considerable and meaningful changes at the population level (Rose, 1992).

Thus, the benefits of stage tailoring and framing are clearly evident, which is highly relevant when considering that these communication strategies are easier to be put into action nowadays. The new communication and information technologies, the new media and Internet-based interventions have facilitated the implementation of tailored interventions, making it less costly. Besides, in cases where it is not possible to evaluate these individual differences in advance, the particular channels and implementation contexts may be used to infer the characteristics of the majority of the target audience. For example, considering that health behaviors tend to co-occur (Lippke, Nigg, &

Maddock, 2012), users of health-related facilities, such as health clubs, gymnasiums, clinics, etc., are likely to be more motivated to change their dietary habits, i.e., it is likely to find a higher proportion of intenders in these contexts, when compared to others. Thus, not only stage tailoring and framing are effective, but also these communication strategies can now be implemented in a rather easy and cost-effective way.

The study presented in Chapter 4 revealed that matching the content of a message to the individual´s stage of change successfully led to increased self-efficacy, intention and greater stage progression among non-intenders and increased self-efficacy among intenders, although no effects were found for fruit and vegetable intake. From the studies presented in Chapters 5 and 6, where a main effect of frame was not obtained, we may conclude that, whereas matching the message frame to the characteristics of the individual (i.e., motivational orientation and intention strength) is a successful strategy, merely matching it to the function of fruit and vegetable intake (i.e., prevention function) is not.

It is important to note, however, that the function of the health behavior is now viewed as a general heuristic people use to infer the relative certainty and degree of riskiness associated with a given behavior (Latimer, Salovey, & Rothman, 2007). Therefore, and as long as variability exists in the way people construe a given health behavior, message frames should be matched to these different construals. In ongoing research, these very construals are measured by a question asking participants whether they would increase their fruit and vegetable intake because they wanted to or because they thought they ought to. Although the majority replied that they would on the basis of wanting to (promotional construal), more than a third stated, nonetheless, that they would do so because they believed they ought to (prevention construal). This suggests that there may be some important variability in the construal of fruit and vegetable intake that would have been important to evaluate.

One may also conclude from Chapter 6 that, despite the fact that matching the frame to individuals' motivational orientation generally contributes to increasing message effectiveness in the promotion of behavioral changes, this is not a strategy that will always work. Congruency only led to increased fruit and vegetable intake whenever the extent of the perceived message quality was high. This result highlights the need for developing messages that may generally be perceived as having high quality, pre-testing them, and for identifying the factors under which matching health messages to recipients' characteristics may contribute to maximal effects.

In sum, our results have attested the relevance of the HAPA model for the prediction of fruit and vegetable intake and the joint role of coping planning and action control in the translation of intentions into action. The validity of the stage construct was also verified, as well as the usefulness of stage-matched health messages in instilling higher self-efficacy among people at both non-intentional and intentional stages, as well as higher intention and stage progression among non-intenders. Although the effects were modest in size, they may be considered relevant from a health promotion perspective. Health messages were, nonetheless, found to be less effective in stimulating planning. Thus, other intervention methods, more suited to the promotion of planning and/or to tackling unreasoned behavior change processes may be used in conjunction with health messages for maximal intervention effectiveness. Besides matching the content to the stage of change, our results also highlighted the relevance of matching the frame to the motivational orientation or baseline intentions of the message recipient. The effect of matching the frame to the individual's motivational orientation may, nonetheless, be conditioned by perceived message quality and, therefore, is an aspect that should be taken into account in the future.

## 3. Limitations and future directions

The limitations of the presented studies will now be addressed. All of them used convenience samples, most of which were composed by highly educated participants, and mainly women. Considering that women and highly educated people tend to already eat more fruit and vegetables, future studies should seek to replicate the findings using more heterogeneous samples. Measures of fruit and vegetable intake were obtained through self-report, with two single-items, one for fruit and one for vegetables. Although similar measures have been used in prior studies (e.g., Luszczynska, Tryburcy, & Schwarzer, 2007) and have been validated against dietary biomarkers (Steptoe et al., 2003), future studies could complement such measures with multiple item measures, thus, avoiding recall and estimation bias (Michie & Abraham, 2004). For example, complementing the assessment of fruit and vegetable intake with a food frequency questionnaire would be advisable. Notwithstanding, decisions around these options usually imply trade-offs, and we opted for non-inclusion of such measures given that food frequency questionnaires

are usually lengthy and demanding in terms of time, which could have compromised participants´ overall compliance with the study, possibly affecting dropout rates and response accuracy.

In the study of the relevant mechanisms by which key psychological antecedents affect fruit and vegetable intake, one mediator, action control, was measured at the same time as the dependent variable. Ideally the mediators should not be measured at the same time as either the independent or the dependent variables, but we were confronted with the pragmatic downsides of having five methodologically accurate measurement points in time. Another limitation of the presented studies is that the time between the measurement points was only one week. It would, nonetheless, have been helpful to include another follow-up, at least one month after the manipulation, to ensure that possible effects of changes in volitional processes were captured and to understand whether longer-term effects of the intervention would have been detected.

As already mentioned, future studies may also seek to use more realistic message formats. Despite having gained more control over the manipulated processes, the fact that, unlike the messages found in real campaigns, the messages used were rather simplistic in format may have compromised the external validity of our findings to a certain extent. Future studies may use videos, showing the consequences of adopting the behavior more vividly, and other people performing the target behaviors as a means to promote self-efficacy through modeling showing, for example, people buying fruit and vegetables, giving practical advice on how to recognize that fruit and vegetables are ripe or ready to be eaten, how to best preserve them, and easier ways to peel and cook them. Moreover, given that each health message included three intervention components, the effects of each individual component cannot be disentangled.

Indeed, it would have been interesting to add one more condition to the factorial design used in the study described in Chapter 4, joining both matched and mismatched treatments, namely a combination condition. If the matched treatment proved to be better or, at least, as effective as the combined treatment, it would give even stronger support to the benefits of tailoring the content to the audience´s stage, given that the same or better results could be attained with a less time-consuming message/ briefer treatment. However, in the case of the combination condition showing better effects, it would be virtually impossible to disentangle whether they stemmed from the added value of providing contents targeting all relevant predictors of behavior change in only one

message, or if the effects were simply due to the duration of exposure to the health message, that would last twice as long as the single matched and mismatched messages.

Considering that promoting the maintenance of an adequate intake of fruit and vegetables is a very important goal, future research should also include actors, and examine whether interventions targeting factors related to behavioral maintenance, such as those proposed by the HAPA model and/or other factors such as satisfaction with the outcome of the behavior (Rothman, 2000; Rothman, Sheeran, & Wood, 2009) and intrinsic motivation (Ryan & Deci, 2000), contribute to sustained changes in eating behaviors. Moreover, considering that eating is imminently a social act and that people tend to eat with others (Conner & Armitage, 2002), exploring the multiple ways in which decision-making processes related to food may be thereby affected is an important research avenue. Recent studies have corroborated the role of received social support in adherence to a low-fat diet (Scholz, Ochsner, Hornung, & Knoll, 2013). Other studies have demonstrated the relevance of dyadic planning, i.e., of making plans with a partner to achieve the target behavior, for rehabilitation exercise (Burkert, Knoll, Luszczynska, & Gralla, 2012) and smoking (Burkert, Knoll, & Scholz, 2005), however, there is still a lack of studies on dyadic planning for eating behaviors.

With regard to the framing of health messages, some moderators are far more established (e.g., motivational orientation) than others (e.g., baseline intentions). However, knowing that people differing in their degree of intention may also diverge in their sensitivity towards a given frame is helpful if one adopts a stage-tailoring perspective for the development of health messages. Given the scarcity of studies demonstrating that baseline intentions are an important moderator of the impact of framed messages, replication of the presented findings is necessary before firm conclusions for practice may be drawn. In addition, we have mentioned that considerations as to the function of the health behavior are not so relevant in helping to select the optimal frame to promote fruit and vegetable intake. However, ongoing research has suggested that differences might exist in the way people tend to think about this behavior, i.e., in more promotional or preventive terms. Thus, future studies should evaluate the construal elicited by fruit and vegetable intake and test whether it moderates the effect of the message frame for fruit and vegetable intake.

Another important aspect is that we know comparatively much more about the conditions when a specific frame is more effective, than about the processes by which

such effects occur. In fact, despite one of our studies demonstrating the interaction between congruency and perceived message quality to affect fruit and vegetable intake through intention, in line with Sherman, Mann and Updegraff (2006), many of the framing studies, finding an effect on behavior, fail to find a mediation of those effects through deliberate decision-making processes such as explicit attitudes or behavioral intentions (see Covey, 2014; Gallagher & Updegraff, 2012). Our results suggest that both elaboration of the message content and the sense of "feeling right", after being exposed to a congruently framed message may be important mediators of the framing effects, however, further research to directly measure these processes is sorely needed. Indeed, exploring other processes, besides the cognitive and deliberate, is an important avenue for future research. Future studies may use other measures, tapping into less conscious and/or emotional processes, such as implicit attitude measures (e.g., implicit association test, Greenwald, McGhee, & Schwartz, 1998), physiological measures (e.g., skin conductance) or neurobiological measures (e.g., functional magnetic resonance imaging), to unveil the fundamental mechanisms accounting for framing effects.

## 4. Final Comments

The research presented in this thesis contributes to furthering knowledge on the psychological processes involved in dietary changes, on the validity of stages in health behavior change, and to the literature on health message framing. Relevant social cognitive antecedents of fruit and vegetable intake were identified, which constituted the targets of health messages developed to promote such intake among people at different stages of change. Stage-matched messages contributed to greater self-efficacy among people in both stages and proved more effective in promoting stage progression and to increasing the proximal predictors of behavior change among non-intenders, thus providing evidence on the validity of stages, as defined by the HAPA model. Moreover, baseline intention was found to moderate the effects of messages´ frame on intention and fruit and vegetable intake, with results indicating a loss-frame to be more effective among those with higher intentions. Finally, congruency between the message frame and the individuals´ motivational orientation was only found to be conducive to higher fruit and vegetable intake when the message was perceived as being of high quality.

Besides these theoretical and empirical contributions, this research has also some applied implications. The recognition that providing nutritional knowledge and/or communicating the risks and benefits related to food choices should be an important component of interventions, but may not suffice for changing dietary habits is worthy of note. Although understanding the health benefits and having confidence in one's own ability to attain the desired level of consumption were key factors for intention formation, actual consumption was found to be optimized when individuals planned ahead, finding ways to overcome potential obstacles to healthy eating and when they kept track of their daily eating choices, making an effort to attain their goals. Thus, for those wishing to change their dietary habits, thinking ahead of possible strategies to overcome identified barriers that may hinder fruit and vegetable intake and monitoring their own daily dietary choices, making an effort to regulate them whenever established goals are not being met, are important psychological processes that have been found to translate into increased fruit and vegetable intake.

This research has also provided extra information so that the design of health messages for the promotion of fruit and vegetable intake may be improved, by specifying the contents and frames that are more effective for different audiences. Individuals' stage of change, as well as their motivational orientation, have proven to be important individual characteristics that have an impact on how people will respond to different information contents and frames. These findings have important implications for public health initiatives seeking to use health messages as a strategy for promoting changes in health behaviors, but may also apply to other health communication contexts, such as the communication between general practitioners or nutritionists and their patients. It is important to acknowledge that not everyone shares the same readiness for change and motivational orientation, and that interventions should, whenever possible, be tailored and framed accordingly. Moreover, by acknowledging that health communications may not be the ideal intervention format to instill planning, the need to complement this format with other more engaging types of interventions is reinforced.

It is our hope that this work may stimulate future research, as well as better articulation between theory and health communication practice, through the development of theory-guided and evidence-based health messages.

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# 8

# APPENDICES

## Appendix A. Health messages targeted at non-intenders, intenders and control (Chapter 3)

### Message targeted at non-intenders

[410 words in the original language]

Cancer is one of the main causes of death throughout the world, the second cause of death in Portugal and is responsible for around 35% of all deaths. Despite advances in cancer treatment, 3 191 600 new cases were diagnosed in the European continent in 2006. In the same year, 1 703 000 Europeans died as a result of this oncological disease.

The disease has a significant impact on the patient's quality of life and many forms of cancer treatment (such as chemotherapy) may have severe side-effects. Cancer can affect people of all ages and its appearance has increased in younger people, such as adults under the age of 30, adolescents and even children.

Many people believe that cancer is a result of our genetic constitution. However, scientific research has shown that it is primarily linked to our lifestyle, and diet is one of the fundamental aspects for its prevention. One in every five gastrointestinal cancers can be prevented by an adequate intake of fruit and vegetables. Therefore, when you eat a sufficient amount of fruit and vegetables you are protecting yourself against this disease.

Eating fruit and vegetables provides vitamins and mineral salts which perform the crucial function of protecting the body. If you eat the recommended portions of fruit and vegetables, you will be helping to boost the immune system, which works to keep you healthy and safe from diseases such as cancer. Moreover, a balanced diet that is rich in fruit and vegetables has a direct effect on the brain and contributes not only to increased energy but also to a boost in positive emotional states and the feeling of satisfaction and pleasure.

The World Health Organization recommends the daily intake of at least 5 portions of fruit and vegetables. It is easy to eat five portions per day and is equivalent to eating,

for example, 3 pieces of fruit and 2 servings of your choice of soup or salad. You have managed, for sure, to eat these 5 daily portions at some stage, which means that in order to eat this amount of fruit and vegetables, it is a question of will and organization. If you do it, you will feel proud of yourself for having been capable of this achievement.

If you eat this amount of fruit and vegetables per day, you will be contributing towards preventing a number of diseases as well as feeling good about yourself and improving your health!

**Message targeted at intenders**

[412 words in the original language]

The World Health Organization recommends the daily intake of at least 5 portions of fruit and vegetables. It is easy to eat five portions per day and is equivalent to eating, for example, 3 pieces of fruit and 2 servings of your choice of soup or salad. You have managed, for sure, to eat these 5 daily portions at some stage, which means that in order to eat this amount of fruit and vegetables, it is a question of will and organization. If you do it, you will feel proud of yourself for having been capable of sticking to your aims.

It is easier to eat five portions of fruit and vegetables every day if you carefully plan how you will put this objective into practice. A number of scientific studies have shown that planning what you are going to eat beforehand is an effective and powerful means for adopting healthier eating habits.

In order to establish this plan, you need to think as carefully as possible about the situations in which you will be able to increase your fruit and vegetable intake. You should think mainly about three fundamental aspects: *when* (For instance: At lunch? At dinner? Between meals, such as mid-morning or afternoon?); *where* (For instance: At home? At university? At work? In the supermarket? In cafes?); and *how* (For instance: By always starting a meal with soup, accompanying the main dish with salad or boiled/sauté vegetables, ending the meal with fruit).

Nevertheless, certain circumstances may hinder the accomplishment of these action plans, such as having a very stressful life, not feeling like eating fruit and vegetables when one is tired or simply forgetting to eat fruit and vegetables. Research has shown that by thinking about strategies to overcome such difficulties the likelihood of being successful is increased. Buying fruit to keep at work or take to university, choosing meals that

include fruit and vegetables when eating out or peeling a large quantity of fruit to have to hand in the fridge are effective strategies which may help you attain your objective of eating 5 portions of fruit and vegetables per day.

If you establish these action plans and anticipate the obstacles that might emerge, you will manage to eat 5 portions of fruit and vegetables every day for sure! If you do this, it will be easier to accomplish your aim, you will feel good about yourself and proud, you will improve your health and feel all the benefits provided by an adequate intake of fruit and vegetables.

**Control condition message**

[411 words in the original language]

Fruit, vegetables and greens are commonly called fruit and vegetables. Nutrients such as apples, strawberries, cantaloupe, melon, watermelon, oranges, bananas, pineapple, pears, kiwis, cherries, plums, papaya, mango, grapes, persimmon, tangerines, passion fruit, raspberries, etc. are included in the fruit group.

The main function of fruit is to protect the developing seed. Throughout their evolution, plants with flowers and fruit have developed new types of fruit and new strategies to disperse their seeds, so that in current species there is a huge variety of color, shapes and flavors, each specialized in a different form of seed dispersion.

Turnip greens, lettuce, white cabbage, Portuguese cabbage, other cabbages, spinach, watercress, leek, garlic, onion, roots, pumpkin, tomato, carrot, horseradish, etc., are included in the greens and vegetable group.

Even after being picked, a number of processes continue to be carried out in vegetables, such as photosynthesis and respiration. The formation of organic compounds rich in energy occurs in photosynthesis, stemming from carbon dioxide and water with the use of energy captured from sunlight by chlorophyl. Respiration is the reverse process, namely the breaking down of such molecules and consequent release of accumulated energy. When separated from the mother plant or soil, the vegetables use their energy-rich organic compound reserves, such as sugars and starch, to maintain cellular respiration and, thus, to produce the energy required to keep them alive.

Nowadays, supermarkets represent the main fruit and vegetable distribution channel for the end consumer, thus, pointing to a need to reduce their storage in supply

chains, to reduce the time involved in their replacement and to reduce out of stock situations.

Logistical efficiency is related to improvement in the process of fruit and vegetable handling, the use of air-conditioned environments and also skilled labor. Logistical efficiency is fundamental as far as fruit and vegetables are concerned, given their high perishability characteristics (in other words, rapid deterioration) and owing to food safety-related issues.

From a logistic perspective, fruit and vegetables may be classified in two broad classes: the first, made up of products with lower perishability and easier financial control, such as the pear; the second is characterized by high perishability and management complexity, thus, generally commercialized directly by producers so as to minimize logistic difficulties, such as watercress.

**Appendix B. Outcomes presented in the gain and loss framed messages (Chapter 4)**

| Gain-Framed Message | Loss-Framed Message |
|---|---|
| **If you *eat* at least 5 portions of FV a day…** | **If you *do not eat* at least 5 portions of FV a day…** |
| One in five gastrointestinal cancers **may be prevented** by **adequate** F&V consumption. | One in five gastrointestinal cancers **are caused** by **low** F&V consumption. |
| **You will be protecting yourself** against this disease. | **You will be unprotected** against this disease. |
| **You will be provided with** vitamins and mineral salts which perform the fundamental role of protecting the body. | **This will result in a lack of** vitamins and mineral salts which perform the fundamental role of protecting the body. |
| …it will **help** the functions of the immune system, which **works to** keeping you healthy | … it will **jeopardize** the functions of the immune system, which **will fail in** keeping you healthy |
| [it may keep you] **safe from** diseases such as cancer. | **It may trigger** diseases such as cancer. |
| **Increase** in energy, **increase** in positive emotional states and sense of satisfaction and pleasure. | **Reduction** in energy, **reduction** of positive emotional states and sense of satisfaction and pleasure. |
| You will feel **proud of** yourself, | You will feel **disappointed with** yourself, |
| For having been **capable** of doing it. | For having been **incapable** of doing it. |
| It may contribute to **preventing** a number of diseases, | It may contribute to **triggering** a number of diseases, |
| **Feeling good** about yourself | **Feeling bad** about yourself |
| And having **better** health. | And having **poorer** health. |

**Appendix C. Health messages (gain/ loss frame) promoting fruit and vegetable intake (Chapter 5)**

The World Health Organization recommends a daily intake of at least 5 portions of fruit and vegetables. Fruit and vegetables are important components of a healthy diet, and their (sufficient/ insufficient) daily consumption can help (prevent/ cause) major diseases, such as cardiovascular diseases and certain cancers.

(Eating/ Not eating) fruit and vegetables (supplies/results in a lack of) vitamins and minerals that play a fundamental protective role in the body, and help to repair already damaged tissues. (If you eat/ If you do not eat) the recommended portions of fruit and vegetables (you will be helping/you will be damaging) the immune system, which (works/will fail) to keep you healthy and safe from such diseases.

Furthermore, (a balanced/ a non-balanced) diet that (is/is not) rich in fruit and vegetables has a direct effect on the brain, resulting in (increased / decreased) energy, (better/worse) moods and (an increased/ a decreased) sense of well-being. (Having/Not having) an adequate supply of these nutrients in the bloodstream (is also important for maintaining attractive/ results in non-attractive) hair and skin, and promotes an (active/inactive) metabolism, which (burns/ does not burn) fat, contributing to an overall (toned/ untoned) and (attractive/unattractive) body. Plus, (good nutrition/ bad nutrition), (rich/poor) in fruits and vegetables, can have a substantial (positive/negative) effect on test performance and academic achievements.

There have probably been times in the past when you have managed to eat 5 portions a day. This means that eating a sufficient amount of fruit and vegetables simply takes motivation and organization. If you (do it / do not do it) you will (be proud of / feel disappointed with) yourself for (sticking to /withdrawing from) your goals.

Eating 5 portions of fruit and vegetables a day is easy, and most of all it´s tasty! If you (eat / do not eat) this amount of fruit and vegetables per day, you will be (protected / unprotected) against disease, you will feel (good/bad) about yourself and you will have (better/worse) health!