“MAAK JE NIET DIK!”

Evaluation of a nationwide mass media campaign aimed at prevention of weight gain in Dutch young adults

Birgitte Wammes

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Evaluation of a Nationwide Mass Media Campaign aimed at Prevention of Weight Gain in Dutch Young Adults

Evaluatieonderzoek naar een landelijke massamediale campagne gericht op preventie van gewichtstijging bij Nederlandse jongvolwassenen

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PART 1

Introduction to
planned health promotion

CHAPTER 1

General introduction

BACKGROUND

The prevalence of overweight and obesity is increasing rapidly (1, 2). In the Netherlands the prevalence of obesity has roughly doubled over the last decade and now more than 40% of the Dutch adult population is overweight and more than 10% obese (3). Obesity is a major burden of disease because of its link to cardiovascular diseases, such as myocardial infarction and stroke, type II diabetes mellitus, musculoskeletal disorders, inability to work and impaired quality of life (4-7).

Obesity is caused by a long-term positive energy balance in which energy input through food consumption exceeds energy output, with physical activity as its main modifiable component. Until now, treatment of obesity has been very disappointing, since people often regain weight after the treatment programme is finished (8, 9). It has been suggested that more attention should be given to the opportunities for preventing weight gain (10-12). In obesity prevention, people should be encouraged to make relatively small but sustained changes in eating and exercise habits, preferably before they have developed significant overweight (13, 14). This is in contrast with the more intensive behavioural changes necessary to achieve significant weight loss for treating obesity (9, 15).

To promote action for preventing weight gain among non-obese Dutch young adults, in December 2002 the Netherlands Nutrition Centre launched the nationwide campaign 'Maak je niet dik!'[1] Mass media, such as television and radio (commercials), newspapers and magazines, a brochure and posters were used to convey the campaign messages.

Mass media interventions have been defined as those interventions that reach groups of individuals by using a medium other than personal contact, and offer a means to reach large numbers of people at less per-unit expense than that associated with face-to-face interventions (18). Campaigns are a specific use of mass media in purposive ways during defined time periods, to increase the salience and community focus around specific issues and to set the agenda for change (19). Mass media campaigns that promote healthy behaviours and discourage unhealthy ones have become a major tool for improving public health and communicating health information to large audiences. Mass media interventions are a relatively inexpensive method of exposing the population to health information, since they reduce personnel costs by minimizing face-to-face contact (16, 17).

Until now, little is known about the success of mass media campaigns, because these approaches have only infrequently been systematically developed or evaluated. This is something that should be standard procedure to increase the likelihood of pursuing the right behaviour-change goals by targeting the right behavioural determinants with the right intervention strategy (20-25). Weight-gain prevention in particular has not been studied extensively, nor has it yet received attention in well-designed and planned health promotion interventions. Furthermore, the progress in mass media campaigns has often been hampered by the lack of a comprehensive evaluation framework appropriate to such programmes. A phased approach to efficacy evaluation has been recommended (26, 27) because internal valid evaluations of mass media interventions are difficult to conduct, especially when such interventions are

[1] Translated literally, 'Maak je niet dik' means 'Don't get fat!' In Dutch, 'Maak je niet dik' is also a popular expression that means 'Don't worry'.

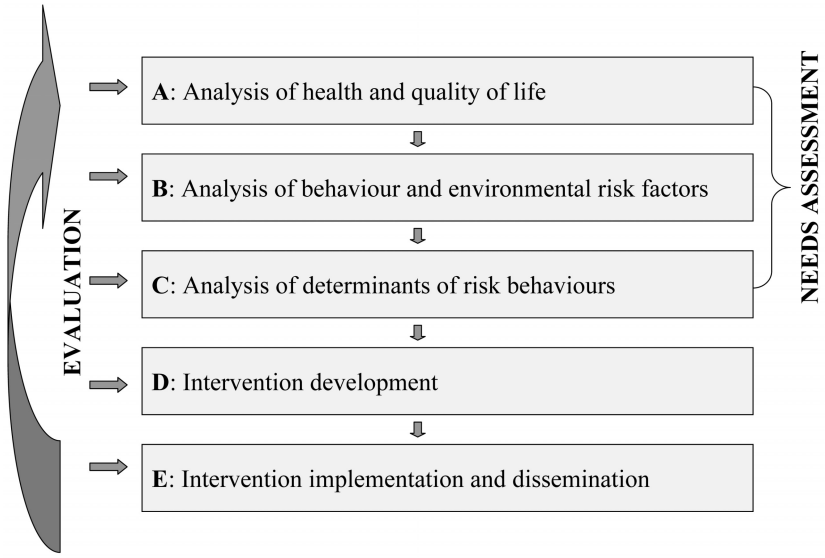

Figure 1. A model for planned health education and health promotion.

launched nationwide. Therefore, individual components of mass media campaigns should first be tested in randomized trials for their potential effects before they are launched as part of the nationwide campaign (28-30).

The aim of the present thesis was to contribute to systematic, evidence-based and theory-driven development, implementation and evaluation of the 'Maak je niet dik!' campaign. Research on the campaign was partly based on a simple model for planned health education and promotion. Within this model, five phases can be distinguished. The first three phases refer to the *needs assessment*. The first phase (A) is the identification of health problems that are serious and/or prevalent enough to allocate resources to prevention (see Figure 1). In the second phase (B), the behavioural risk factors for health problems are identified. The third phase (C) identifies the most important and appropriate changeable personal and environmental determinants of the risk behaviours.

The needs assessment is followed by the 'intervention development' (D). In this phase, the determinants identified by the needs assessment are translated into interventions (D) that can be implemented and disseminated (E). The intervention development phase should identify or develop intervention methods that induce changes in the behavioural determinants and subsequently reduce the risk behaviour. These methods are then translated into deliverable intervention strategies and evaluated for their efficacy. *Evaluation* is an integral part of all phases in the process of planned intervention development (Figure 1).

Research on the 'Maak je niet dik!' campaign focused mainly on the needs assessment and intervention evaluation. The intervention development was not part of this thesis, since the Netherlands Nutrition Centre was responsible for this phase.

In broad terms, three steps of research activities were distinguished. The first step was to identify important predisposing factors for inducing change in weight-gain prevention behav-

iours to define proximal programme objectives (Figure 1, Phase C). Subsequently, the Balance Intervention, initiated by the Netherlands Nutrition Centre, was pre- and pilot tested in a controlled setting. Finally, an outcome evaluation was conducted of the entire 'Maak je niet dik!' campaign.

The research presented in this thesis was realized in close collaboration with the Netherlands Nutrition Centre and can be regarded as an example of a so-called solution-oriented research paradigm with more immediate relevance for practice. With this, we mean that the studies presented in this thesis were true applied studies with direct links to implementation practice. The campaign staff of the Nutrition Centre was primarily responsible for the development and implementation of the campaign, while the Department of Public Health at Erasmus MC was primarily responsible for the evaluation studies. This thesis is based on these studies.

OUTLINE

For clarity, this thesis is written in chronological order of the steps taken to provide information on the development and implementation of the campaign.

Part 1 introduces the need for planned health promotion. *Chapter 1* is the general introduction and *Chapter 2* deals with planned promotion of healthy eating to improve population health. Although this chapter is framed to healthy eating, the same approach is valid for interventions for physical activity.

Part 2 deals with the needs assessment. Three studies were conducted to identify potential programme objectives for the campaign. *Chapter 3* presents the results of a study on the awareness of personal weight status, since unwarranted over- and underestimation of personal weight status may prevent appropriate weight maintenance behaviour. A second study was conducted to investigate the correlates of the motivation to prevent weight gain *(Chapter 4)*. To explore the discrepancy between reported preventive actions on the one hand and more people becoming overweight on the other, a third needs-assessment study was carried out to investigate the prevalence of and differences in self-reported occasions of overeating (such as at celebrations and other parties), compensatory behaviours and specific weight-gain prevention strategies according to socio-demographics and overweight status *(Chapter 5)*.

Part 3 deals with the research on 'intervention pilot testing' and 'outcome evaluation'. The Netherlands Nutrition Centre developed and pre-tested the Balance Intervention. The Balance Intervention was initiated by the Netherlands Nutrition Centre and promotes moderating food intake and/or increasing physical activity in response to occasions of overeating.

Chapter 6 presents a formative evaluation research to pre- and pilot test the Balance Intervention the Netherlands Nutrition Centre planned to use in the nationwide campaign. The formative evaluation was to promote an optimally effective design and production of messages more likely to be acted upon by the target audience. This included qualitative focus-group interviews and pre-testing of draft intervention materials.

Chapters 7 and *8* concern the *outcome evaluation* in which results of the process and impact evaluation of the nationwide mass media campaign 'Maak je niet dik!' are presented. The outcome evaluation plan was intended to guide the assessment of the effects of the nationwide campaign. Multiple measures were conducted during three campaign years to explore changes over time. First, a study was conducted to evaluate the initial campaign activities *(Chapter 7)*. In addition, the effects of the three-year mass media campaign were documented in *Chapter 8*.

In **Part 4,** results are discussed and integrated in the general discussion. Methodological and theoretical issues are discussed, as well as implications for future research and recommendations for future intervention development.

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CHAPTER 2

The planned promotion of healthy eating to improve population health

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2.1 INTRODUCTION:
A simple model for Planned Promotion of Population Health

Ecological studies, migrant studies and case-control studies in the nineteen-eighties suggested that a high total fat intake was associated with higher breast cancer incidence (e.g.(1)). This association was one of the reasons for fat reduction campaigns in many countries. The preliminary evidence that fat intake increased cancer risk was subsequently communicated to the general public in order to increase risk perceptions to motivate dietary change. Mass-media approaches were often applied to spread the fat-and-cancer-risk message (e.g. (2, 3)).

However, later prospective cohort studies, i.e. studies with a much stronger design to investigate possible dietary risk factors for cancer, failed to confirm that dietary fat intake was an independent risk factor for breast cancer (e.g. (4)). Furthermore, results of health psychology research have provided strong evidence that fear appeals often fail to motivate people to change their risk behaviours (5, 6), and health education studies have indicated that mass-media interventions by itself are not well-suited to initiate behaviour changes (7, 8). In short: a doubtful behaviour change goal was pursued, by targeting a doubtful determinant of behaviour change, with a doubtful intervention strategy.

A healthy existence is to a large extent dependent on health behaviour (9-11) and next to smoking and lack of physical activity, unhealthy eating has been identified as one of the important behavioural risk factors for important burdens of disease worldwide (9, 11) and the main means to promote healthy dietary habits is health education and health promotion. To avoid non-optimal use of the sparse resources available for healthy diet promotion, careful evidence-based planning of such interventions should be standard procedure in order to increase the likelihood that the right behaviour change goals are pursued by targeting the right behavioural determinants with the right intervention strategy.

This careful planning of health promotion has especially been advocated since the publication of Green and Kreuter's Precede and Precede-Proceed models (12). These and other planning models (13, 14) show great similarities. Comparison and integration of the available health promotion planning models identified five important steps or phases in health promotion planning (15) (Figure 2.1).

The first two steps cover the epidemiological analysis. When applied to public health nutrition, these steps should identify the most important health and quality of life issues and their nutritional risk factors. These first two steps thus result in setting priorities for dietary change interventions and identification of behaviour change goals.

The third step is to investigate the mediators or determinants of these dietary risk factors. Since diet is subject to free choice for most people, especially in affluent societies where the variety in possible food choices is overabundant (with exceptions for specific population groups such as small children and some institutionalised people), eating behaviours cannot be influenced directly. In healthy diet promotion we need to be able to influence people's choices. What, when and how much people choose to eat is influenced by a complex, interrelated set of so-called behavioural 'mediators' or 'determinants' and successful dietary behaviour

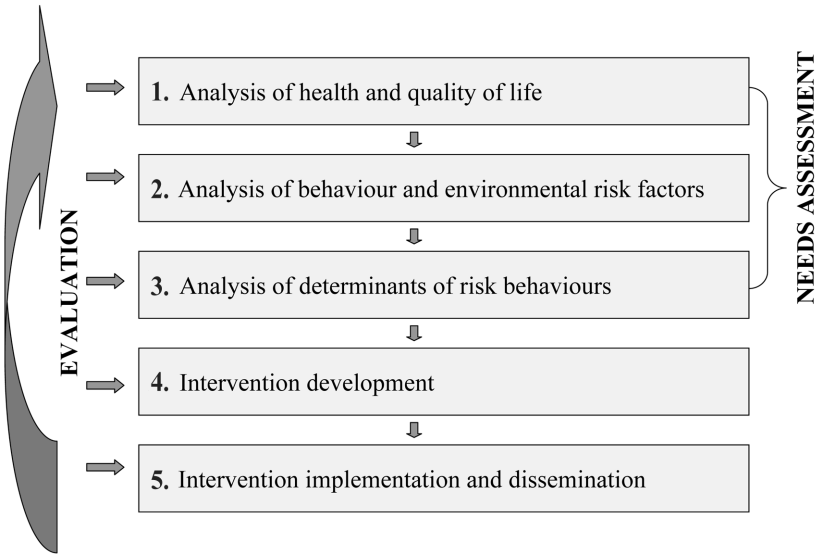

Figure 2.1. A model for planned health education and health promotion.

change interventions are dependent on the identification of the important and changeable determinants. This step of determinants analysis thus helps to identify more proximal, intermediary intervention goals, but also to identify specific target groups for interventions.

In step 4 of the planning process, intervention strategies, methods and materials need to be selected or developed that are tailored to the target populations and the most important and best modifiable determinants of behaviour change. In step 5 the intervention should be implemented and disseminated so that the target-population is reached and exposed to the nutrition education messages. Each step should preferably be evidence-based and evaluation of each step is necessary.

In brief, the above-explained planning model states that we need to understand the food consumer's major health problems and related dietary behaviours, as well as what drives the consumer's food choice in order to be able to come up with effective healthy diet promotion interventions. In the remainder of this chapter we will use this planning model to first briefly describe some of the main dietary factors related to population health, after which we will elaborate on determinants of nutrition behaviours and different healthy diet intervention strategies for promotion of population health.

2.2 THE EPIDEMIOLOGICAL ANALYSIS

A selection of issues in diet, nutrition and population health

Recent reviews of the most important determinants of the major burdens of disease indicate that diet is important (9, 11). Dietary factors - energy, fat, and fruit and vegetable intake in particular - influence risk for the main health threats of today, such as cardiovascular disease

(CVD), cancer, type 2 diabetes mellitus, and obesity. There are many other dietary factors that contribute to health, but for brevity this paragraph will be restricted to a short overview of the presumed health effects of excess energy, fat, and fruit and vegetables, since these are arguably the main dietary factors for population health promotion efforts, at least in affluent countries.

Obesity is expected to become the most important determinant of preventable disease, surpassing smoking in this respect within the next few years (16) (although to date underweight is still responsible for a larger proportion of avoidable loss of life years than overweight (9)). Obesity is an independent risk factor for a wide range of diseases including CVD, arthritis, breast cancer, and Type 2 diabetes (17). Weight gain, which may eventually lead to being grossly overweight or obese, is caused by a long-lasting positive energy balance: energy intake (diet) is larger than energy output (basal metabolic rate + physical activities). Reducing energy intake is therefore one means of preventing weight gain. However people do not eat energy as such but choose a variety of foods that are combined and prepared in different ways. Swinburn and colleagues (18) reviewed the evidence on specific dietary risk behaviours for weight gain. They concluded that there was convincing evidence that a high consumption of energy-dense foods, normally containing large amounts of fat (fat is the most energy-dense macronutrient) and/or sugar, is associated with higher risk for weight gain, overweight and obesity. The evidence for a protective effect of a high intake of fibre-rich foods was also classified as convincing. A high intake of sugar containing drinks was identified as a probable risk factor for weight gain.

Total fat intake has a long history of smear. The only remaining real suspicion related to total fat intake is related to fat's high energy density; high-fat diets may induce weight gain. However, high-fat low-carbohydrate weight loss diets appear to be somewhat successful, and at least not less effective than low-fat high-carbohydrate diets (19). Total fat in an energy-balanced diet is thus not regarded as a public health issue anymore, but there is convincing evidence that the quality of dietary fat is of importance since different kinds of fatty acids contribute to either promotion or to prevention of CVD-risk. A high intake of saturated fatty acids, especially present in foods of animal origin (meat, dairy), is associated with elevated serum LDL cholesterol levels, which is a risk factor for CVD. Poly and mono-unsaturated fat (oils from nuts and seeds and fatty fish, and olive oil respectively, are important dietary sources) on the other hand are associated with lower LDL and higher HDL cholesterol levels, predicting lower CVD-risk.

Fruit and vegetable promotion has received enormous attention in the past decades because of evidence, mostly from observational studies, that a high fruit and vegetable intake is associated with lower risk for different cancers, especially of the digestive and respiratory tracts, CVD, chronic obstructive pulmonary disease, and obesity (20). Fruit and vegetables have high nutrient densities and low energy densities. The protective effect of fruit and vegetables has been ascribed to their high contents of antioxidants and fibre. However, recent research suggests that the protective effect of fruit and vegetable for cancer and CVD may be less strong than earlier studies indicated (21).

Studies investigating possible dietary risk and protective factors are overabundant. In an on-

going review of the World Cancer Research Centre on the dietary factors related to cancer risk numerous original studies were identified, of which a majority was published since the completion of the review that resulted in the much cited World Cancer Research Fund's report on Diet, Nutrition and Cancer, published in 1997 (22, 23). A library of papers of similar magnitude has been published on investigations of dietary risk factors for CVD (24). Although there is still controversy on which specific dietary factors, ingredients, nutrients, foods are most important for health, there is some consensus that diets low in saturated fats, high in fruits and vegetables, and that contribute to a neutral energy-balance should be promoted. There is, however, much less evidence available and thus also much less certainty about why many people do not choose such healthy diets, and how healthy diets can successfully be promoted.

2.3 DETERMINANTS OF HEALTHY FOOD CHOICE

2.3.1 Motivation, ability and opportunity

People in general choose what, when and how much they eat. To induce dietary change, one needs to change people's food choices. To be able to do that, insight in why people choose to eat what they eat is necessary.

Studies on such determinants of food choice and eating behaviours have used learning theory, social cognition models and ecological models of determinants of human behaviour (25, 26). A framework proposed by Rothschild (1999) (27) provides a simple and easy to understand model to categorise the large and diverse number of potential determinants recognised in the different more specific behaviour theories. Rothschild identifies three categories of determinants: motivation, ability and opportunity.

2.3.2 Motivation: do you want to eat a healthy diet?

In nutrition education and other health education research, determinants of behaviour have been studied mostly from a social psychology perspective. Within social psychology, different theories and models have been proposed to study nutrition behaviours. These theories and models include the Health Belief Model, Protection Motivation Theory, Social Learning Theory and the Theory of Planned Behaviour, and these theories share a common feature in that they recognize behavioural decision, motivation or intention as the primary determinant of behaviour. Each theory proposes different but similar determinants of intentions. Based on an integration of insights from the aforementioned theories, four groups of determinants that predict intention can be recognised: attitudes, perceived social influences, self-efficacy and self-representation.

Attitudes are based on a subjective weighing of expected positive and negative consequences or outcomes of the behaviour. Closely related constructs are decisional balance, outcome expectations, and perceived threat. But which expected outcomes are important for most people in making a balanced decision on what to eat? In general, expectations about short-term outcomes are more important than longer-term outcomes. Taste, satiety and pleasure are

of major importance for most people. People will eat what they like, and disliked foods will not be chosen (28). Certain taste preferences are innate, such as a liking for sweet, a dislike for bitter. However, taste preferences can be learned and unlearned (29). Satiety is a strong reinforcer and we therefore quickly learn to like and appreciate energy-dense foods (28, 29), but the fact that many people like the taste of coffee and beer illustrates that we can even unlearn our innate dislike of bitter tastes. (Learning to like and dislike certain tastes are basic classical and operant conditioning processes). Some specific types of learning strategies have been identified related to food and eating. Taste-nutrient learning is based on the aforementioned reinforcing character of satiety. Taste-nutrient learning means that people easily learn to like tastes of foods that lead to the pleasant feeling of satiety, and is an example of operant conditioning. Evolution psychologists claim that this makes much sense given the fact that learning to like such energy-dense foods improved chances for survival in the long history of evolution in which times of energy shortage were much more likely than times of abundance. The present day obesity epidemic has, however, been attributed to this innate tendency to learn to prefer energy-dense foods in combination with an 'obesogenic' environment (30)(see paragraph 2.3.4). In the last decades, a period that is not more than a blink of the eye in history of mankind, in which an over-abundance of palatable foods have become available and accessible for many people, we still tend to choose foods as if we expect meagre years. Since most fruits and vegetables have low-energy densities, preferences for these foods are not so easily learned.

Two other food preference-learning strategies are examples of classical conditioning and are referred to as taste-taste learning and taste-environment learning. If a new, unfamiliar, taste is combined with a taste for which a preference already exists, people will more easily learn to like the new taste. Almost all lovers of black coffee and tea have learned to like the taste by starting out with sugared drinks. (However, learning to like coffee or tea is also a result of operant conditioning: the caffeine stimulant works as a behaviour reinforcer.) Similarly, tastes that people are exposed to in pleasant physical and/or social environments are also more easily learned to like. Foods first encountered during a pleasant holiday, may become favourite foods this way.

Health related outcome expectations or beliefs are also important in food choice; 'health' usually comes second after 'taste', if people are asked about what they find important in their diet and food choice (31, 32), especially in women (33). Nevertheless, 40% of Americans and 57% of Europeans indicated rarely or never to compromise on taste to improve the healthfulness of their diets (34). Furthermore, in practice, health expectations may only significantly influence food choices for most people when the health consequences are expected to be soon, severe and easy to recognise. People may therefore very quickly develop negative attitudes toward foods for which they are allergic or intolerant, i.e. foods that literally make you sick (28). But remember that energy dense foods provide a comfortable feeling of satiety. The potential negative consequences, like obesity, type 2 diabetes and heart disease will present itself only to some and probably only decades later. Convenience is a third important factor in decisional balance (e.g. (35). In Europe 42% of consumers indicate to rarely or never give up convenience for good health compared to 24% in US and Australia (34).

Perceived social influence is the second category of determinants of intention, and includes subjective norms and descriptive norms. Subjective norms are expectations about what 'important others' want us to do. If, for example, someone expects that her partner and children want her to eat a high diet high in fruit and vegetables, this person will be more motivated to do so. Descriptive norms are based on observed behaviour of important others. If a persons' partner and children eat diets high in fruit and vegetables, she will be more likely to be motivated to do so herself.

Self-efficacy, or *perceived behavioural control,* is the third determinant category, and refers to the perception of, or confidence in, one's abilities and skills to engage in certain behaviour. A person who is confident that he can cut back on saturated fat intake will be more motivated to do so. Perceived control is behaviour and context specific. A person can, for example have high confidence to be able to eat less fat, but not to increase vegetable intake; and confidence to cut back on fat may be high for regular meals prepared at home, but not for eating out. Perceived control is strongly related to abilities and skills, for which we refer to paragraph 2.3.3.

Finally, *self-representations* or self-identity reflect what a person thinks of as important and stable characteristics of the self. Such representations can importantly influence food choice if related to one's personal moral values and norms. People may see themselves, for example, as health conscious, environmental conscious, or animal friendly. Such personal norms may induce specific dietary habits such as healthy eating, choosing organically grown foods or adopting a vegetarian diet (26).

Additionally, it has been suggested that the aforementioned rationale and conscious decision making factors can only predict eating behaviour to a limited extend because many eating behaviours are habitual. Different eating behaviours are indeed repeated often and may therefore become habitual. Thus, a conscious decision making process (as proposed in models like TPB and ASE) may be less likely to occur. *Habitual behaviour* is considered to be 'automatic', triggered by environmental cues instead of conscious evaluations of possible outcomes, the opinion of other people, and confidence about being able to perform the behaviour (36). Studies show that inclusion of an assessment of past behaviour, in addition to attitudes, norms and PBC, has demonstrated higher explained variance and non-significant associations of attitudes, norms and PBC with behaviour (37). Such findings support the habit hypothesis (38). However, tracking of past behaviour to the present is not the same as habitual behaviour. Further, even if past behaviour is a *strong* determinant of present dietary practices, past behaviour is not changeable. In contrast, habit strength, a concept that is more than just past behaviour, may be *changeable*. More comprehensive tools to measure habit strength have successfully been tested and used in previous research (39). Such measures include assessments of repetition as well as 'automaticity' of eating behaviours. A series of studies that we conducted recently in which we applied such habit strength measures shows that habit strength is indeed a strong predictor and correlate of a range of dietary behaviours (e.g. fat, fruit, soft drink intake), in study populations of adults, adolescents as well as children (40, 41)

and that habit strength may modify the association between attitudes and intentions as well as intention – behaviour associations (42).

2.3.3 Ability: What enables people to eat a healthy diet?

In paragraph 2.3.2 we indicated that people with high confidence in their skills and abilities to make healthy dietary choices, will be more motivated to do so. If such confidence is based on true personal abilities and skills, people can translate their motivation into action.

Skills and abilities are to some extent dependent on practical knowledge. For example, knowledge of recommended intake levels and healthy alternatives for unhealthy choices help to enable voluntary dietary change. To make dietary changes for better bodyweight maintenance, knowledge is necessary about which dietary changes will be most effective. Some knowledge about which foods are high in calories, and which preparation techniques help to avoid caloric enrichment of foods, is helpful to be able to avoid high calorie foods and for self-monitoring of caloric intake. Nevertheless, earlier research has shown (e.g. (43)) that knowledge is often not a direct determinant of eating behaviours.

The complexity of energy balance behaviours has been mentioned before. Since caloric intake and expenditure are determined by such complex collections of different specific acts, from choosing foods, portion sizes and preparation methods, to transportation, work and leisure time physical activities, it takes a great deal of food knowledge and good arithmetic skills to monitor one's calorie intake or day-to-day energy balance. If the opportunities for objective self-assessment are lacking, people tend to search for other comparison possibilities, and often social-comparisons are used: people compare their own actions and performance with what they perceive that others do and accomplish. Such social-comparisons tend to be liable to a so-called optimistic bias, especially when people perceive a high personal control. Different studies have shown that many people think of themselves as complying with recommendations for complex behaviours such as low fat intake, fruit and vegetable consumption (e.g. (44, 45)), as well as physical activity ((46)), while their actual behavioural patterns are not in line with the recommendations. This may not be surprising given the fact that behaviours such as fat intake or energy intake are in fact the result of a series of interrelated specific actions, such as buying, preparing, combining and eating specific foods in different serving sizes. To calculate one's total calorie or fat intake requires intensive self-monitoring as well as advanced arrhythmic skills. In studies conducted in the Netherlands we found that up to 10% of the population thought that their diets were too high in fat, while more objective food consumption research showed that about 80% of the population had high fat diets (47). Similar results were found for fruit and vegetable intakes (44, 45). If people think that they already comply with dietary recommendations, they will not be motivated to change (45, 47). Awareness of personal intake levels is thus an additional predictor of motivation, as well as a moderator of the importance of the other aforementioned determinants of motivation. Studies have shown that awareness of unhealthy eating habits was a strong positive correlate of intentions to make dietary changes and that social cognitions such as attitudes, perceived control and subjective norms were only significantly associated with intentions to change among respondents who were aware of their intake levels (44, 45, 47). These findings indicate that improving awareness of personal intake levels is an important first step in improving motivation to change.

2.3.4 Opportunity: availability and accessibility of healthy choices

In promotion of health behaviours in recent decades, most attention has been given to health education as the primary tool to encourage the general public to adopt healthy lifestyles. Health education has been defined as "planned learning experiences to facilitate voluntary change in behaviour"(12). Health education, including nutrition education, thus strongly focuses on conscious behaviour change and on improving individuals' motivations and skills to increase likelihood of adopting healthy diets. It is therefore not surprising that TPB, its predecessor the Theory of Reasoned Action, and the Health Belief Model were among the theories most often applied to shape health education interventions (14). However, people's opportunities to make health behaviour changes may be strongly dependent on the environments they live in. The health promotion movement recognized this ecological focus; health promotion has been defined as "the combination of educational and environmental supports for actions and conditions of living conducive to health"(12). This health promotion approach has resulted in a stronger attention for environmental barriers and opportunities for health behaviours, which has resulted in a large number of studies on the associations between environmental characteristics and health behaviours, as well as on the effectiveness of environmental change interventions.

The environment can be defined as everything and anything outside the person. Environmental factors are often believed to influence health behaviour via the personal determinants (motivation and abilities). Environments that offer appealing and tasty opportunities for healthy eating may improve motivation to do so, in an environment that offers easy opportunities, a person may need less motivation and fewer skills to engage in healthy eating, and people who have strong motivation and self-efficacy will be more likely to pursue healthy eating despite environmental barriers. Social Cognitive Theory (48) makes this interaction between person and environment explicit in predicting health behaviour.

Just as personal factors have been further subdivided in more specific determinant constructs and proposed pathways of mediation, so can and should the environment be further defined by means of distinguishing various environmental factors.

Different classifications of possible environmental determinants of health behaviours have been proposed (14, 49-51), and these classifications show great overlap and similarities. So-called ecological models of health behaviour arguably put most emphasis on the environmental factors in shaping health behaviours (52). In early ecological models of health behaviour, five levels of influence were distinguished, intra-personal factors, interpersonal processes, institutional factors, community factors and public policy. Story et al.(51) recognise social environmental influences (interpersonal influences), physical environmental influences (influences within community settings), and macro-systems influences (influences at the societal level). Flay and Petraitis (50) distinguish between the social environment and the cultural environment as important categories of environmental determinants of health behaviour, and within these categories they make a further distinction between ultimate, distal and proximal factors. Based on the distinctions within the environment combined with the proximity of the factors within these broad categories, a matrix or grid could be designed with six cells that represent different classes of environmental influences.

Such a grid structure is explicitly proposed in the ANGELO framework (53) (Figure 2.2).

	Micro-environment	Macro-environment
Physical environment		
Economic environment		
Political environment		
Socio-cultural environment		

Figure 2.2. The ANGELO Grid (based on Swinburn et al, 1999).

This framework was specifically developed to conceptualise health behaviour environments, and enables the identification of potential intervention settings and strategies. ANGELO was developed for investigation and classification of so-called obesogenic environments, i.e. environments that promote excess energy intake and lack of physical activity, but the categorization of environmental factors seems also applicable for other nutrition behaviours. The ANGELO framework is a grid with two axes.

On the first axis two 'sizes' of environment (micro and macro) are distinguished. Micro-environments are defined as environmental settings where groups of people meet and gather. Such settings are often geographically distinct and there is often room for direct mutual influence between individuals and the environment. Examples of micro-environments are homes, schools, work places, supermarkets, bars and restaurants, other recreational facilities, and also include neighbourhoods.

Macro-environments, on the other hand, include the broader, more anonymous infrastructure that may support or hinder health behaviours. Examples of macro-environments are how food products are marketed, taxed and distributed; the media are also included in the macro-environment.

On the second axis four 'types' of environments, are distinguished: physical, economic, political, and socio-cultural. The physical environment refers to availability of opportunities for healthy and unhealthy choices, such as points-of-purchase for fruit and vegetables, soft drink vending machines, availability of low saturated fat spreads in worksite cafeterias, et cetera. The economic environment refers to the costs related to healthy and unhealthy behaviours, such as the costs of soft drinks, fruit and vegetables or energy-dense snacks. The political environment refers to the rules and regulations that may influence food choice and eating behaviour. Bans on soft drink vending machines in schools, rules on what treats can and cannot be brought to school, nutrition policies in worksites and institutions, but also family food rules are examples of political environmental factors. The socio-cultural environment refers to the social and cultural subjective and descriptive norms and other social influences such as social support for adoption of health behaviour, social pressure to engage in unhealthy habits, and thus show overlap with some of the motivational factors.

The aforementioned social cognition models, such as TPB, assume that the environmental

influences are mediated by cognitions: the environment is observed and perceived by the person and these perceptions of the environment will influence attitudes, subjective norms or perceived control. TPB thus, for example, assumes that an environment with little opportunities to eat fruits and vegetables will result in lower perceived behavioural control related to fruit and vegetable consumption and therefore in weaker intentions to eat fruits and vegetables. However, there is some evidence that physical and social environmental factors are significantly associated with dietary behaviours after TPB variables have been accounted for (54).

We recently conducted two systematic reviews to evaluate the evidence for environmental influences on dietary behaviours in children and adults (55, 56). For children especially family environmental influences, such as parental support, parenting styles, and parental modelling, as well as availability and accessibility of foods seem important. For adults, availability and accessibility of health foods, portion sizes, family income and possibly labelling of healthy choices are important. Studies in which the interrelations and possible mediation between personal and environmental determinants of food choice are studied are especially needed.

2.4 INTERVENTIONS TO PROMOTE HEALTHY EATING

Interventions to promote healthy eating should address the most important and changeable determinants of healthy eating. To promote healthy eating, people should be motivated to do so, should be confident about their abilities, and should preferably be exposed to environments that offer them easy opportunities.

Different intervention strategies have been applied to encourage healthy eating. In this chapter we make a distinction between mass media nutrition education interventions, personalised nutrition education interventions and environmental change interventions as strategies that differ in their potential to target the different categories of important determinants of dietary behaviours.

2.4.1 Agenda setting and motivation: Mass media interventions

Since the major dietary risk factors are present in large proportions of populations world wide, interventions are needed that reach many people. Mass media approaches are therefore often chosen to communicate dietary change messages. Effective use of mass communication via mass media may indeed be essential to communicate health information to large audiences (57-59).

Mass communications has been defined as any form of communication with the public, which does not depend on person-to-person contact, and as 'purposive attempts to inform, persuade, and motivate a population (or sub-group of a population) using organized communication activities through specific channels, with or without other supportive community activities' (60). There are currently many examples of using mass media channels for health promotion including broadcast (TV, radio), print (newspapers and magazines, billboards and leaflets) and, more recently, electronic media and Internet (see also 2.4.2).

Mass media campaigns to promote healthy eating and discourage unhealthy eating have

also often been used in healthy diet promotion. In the past, mass media campaigns were often aimed at behavioural change, but with limited success (61, 62). Such mass media approaches aiming to change behaviours were often based on the assumption that if people knew the facts, i.e. that their diet put them at risk, they would act accordingly: change their eating habits to reduce their health risks. Unfortunately, few of the mass media health promotion campaigns that have been evaluated have demonstrated successful behaviour change, especially at the longer term (63-65). Despite the fact that mass media interventions may often not lead to behaviour changes, mass media communication campaigns can serve a very useful purpose in health education when their inherent limitations are recognized (62, 66). The limitations of the mass media are that they are less effective in conveying complex information, in teaching skills, in shifting attitudes and beliefs, and in changing behaviour, especially in the absence of other forms of communication or environmental changes. Mass media campaigns are, however, well-suited for public and community agenda-setting, and for influencing potential early mediators of motivation and behaviour change such as awareness, health beliefs and risk perceptions, but more tailored or interpersonal communication is necessary to establish behaviour change (58, 67, 68). Furthermore, a mass media campaign that is successful in raising public awareness and agenda setting can lead to social changes, changes in social norms, especially if the messages raise a public discussion. Such a public discussion and social changes may encourage politicians and other decision-makers to make policy changes to promote healthier diets (57, 61, 69). For example, during the Fat Watch campaign, a mostly mass media campaign to reduce fat intake levels in the Netherlands, a public-private collaboration between government and the food industry resulted in production and marketing of lower fat foods (3). A more recent example is the 'Maak je niet dik!' campaign of the Netherlands Nutrition Centre, a five-year initiative to promote weight gain preventive actions among Dutch adults 25-35 years of age. A study was conducted to evaluate the first campaign phase aimed at placing the issue of weight gain prevention on the public agenda, by creating awareness of a need to act to prevent weight gain, and to induce more positive attitudes and intentions towards prevention of weight gain. The first campaign phase reached a large proportion of the population and initiated some positive changes in attitudes but did not achieve significant improvements in other determinants of the prevention of weight gain such a as awareness of personal body weight status, overweight related risk perceptions and motivation to prevent weight gain. Despite the limited results on determinants of prevention of weight gain the campaign created a lot of free publicity. The fact that during and soon after the campaign, several television and radio programs and national newspaper and journal articles on the issue were published, may indicate that the campaign was successful in placing the issue of prevention of weight gain on the public agenda (8).

In conclusion, the strength of the mass media lies in helping to put issues on the public agenda, in reinforcing local efforts, in raising consciousness about health issues and in conveying simple information. The mass media may not tell people what to think, but they may help to tell people what to think about. In addition, they can play a strong supportive role in drawing attention to programs and strategies, in disseminating information and in setting the agenda for future health promoting initiatives (59, 69).

2.4.2 Motivation and abilities: Personalized interventions

To go beyond agenda setting and the first stages of motivating people to make dietary changes, more intensive and interactive intervention strategies are needed. Based on the most comprehensive review of nutrition education to date (70), three important conditions for likelihood of effect were identified. Nutrition education

- should be tailored to personally relevant motivators and reinforcers;
- apply personalized self-assessment and self-evaluation techniques;
- enable and encourage active participation in the intervention.

Personal nutrition counselling may offer the best opportunities to meet these conditions. A personal counselling technique that shows promise and can be applied in person-to-person nutrition education is motivational interviewing (MI)(71, 72). The basic framework of MI reflects stages of change theory (73) and self-determination theory (71); motivation is regarded as a modifiable state of readiness to change, and not as a stable trait. MI tries to facilitate patients resolving their ambivalence about changing their behaviour and avoids taking a confrontational approach that may lead to argumentations between patient and counsellor. MI encourages the patient to do most of the talking during consults and encourages the counsellor to facilitate the patient to express what she or he thinks and feels, to explore ambivalence about behaviour change, so that the patient reaches a decisional balance and eventually chooses what to change and decides on a change plan and strategy, assisted by the counsellor. An empathic counselling style is essential to MI. The counsellor should expect ambivalence in patients and help to explore resistance to change; this is a first step towards change. Self-efficacy is another key-issue in MI: the patient is responsible for change but the counsellor should help increase self-confidence, by helping to strengthen the patient's abilities to change. Counselling techniques, such as reflective listening and expressing acceptance, are part of MI, affirming the patients' own responsibility and freedom of choice. Advice is provided on patients' request without judgement, so that patients are indeed encouraged to make their own choices. MI has been applied in nutrition education, but good trials testing such applications are few (72). Our centre recently conducted a trial testing the impact of MI for dietary change in diabetes patients. Dieticians were randomly allocated to receive MI-training or not and the results showed that patients of MI-dieticians had significantly lower fat intake levels at post-test compared to patients of controls. No differential effects on blood glucose levels (HbA_{1c}), body mass index (BMI) and waist circumference were found but patients in both study groups showed significant improvements in mean fat intake, HbA_{1c}, BMI and waist circumference from baseline to follow-up (74).

Interpersonal counselling techniques like MI are, however, not suitable to reach the majorities of populations that have unfavourable diets; MI takes time, needs trained counsellors, and is thus expensive. In the last decades several potentially important new channels for health communication have emerged, such as interactive computer programmes, mobile technologies like mobile phones with text messaging and hand-held computers, interactive television, and maybe most importantly, the Internet with its World Wide Web (WWW) and email applications (75-77). Such interactive technologies can be used to tailor nutrition education for larger groups of people (78, 79) and especially the WWW shows promise since it is a pre-

ferred source of health information for many consumers (80-82).

Computer-tailored nutrition education has been identified as one of the more promising nutrition education techniques (78). Computer-tailored interventions mimic personal nutrition counselling to a certain extent. Computer-tailored nutrition education provides people with information that is based on personal characteristics, such as personal dietary intake data, personal motivation, attitudes, knowledge, self-efficacy, and abilities for dietary change. Earlier reviews of the literature suggest that computer-tailored interventions are more effective than generic nutrition education (83, 84). In a recent systematic review 26 studies on computer-tailored nutrition education were identified of which 20 studies found significant effects in favour of the tailored interventions. The evidence was most consistent for tailored interventions on fat reduction (85).

The process of computer-tailoring is similar to personal counselling: people are surveyed or interviewed and the results are used to develop individualized feedback and advice. The pooled expertise of nutrition counsellors is documented in a computer-program, making 'mass-customisation' possible: provision of individualized feedback and advice to large groups of people. In most computer-tailored interventions evaluated to date, the surveys were written self-administered questionnaires or occasionally administered by telephone and the survey results were keyed or automatically scanned into a data file (78). The tailoring expert system analyses these data and links them with a feedback library-file that contains feedback and advice messages tailored to each survey response. The tailored feedback in such interventions are mostly print computer-tailored personal feedback letters or newsletters, and the aforementioned evidence for the effectiveness of tailored nutrition education is largely based on such 'first generation' computer-tailoring (78). However, several limitations of printed tailored feedback have been noted (86). Computer-tailored print materials only utilize part of the potential of computer-tailoring, since interaction and immediate feedback is not possible. First generation computer-tailored interventions are also more expensive than generic nutrition education, since it requires at least some handling of the survey questionnaires and the feedback letters (78, 87).

Using interactive technology in computer-tailoring may offer better opportunities to tackle these issues: lower costs, better interaction, less time between screening and feedback, and opportunities for combining computer-tailored feedback with Internet-based social support, for example via email, forum, MSN or chat applications. Interactive technology allows participants to enter the answers to the survey questions directly into the interactive system by means of, for example, mouse clicks, keyboard, voice recording or touch screen video. Feedback is then given almost immediately on the computer screen (86). Furthermore, such systems much better allow interaction; one or few survey questions followed directly by feedback on the answers given, followed again by a small set of questions, answers and feedback, until the entire tailored-advice system has been completed. It also better allows so-called iterative feedback, since 'diagnosis' and initial feedback can be saved and retrieved to inform follow-up feedback for respondents who repeatedly use the tailored system.

It has, however, also been argued that personalized advice may not be enough because dietary habits are often not volitional, or personally determined, since food is often bought or

prepared by others, and dietary choices may be largely dependent on what is available and other environmental determinants of food choice, i.e. the opportunities for healthy eating.

2.4.3 Opportunities: Environmental change interventions

If the environment offers good opportunities for health behaviour, people can more easily turn their motivation into action and may need fewer skills to do so. There is a strong belief that the changes in our eating environments, from an environment with a high likelihood of shortage of food toward and environment that offers and encourages plenty of opportunities to eat palatable energy-dense foods almost always and everywhere, contributed to the present-day obesity epidemic (18, 88-90). Is it also possible to make planned changes in the environment to encourage healthy eating?

The case of the reductions in number of smokers in industrialized countries offers a good example that deliberately changing the physical, social, political and financial environment may contribute to positive health behaviour changes. To promote smoking prevention and cessation health education has been backed up by smoking bans in public buildings, taxation to increase the price of smoking, and increasingly more negative social norms toward smoking (91).

Fewer examples are available for environmental interventions to promote healthy eating. In a recent review of the literature (55) increasing availability and accessibility of health foods and decreasing availability and accessibility of less healthy choices proved to be successful strategies to promote healthier diets.

Since children and adolescents are less autonomous in the dietary choices, and environmental interventions to improve availability and accessibility of healthy foods at the home and school environment may be especially relevant (92). The Pro Children project is a cross European study to develop and test effective strategies to promote adequate consumption levels of fruits and vegetables among schoolchildren (93). This project is an interesting example of an intervention study that attempted to promote healthy eating, i.e. fruit and vegetable consumption, especially by improving availability and accessibility of fruit and vegetables at school (94) with provision of fruit and vegetable in the schools as the main element, either as free in-school distribution, a subscription program, or as part of school meals.

The Pro Children intervention programme has been tested in a group-randomised trial design where schools in three of the participating countries (i.e. the Bilbao region in Spain, in Rotterdam, the Netherlands, and in Buskerud county of Norway) have been randomly allocated to an intervention arm and a delayed intervention arm (comparison group). Surveys among all participating children and their parents were conducted prior to the initiation of the intervention, immediately after the end of a one school year intervention period, and at the end of the subsequent school year (93).

Preliminary analyses of the effects after the one-year implementation, shows that fruit and vegetable intake in children in the Intervention group was approximately 20% higher than in children in the control group (95).

2.5 CONCLUSIONS, IMPLICATIONS FOR PRACTICE, RECOMMENDATIONS FOR FURTHER RESEARCH

Promotion of healthy eating should be based on thorough analyses of the epidemiology of healthy eating and mediators of such eating behaviours. Such mediators can be individual or environmental and can be categorized in three groups: motivational factors, abilities and opportunities. In healthy diet promotion efforts most emphasis has been put on improving motivation and abilities to eat more healthily, but more recently more attention is given to the environmental opportunities that may encourage or hinder healthy eating.

Mass media interventions are important in promotion of healthy eating to raise attention and awareness, but mass media interventions alone are unlikely to lead to behaviour changes. Behaviour change may be more likely when interventions are more personalized and tailored and when environmental changes that improve the availability and accessibility of healthy choices are incorporated.

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PART 2

The needs assessment

CHAPTER 3

Underestimation and overestimation of personal weight status: associations with socio-demographic characteristics and weight maintenance intentions

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ABSTRACT

Objective – Unwarranted underestimation and overestimation of personal weight status may prevent weight maintenance behaviour. The present study reports on correlates of under- and overestimation of personal weight status and the association with weight maintenance intentions and self-reported action.

Design – Comparison of three cross-sectional surveys, representing different population groups.
Subjects: Survey 1: 1,694 adolescents 13-19 years of age; survey 2: 979 non-obese adults 25-35 years of age; survey 3: 617 adults 21-62 years of age.
Measurements: Self-administered written questionnaires (surveys 1 and 3) and telephone-administered questionnaires (survey 2); self-reported BMI, self-rated weight status, intentions and self-reported actions to avoid weight gain or to lose weight, sex, age, education and ethnic background. Respondents were classified as people who are realistic about personal body weight status or people who under- and overestimate their body weight status, based on BMI and self-rated weight status..

Results – Most respondents in the three survey populations were realistic about their weight status. Overestimation of weight status was consistently more likely among women, while underestimation was more likely among men, older respondents and respondents from ethnic minorities. Self-rated weight status was a stronger correlate of intentions and self-report actions to avoid weight gain than weight status based on BMI.

Conclusions – Relevant proportions of the study populations underestimated or overestimated their bodyweight status. Overestimation of personal weight status may lead to unwarranted weight maintenance actions while underestimation may result in lack of motivation to avoid further weight gain.

INTRODUCTION

The prevalence of obesity is increasing rapidly worldwide (1). Obesity is a major burden of disease by being a pre-disposing factor for cardiovascular diseases, type II diabetes, musculoskeletal disorders, work disability and impaired quality of life (2-5). An increase in body weight occurs when energy intake exceeds energy expenditure. The current prevalence of being overweight and obese exceeds 40% and 10%, respectively, and a further increase is expected in most Western countries (2, 3, 6).

Treatment of obesity is not very successful in halting the obesity epidemic, since people often regain weight after the treatment program is finished (7) and it has been suggested that prevention of (further) weight gain should be given more attention in fighting the obesity epidemic (8-10).

In the Netherlands the average annual increase in body weight among the adult population is approximately 400 to 800 grams (3). This is the equivalent of a positive energy balance of about 85 kcal per week, or less than one bottle of beer, a handful of nuts, or a chocolate cookie, and can be compensated by a 20 minute walk. Thus, relatively small but sustained behavior changes are required in order to prevent gradual weight gain in the population at large.

Health behavior change has been described as a staged process. The most important stages of change models, i.e. the Transtheoretical Model (11) and the Precaution Adoption Process Model (12) both posit that awareness is important in the earlier stages of change. People will only deliberately consider making behavioral changes, when they experience a 'need to change', i.e., when they are aware that they have certain characteristics that may put them at risk (13). Earlier research has shown that large proportions of populations are not aware of weight-gain related behaviors. For example, many people underestimate their intakes of fat, and overestimate their intakes of fruits, vegetables and amount of physical activity (14, 15).

Awareness of personal weight status may be an important first step for the motivation to avoid further weight gain. Various developments in present day society may induce a lack of awareness of weight status (16), leading people to underestimate their weight status, which may result in a lack of motivation to avoid weight gain and in becoming overweight. People tend to use social comparison information instead of objective standards to evaluate their own behavior or health status (17, 18). Since many people are overweight, this may result in an underestimation of weight status. Additionally, because larger body size is now common, the physical environment may be adjusted to serve larger people (e.g. larger seats in restaurants/sports stadiums, larger clothes sizes), and many people believe that weight gain and being overweight may be inevitable with proceeding age (19). Such developments and beliefs indicate that being overweight may soon be the norm and become acceptable.

Although the prevalence of overweight and obesity is growing in most population groups in the Netherlands as well as in most other countries, older people, people with lower socioeconomic status, and ethnic minorities are more likely to be overweight (7). People from the most common ethnic minority groups in the Netherlands (Morocco, Turkey, Surinam, Antilles) may also perceive larger body sizes as more desirable than people of Dutch origin (20, 21). Underestimation of body weight status may thus vary between different populations (22).

The present epidemic of weight gain and obesity may therefore induce underestimation of personal weight status in the general population and maybe more so in certain population groups. There is, however, also evidence for overestimation of self-rated weight status and unwarranted weight concerns in certain population groups. Previous studies show, for example, that especially women who are not overweight may still believe they are (23-25) and as a result may participate in unnecessary/counterproductive attempts to lose weight.

In the present study we investigated in three population samples:

(I) The prevalence of awareness of body weight status: we assessed the proportion of respondents who were realistic about their weight status and the proportion of respondents who under- or overestimated their weight status.

(II) The association of sex, age, education, and non-Dutch origin with underestimation and overestimation of self-rated weight status.

(III) The association of self-rated overweight status and BMI-based overweight status with weight maintenance intentions and self-reported action.

METHODS

Survey Populations

Data from three different surveys (referred to as survey 1, 2 and 3) representing different population groups were analyzed for the present study. We included these three different populations to test if the associations that were studied were similar in different samples.

Survey 1 was conducted among school students 13-19 years of age. Data for the present analyses were collected among students in the control group of an intervention study on organ donation education (26). Data were collected by self-administered questionnaires in class time. Survey 2 collected data from a random sample of non-obese Dutch adults (25-35 years old) in a baseline survey before the implementation of a national media campaign aimed at the prevention of weight gain (27). Data were collected by telephone-administered questionnaires. A stratified random selection of phone numbers was obtained by random digit dialing, ensuring inclusion of participants from each region of the Netherlands. Survey 3 was conducted among an adult sample of volunteers (21-62 years of age) who participated in a study evaluating the effects of web-based computer-tailored nutrition education about saturated fat, fruit and vegetable consumption (28). Data were collected using written self-administered questionnaires. Respondents were recruited at different worksites in the Netherlands.

Measures

Socio-demographic characteristics:

All three studies collected data on BMI (calculated based on self-reported height and weight), education, sex and ethnic background.

Education was measured by asking participants about the highest level of education they attended (survey 1) or completed (surveys 2 and 3). Among adolescents in survey 1, three levels

Table 3.1. Descriptive statistics for the three study populations

	Study 1 (N=1694)	Study 2 (N=979)	Study 3 (N=617)
% female	45.5	56.7	43.1
% low education level	9.5	13.3	18.9
% high education level	38.6	42.4	42.8
% non Dutch origin	17.2	9.9	12.3
% realistic about weight status	71.5	75.5	75.2
% underestimation of weight status	1.5	6.8	13.0
% overestimation of weight status	27.0	16.7	11.9
% BMI ≥ 25	5.8	30.0	39.2
% self-rated weight status heavy/fat	31.3	39.0	38.1
% 'heavier as compared to others'	29.6	22.8	26.0
BMI			
Mean (SD)	20.9 (7.9)	23.7 (2.6)	24.8 (3.6)
Median	20.1	23.4	24.4
Age	16.5 (0.6)	30.8 (3.0)	42.1 (8.8)

were distinguished, low (lower level vocational training), medium (preparatory education for higher vocational training), high (preparatory education for university). For the adult populations, level of education was re-coded to low (primary school or lower vocational training), medium (high school or higher vocational training) or high (college or university training). Ethnic background was determined based on the country of birth of both of the respondent's parents and was coded as non-Dutch if at least one parent was born outside the Netherlands.

Self-rated weight status:
Self-rated weight status was assessed by one questionnaire item in all studies; respondents were asked to evaluate their own weight on a 5-point scale ranging from 'much too light' (1) to 'much too heavy' (5) (surveys 1 and 2) or on a 7-point scale ranging from 'very thin (1) to very fat' (7)[1] (survey 3). The self-rated bodyweight variables were dichotomized as 'being overweight' and 'not being overweight'.

Evaluation of weight status in comparison to others
In all surveys participants were asked to evaluate their own body size compared to that of others of the same age and sex. For surveys 1 and 2 responses were on a 5-point scale (ranging from much lighter-much heavier) and on a 7-point scale for survey 3 (ranging from 'much thinner- much fatter'[1]).

[1] The word 'fat' here is the English translation of the Dutch word 'dik'. However, the true meaning of the word 'dik' is somewhere in between 'heavy' and 'fat'. 'Dik' does not have the very strong negative connotations as the word 'fat' in the English language.

Self-rated weight status / BMI-based weight status	Not overweight	Overweight
Not overweight (BMI < 25)	Realistic	Overestimation of weight status
Overweight (BMI ≥25)	Underestimation of weight status	Realistic

Figure 3.1. Classification of people who are realistic and who underestimate of overestimate their personal weight status

Intentions and self-reported actions to avoid weight gain or to lose weight
Respondents in survey 2 were asked to indicate whether they 'intended to actively prevent weight gain' ('weight maintenance intention'), or if they were 'already actively trying to avoid weight gain' ('weight maintenance action') on 5-point scales (certainly not – certainly). In survey 3 participants were asked to indicate if they 'intended to lose weight' ('weight loss intention') on a 7-point scale (certainly do – certainly do not). Recoding the two (Survey 2) or three (Survey 3) most positive answering categories as positive intention and the other three as no positive intention dichotomized these measures. A similar procedure was followed for the self-report action measure.

Awareness of personal body weight
In order to construct weight-awareness indicators, participants were firstly classified as being overweight (≥ age-specific BMI cut-off points for adolescents (Cole, 2000 #2838) or BMI ≥ 25 for respondents 18 years or older) or not.

The BMI-based overweight classification was compared to participant's self-rated weight status, and three groups were distinguished: people who were realistic, under- and overestimators (see figure 3.1). Subsequently, two dichotomous variables were constructed: respondents who underestimated their weight status [1] /respondents who do not underestimate their weight status [0] and respondents who overestimated their weight status [1] / respondents who do not overestimate their weight status [0].

Analyses
Descriptive analyses were conducted to describe the distribution among the different levels of awareness, and self-rated weight status compared to others.

The further analyses were conducted in two phases, firstly to identify correlates of under- and overestimation of weight status, and secondly to ascertain correlates of weight maintenance intention, weight maintenance actions and weight loss intentions. In the first set of analyses, three separate multiple binary logistic regression analyses (one for each survey) were con-

ducted to study associations with age, sex, education, and ethnic background (as independent variables) with under- and overestimation of weight status (as dependent variables).

Furthermore, a subsequent series of multiple logistic regression analyses examined the relationships between BMI-based overweight and self-rated overweight status (both entered as independent variables in all models) with three dependent variables: the intention to maintain weight, reported weight maintenance action, and the intention to lose weight. These analyses were adjusted for sex, age, education and ethnic background.

RESULTS

Survey 1

All 1771 students who were at school during data collection completed the questionnaire; valid data were obtained from 1694 students. The sample was comparable to the Dutch student population in terms of Dutch ethnicity and BMI. However, students at the higher school level were somewhat over-represented (39% in our sample and 34% in the population at large) and girls (45.5%) were under-represented (29).

Less than 6% of adolescents were classified as being overweight, however more than 30% evaluated their weight as too high and almost 30% perceived themselves heavier than their same age, same sex peers (Table 3.1). More than 70% were realistic about their weight status and 27% of the adolescents perceived themselves as being overweight.

Sex, education and ethnic background were significantly associated with an optimistic evaluation of weight status among adolescents (Table 3.2). Boys were significantly more likely to underestimate their weight status. Adolescents of non-Dutch origin and those in mid-level education were more likely to underestimate their weight compared to their Dutch and less-educated counterparts, respectively.

Sex was significantly associated with overestimation of weight status (Table 3.3), with girls being almost five times more likely to overestimate.

Survey 2

Participation rate was 71.4% (n=1017). Pregnant women (n=38) were excluded from the study, resulting in a sample of 979 respondents. Women (56.7%) and higher educated respondents (42.2 vs. 38%) were over-represented compared to the Dutch population. BMI and the proportion of overweight respondents were similar to population levels (29).

While 30% of the respondents were classified as being overweight based on BMI, almost 40% perceived their weight as too high, and more than 20% perceived their weight as higher than that of others (Table 3.1). About three quarters of these adults provided realistic evaluations of their weight and 7% underestimated and 17% over-estimated their weight status. The majority of the respondents (85%) intended to avoid weight gain, and 61% of the respondents who perceived their weight as too high reported to actively try to prevent weight gain.

Sex and ethnic background were significant predictors of underestimation of weight status (Table 3.2); men and respondents from ethnic minorities were more likely to underestimate their weight.

Table 3.2. Correlates of underestimation personal weight status: odds ratios and confidence intervals from multiple binary logistic regression analyses.

	Study 1 (N=1694)		Study 2 (N=979)		Study 3 (N=617)	
	OR	95% CI	OR	95% CI	OR	95% CI
Sex						
(male=0; female=1)	0.39	0.17-0.91	0.18	0.09-0.34	0.19	0.09-0.37
Age	1.02	0.93-1.12	1.00	0.92-1.09	1.06	1.02-1.09
Education						
(Low=0; medium=1)	6.69	2.13-20.96	1.96	0.90-4.27	1.52	0.78-2.98
(Low=0; high=1)	1,81	0.63-5.18	1.58	0.87-2.86	1.66	0.95-2.97
Ethnicity						
(Dutch=0; Non Dutch=1)	2.21	1.11-5.91	2.49	1.24-4.99	0.57	0.30-1.10

Sex, education and age were associated with overestimation of weight status (Table 3.3): women, lower educated and older participants were more likely to overestimate their weight compared to men, younger and high educated participants. Self-rated weight status was a significant predictor of weight maintenance intention (Table 3.4). Respondents who perceived their weight as too high were approximately five times more likely to intend to avoid weight gain, even after adjustment for weight status based on BMI, sex, age, education, and ethnicity. Women were more likely to intend to prevent weight gain.

Self-rated weight status was significantly associated with weight maintenance action, after adjustment for being overweight (Table 3.4). Sex, education and age were also significantly associated with weight maintenance action; women, the higher educated and older respondents were more likely to report weight maintenance action.

Table 3.3. Correlates of overestimation of personal weight status: odds ratios and confidence intervals from multiple binary logistic regression analyses.

	Study 1 (N=1694)		Study 2 (N=979)		Study 3 (N=617)	
	OR	95% CI	OR	95% CI	OR	95% CI
Sex						
(male=0; female=1)	4.76	3.68-6.17	3.30	2.23-4.86	2.29	1.36-3.84
Age	0.97	0.90-1.06	1.06	0.99-1.12	0.98	0.95-1.01
Education						
(Low=0; medium=1)	1.28	0.85-1.91	0.57	0.32-1.01	0.36	0.15-0.89
(Low=0; high=1)	0.98	0.76-1.25	0.66	0.46-0.96	0.74	0.43-1.25
Ethnicity						
(Dutch=0; Non Dutch=1)	0.92	0.67-1.23	0.76	0.46-1.43	1.23	0.53-2.84

Table 3.4. Correlates of positive intentions to act to avoid weight gain (study 2) or to lose weight (study 3). Odds ratios and confidence intervals from multiple binary logistic regression analyses, adjusted for sex.

	Study 2 (N=979)				Study 3 (N=617)	
	Weight maintenance intention		Weight maintenance action		Weight loss intention	
	OR	95% CI	OR	95% CI	OR	95% CI
Self-rated weight status (not overweight=0; overweight=1)	4.89	2.65-9.02	1.42	1.02-1.97	8.48	5.23-13.75
Overweight based on BMI (BMI < 25=0; BMI ≥ 25=1)	1.24	0.70-2.22	1.09	0.77-1.56	2.14	1.42-3.23
Sex (male=0; female=1)	1.82	1.22-2.71	2.52	1.91-3.32	2.14	1.42-3.23
Age	1.05	0.99-1.12	1.05	1.00-1.09	1.02	1.00-1.04
Education (Low=0; medium=1)	0.93	0.50-1.73	0.82	0.54-1.24	0.74	0.43-1.25
(Low=0; high=1)	0.72	0.47-1.09	0.72	0.54-0.96	1.26	0.82-1.92
Ethnicity (Dutch=0; Non Dutch=1)	1.00	0.52-1.90	1.15	0.73-1.81	0.98	0.56-1.72

Survey 3

Response rate was 79% (n = 617). Women (43.1%), people with overweight (33.6 vs. 44.8%) and respondents with lower education (46 vs. 67%) were under-represented and higher educated respondents over-represented (41% vs. 30%) compared to the Dutch population (29).

Almost 40% of survey participants were classified as being overweight, and approximately 40% perceived their weight as too high (Table 1). The rates of under- and overestimation were 13% and 12% respectively. A small majority of respondents (58%) intended to lose weight. Among the respondents who perceived their body weight realistically or who underestimated their weight status, 39% reported weight loss intentions.

Sex and age were significantly associated with underestimation (Table 3.2); men and older respondents were more likely to underestimate their weight status.

Sex and education were significantly associated with overestimation (Table 3.3): women and those with mid-level education were more likely to overestimate than men and lower-educated respondents. Both self-rated weight status and BMI-based weight status were significantly associated with weight loss intention, however, self-rated weight status was the stronger predictor in the multiple logistic regression model (Table 3.4). Women and older participants were more likely to intend to lose weight than men.

DISCUSSION

Most respondents in the three survey populations comprising of different age-ranges were realistic about their weight status. Small, but relevant, proportions of respondents underestimated or overestimated their bodyweight status. The proportion of respondents who overestimated their weight was more prevalent in the survey populations with a lower mean age (surveys 1 and 2), while the number of people who underestimated their weight was more prevalent in the population with a higher mean age (survey 3). In all surveys women were more likely to overestimate and men more likely to underestimate their weight. Evidence of an association of age, education and ethnic background, with either underestimation or overestimation of body weight was less consistent.

Our study was a further exploration of weight status awareness and contributes to the earlier studies on this issue in that three different populations were considered and a broader range of potential correlates of weight-related misconceptions were analyzed. The results on significant correlates of under- and overestimation of personal weight status and weight maintenance intentions were rather consistent for all three samples, which indicates that the associations found are likely to be independent of sampling frame and socio-demographics of the study population, and thus rather robust. But although we found consistent findings, the results should be interpreted with caution, because of some study limitations.

First, different methods of data collection were used for the three surveys, and we cannot rule out completely that there were any systematic differences in participant's responses by the different administration modes. There is no conclusive evidence for a difference in validity of response between mail and telephone surveys in general, but there have been reports of better validity of responses and more willingness to answer sensitive questions in mail surveys (30, 31).

A second limitation was that our samples differed from the population on some relevant characteristics, with the consequence that the findings cannot directly be extrapolated to the Dutch population at large. The proportion of people who under- and overestimate their weight may be somewhat different in the average Dutch population compared to what we found in our study.

Another limitation is that a certain degree of misclassification of respondents into realists, over- or underestimators may have occurred, because of the self-reported height and weight measures. Participant's self-reported BMI may be completely accurate, since it is well documented that people tend to underreport their weight (32, 33). The use of self-report BMI only becomes a problem, however, when the underreporting of weight is so large that respondents are misclassified according to their weight status.

Jefferey (32) reported mean underestimations of 0.93 kg and 1.68 kg in men and women in the highest weight tertile and 1.03 kg in women in the middle weight tertile. Taking these data as a reference, the under-estimation in the highest weight tertile is so small that this could not have resulted in misclassification caused by an inaccurate BMI estimate, but the underreporting in the middle-weight tertile in females may have led to some misclassification. However, this misclassification may be counteracted by the fact that women have found to be more weight conscious and more likely to think they are overweight (even though they may

underreport their own weight). Misclassification may therefore not be a severe threat to the validity of the study in the adult samples. A recent study has shown that there is considerable underreporting of weight and therefore inaccurate estimation of BMI among adolescents (34). Therefore, it has to be kept in mind that in the adolescent sample, some misclassification may have occurred.

Despite these possible limitations, our results are in line with the few other studies on the issue of misclassification of weight status. The finding that women were more likely to overestimate their weight and that men were more likely to underestimate their bodyweight status is in accordance with earlier studies in various populations and different age groups (22, 23, 25). Women have been found to be more weight conscious than men, and our results indicate that a significant proportion of women considered themselves to be too heavy, even though their weight was within a healthy range. Women were also more likely than men to have a weight loss intention, independent of their BMI.

In two of the three studies there was an indication that people from ethnic minorities may evaluate their weight as not too high, despite being overweight. Earlier studies have indicated that people from non-Western ethnic minorities may prefer higher bodyweights, which are regarded as reflecting more affluence (20, 21, 35). In the present study we were only able to make a distinction between respondents of Dutch and non-Dutch origin (e.g., Surinam, Moroccan, Turkish and other European countries). This rather crude classification may have obscured the magnitude of the effect of ethnic background on weight status awareness.

Our finding that higher age was somewhat associated with a greater likelihood to underestimate weight status may indicate that with increasing age people regard being overweight as more normal. Being overweight is more common with age (3), and in an age group in which the majority of people are overweight individuals may be more likely to underestimate their weight status. The rising prevalence of underestimation of weight status with age is further supported by the differences in prevalence of respondents who underestimate their weight status between the three surveys comprising this study.

In summary, it can be concluded that most people in the Netherlands are aware of their personal weight status, but that relevant proportions of the study populations underestimate or overestimate their bodyweight. Since underestimation of weight status may be higher among populations in which more people are overweight, the prevalence of people who underestimate their bodyweight status may rise in the years to come, which may result in lower motivation to avoid weight gain or to lose weight.

Implications for research and practice

The current study was an explorative study. Further research is needed with objective measures on weight and height to be able to investigate the true level of people who under- or overestimate their bodyweight status.

The findings suggest that people could be encouraged to compare their bodyweight status to standards that are relevant for public health and not to their perceptions of other people's bodyweights or 'beauty parlor' standards since this may lead to unwarranted under- and overestimation of weight status. Therefore, health professionals involved in the prevention of weight gain and overweight may consider including weight awareness strategies in their inter-

ventions. Among women, unwarranted weight loss actions may be avoided by correcting the overestimation of their own weight. However, among men and with increasing age, underestimation of weight status can be a barrier towards effective weight maintenance.

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CHAPTER 4

Correlates of motivation to prevent weight gain: a cross sectional study

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ABSTRACT

Background – This study is an application of the theory of planned behaviour (TPB) with additional variables to predict the motivations to prevent weight gain. In addition, variations in measures across individuals classified into Precaution Adoption Process stages (PAPM-stages) of behaviour change were investigated.

Methods – A cross-sectional survey among 979 non-obese Dutch adults aged 25-35 years was conducted. Multiple binary logistic regression analysis was conducted to assess the associations of Body Mass Index (BMI), demographic factors and psychosocial variables from the TPB with the intention to prevent weight gain. Differences in BMI, demographic and psychosocial factors between PAPM-stages were explored using one-way analysis of variance and chi-square tests.

Results – Eighty-five percent of respondents intended to prevent weight gain. Age, attitudes and risk perceptions related to weight gain were the strongest correlates of intention (age: OR=1.12, 95%CI: 1.04-1.20; attitude OR=7.91, 95%CI: 5.33-11.74; risk perception OR=1.24, 95%CI: 1.11-1.38). Significant differences were detected between the PAPM-stages in almost all variables. Notably, perceived behavioural control was lowest among people who had decided to prevent weight gain.

Conclusion – Messages to influence attitudes towards the prevention of weight gain and risk perception may affect people who are not yet motivated to prevent weight gain. Interventions increasing people's perceived behavioural control in overcoming barriers to prevent weight gain may help people to act on their intentions.

INTRODUCTION

Prevalence of overweight and obesity in Western societies has increased rapidly (1). This is a threat for public health by its link to chronic illness and disabilities and impaired quality of life (2-4). Overweight is a result of a long-term positive imbalance between energy intake and energy expenditure produced by a relative excess in energy input (diet) and/or a deficit in energy output (physical activity) (5).

In The Netherlands, the prevalence of obesity has approximately doubled over the past 20 years (1). The prevalence of overweight and obesity is about 45% for men and 35% for women, while 11% of the men and 12% of the women are obese (5, 6). To stop the increase in the prevalence of overweight and obesity, effective strategies for the management and prevention of overweight and obesity need to be developed. Current strategies aimed at treating obesity are not very successful in the long-term (7, 8). The behavioural changes necessary to achieve significant weight loss and maintain a healthy weight are difficult for most people. Therefore, intervention programs aimed to prevent weight gain by encouraging relatively small changes in physical activity and eating habits among people who are not yet overweight may be more promising (6, 9, 10).

Young adults are of particular interest for prevention of overweight. There is evidence that weight gain is most likely to occur among males and females between the ages of 25 and 34 (6, 11, 12). It has also been suggested that the onset of weight gain may have a situational basis, with important events in the life cycle such as entering the workforce, marrying and/ or having children triggering energy imbalance (13). Prevention of (further) weight gain is also important in young adults who are already overweight.

To support relatively small behavioural changes to reverse the gradual increments in weight with age, it is important to identify correlates of people's motivation to prevent weight gain. Such correlates may be intermediate goals in weight gain prevention programs (14). The Theory of Planned Behaviour (15) is one of the most widely-applied models to explain health behaviours (16, 17). According to this theory, behaviour in general is determined primarily by behavioural intention and postulates that this intention is determined by three conceptually independent constructs: attitude, subjective norms and perceived behavioural control. Attitudes are the overall evaluations of the behaviour by the individual; subjective norms consist of a person's beliefs about whether significant others think he or she should engage in the behaviour; perceived behavioural control is the individual's perception of the extent to which performance of the behaviour is under voluntary control.

The present study aims to identify potential correlates of motivation to prevent weight gain in a population of young adults in preparation of the development of nation-wide mass media campaigns to prevent weight gain, from the Netherlands Nutrition Centre. Therefore, the present study is a first step to identify potential mediators that should be addressed in such campaigns (18, 19). Primarily, we investigated associations with the constructs from the Theory of Planned Behaviour (TPB) to identify potential correlates of intentions to prevent weight gain in a population of young adults. Additionally, we included constructs that have been identified as a possible extension of the TPB that may be relevant to explain weight maintenance behaviours: descriptive norms (modeling) and social support related to prevention of

weight gain, overweight-related risk perceptions, and perceptions of personal weight status. A study by de Vries et al (1995) indicated that there are at least two other categories of social influences besides subjective norms that may determine health behaviour: descriptive norms, i.e. the observed behaviour of others in the direct social environment, and social support, i.e. the direct support people experience for preventive behaviour (20). Risk perceptions were included as a separate potential determinant in the present study since important alternative health behaviour models such as the Health Belief Model (21) and the Protection Motivation Theory (22) emphasise risk perceptions as a determinant of prevention motivation. Further, weight perception, i.e. self-rated weight status, was included as an additional variable, since there is evidence that people underestimate their weight, which may reduce their perceived need to change and thus their prevention intentions (23-25).

Nowadays, behaviour change is generally conceptualised to occur in subsequent stages or phases (26). Such stage models like the Transtheoretical model (TTM)(27) and the Precaution Adoption Process Model (PAPM) (28, 29) suggest that people in different stages behave in qualitatively different ways and that the content of interventions to encourage people to move toward action should be stage-specific. Transition between stages can be viewed as barriers that must be overcome before action is taken. These stage-models generally distinguish between people who are unaware of or unengaged by a health issue (stage 1), 'engaged and deciding what to do' (stage 2), 'planning to act but not yet acting' (stage 3), 'acting' (stage 4) and 'maintaining' (stage 5). Further, PAPM explicitly distinguished a separate aware but not acting stage, i.e. a step out of the sequence toward action. There is now preliminary evidence that PAPM is applicable to investigate complex behaviour change, like diet and physical activity, and that people in different PAPM stages for these behaviours differ in psychosocial variables like attitudes and perceived behavioural control (30). Therefore we also investigated how a young adult population was distributed over the different stages related to prevention of weight gain and if people in different PAPM-stages differ in demographic and psychosocial characteristics.

METHODS

Participants and recruitment

Data for the present study were derived from a cross-sectional survey conducted in November and December 2002. Data collection was performed using telephone questionnaires to obtain representative data of the non-obese Dutch population aged 25-35 years. Telephone numbers were selected at random by means of random digit dialling and stratified to different regions to ensure an equal distribution over the Netherlands.

The participation rate among the population was 71.4% (6587 of the 23053 participants who were called refused to participate to the telephone interview). Those who did not meet the age and BMI inclusion criteria (n=15449) were excluded. Only respondents aged between 25 and 35 years and with a BMI between 20 and 30 kg/m^2 could participate in the study. BMI was calculated from self-reported weight and height. Pregnant women (n=38) were also excluded from the analysis, since weight gain can and should be expected during pregnancy.

This resulted in a study population of 979 respondents of which 56.7% were female; 10.2 % was of non-Dutch origin; 57.5 % had intermediate or less than intermediate vocational training. The mean age was 30.0 years (SD=3.0) and mean BMI was 23.7 (SD=2.6), with a 30.1 % prevalence of overweight (BMI ≥ 25).

Measures

Administration of the telephone questionnaire took approximately 15 minutes. The questionnaire included items of demographics, psychosocial factors related to prevention of weight gain based on the TPB-model, descriptive norm, social support, risk perception and weight perception. Furthermore, the questionnaire obtained measures based on the Precaution Adoption Process Model.

At the start of the interview, the interviewer introduced the topic by explaining that questions would be asked on prevention of weight gain. It was further explained that prevention of weight gain should be understood as 'watching one's weight' by implementing small changes in lifestyle, such as eating habits and physical activity (e.g. reducing the amount of calories of food in meals and snacks and activities to increase amount of physical activity), not only with the purpose to lose weight but particularly in order to avoid gaining weight.

All items to assess TPB and other psychosocial constructs were measured on bipolar five-point scales. The interviewer read out the answering categories. For constructs that were assessed with multiple items, the mean item score was calculated after sufficient internal consistency was established. Cronbach's alphas and inter item correlations were calculated to analyse the internal consistence between the items related to behavioural determinants. Alpha > 0.5 were regarded as acceptable for the present exploratory study (31).

TPB constructs: Attitude was assessed directly with three items asking how bad or good; unimportant or important; and unpleasant or pleasant they regarded prevention of weight gain (-2 = very bad; unimportant; unpleasant; 2 = very good; important; pleasant) (α=0.53). Subjective norm was assessed with one item by asking if respondents thought that 'important others' (e.g. spouse, family, friends, colleagues) wanted them to prevent weight gain (-2 = no, certainly not; 2 =yes, certainly). Perceived behavioural control was assessed with two items asking how difficult or easy respondents thought it is to prevent weight gain is (-2 = very difficult; 2 = very easy) and how certain they were that they can prevent weight gain (-2 = no, certainly not; 2= yes, certainly) (α = 0.53). Behavioural intention was measured with one item asking the respondent whether they intended to prevent weight gain (-2 = no, certainly not; 2=yes, certainly).

Other psychosocial constructs: Descriptive norm (modeling) was measured by asking respondents to assess how many people they perceived in their direct social environment to actively try to prevent weight gain (-2 = very few people; 2 = almost all people). Social support was measured by asking respondents how much support they received from 'important others' to prevent weight gain (–2 = very little support; 2= very much support). Risk perception of weight gain was calculated by multiplication of two items, one in which respondents were asked if they believed that they were at less or more risk for weight gain compared to others of

Table 4.1. PAPM staging-algorithm applied to weight gain prevention

Respondents in stage:	Agreed with statement:
Unengaged	I have never thought about actively trying to prevent weight gain
Undecided to act	I have thought about actively trying to prevent weight gain but I do not know (yet) whether I will do so
Decided not to act	I have decided not to actively try to prevent weight gain
Decided to act	I have decided to actively try to prevent weight gain but I am currently not doing so (yet)
Action and maintenance	I do already actively try to prevent weight gain

same sex, age and height (1 = much less risk; 5 = much more risk) and one item asking how serious they perceived weight gain to be on a three point scale (1=not serious; 2= serious; 3= very serious). This resulted in a risk perception scale of 1-15. Finally, weight perception was assessed by two items, one which asked whether respondents rated their body weight as low or high (-2 = far too light; 2 = far too high) and one in which respondents compared their weight to that of other people of the same sex and age (-2 = much lower weight; 2= much higher weight) (α = 0.65).

PAPM stages of weight gain prevention behaviour: Following Weinstein's method (28), a staging algorithm was used to assign respondents into different PAPM stages (See Table 4.1).

Analyses Methods

Multiple logistic regression analysis was conducted in a 3-step process to assess the association of demographic characteristics (age, gender, education, ethnicity and BMI; step 1), TPB constructs (attitude, social norm and perceived behaviour control; step 2) and other psychosocial constructs (modeling, social support, risk perception and weight perception; step 3) with the intention to prevent weight gain. We used logistic regression analyses since we dichotomised the dependent variable 'intention to prevent weight gain' (negative or no intention =0; positive intention =1), because of a skewed distribution. Behavioural intention was dichotomised by categorising respondents who answered the intention-question with option 1 (yes, certainly) or 2 (yes, probably) as having a positive intention and those who answered with option –2 (certainly not), -1 (probably not) or 0 (not sure) as having a negative intention. One-way analysis of variance with Scheffe's multiple-comparison test (alpha = .05) and Chi Square (alpha = .05) was used to test for significant differences in demographic and psychosocial factors between the stages of change. All analyses were performed using the SPSS 11.0 statistical program for Windows.

RESULTS

Eighty-five percent of respondents had a positive intention to prevent weight gain. On average, respondents had positive scores on attitude and perceived behavioural control, negative

Table 4.2. Number of items on determinant constructs related to prevention of weight gain, the internal consistency between the items and the mean scores on the constructs, n=979

Determinant (Range)	Number of items	Internal consistency (α)	Mean score (SD)
TPB construct:			
Intention (-2,2)	1		1.36 (1.18)
Attitude (-2,2)	3	0.53	0.59 (0.65)
Subjective norm (-2,2)	1		-0.67 (1.47)
Perceive behavioural control (-2,2)	2	0.53	0.88 (0.92)
Other psychosocial constructs:			
Descriptive norm (-2,2)	1		0.20 (1.19)
Social support (-2,2)	1		-1.05 (1.03)
Risk perception (1,15)	2		5.92 (3.69)
Weight perception (-2,2)	2	0.65	0.12 (0.72)

scores on subjective norm and social support, and neutral scores on descriptive norm, and weight perception (See Table 4.2).

Predictors of intention to prevent weight gain

With the first step, the logistic regression model explained 11.3% of the variance in intention to prevent weight gain (see Table 4.3). In this model the variables BMI, sex and age were significant predictors of the intention to prevent weight gain. With the second step, the model was extended with the TPB constructs and explained 45.5% of the variance. Additional to BMI, sex and age, were also attitude and subjective norms significant predictors of the intention to prevent weight gain. With the third step, the regression model was extended with the variables modelling, social support, risk perception and weight perception and explained 49.9% of the variance in intention to prevent weight gain. The results of the likelihood ratio test show that the inclusion of the variables at step 3 significantly increased the explained variance compared with the previous models. In the final model only age, attitude and risk perception were significant predictors of the intention to prevent weight gain (Table 4.3): respondents were more likely to have a positive intention to prevent weight gain when they were older, had a more positive attitude to prevent weight gain and had higher overweight-related risk perceptions.

Differences in factors across PAPM stages of change

Table 4.4 shows that a majority of the respondents reported that they already act to prevent weight gain. Significant differences were detected between the PAPM stages in almost all socio-demographic and psychosocial variables with the exception of educational level and descriptive norms. Respondents who were in the decided-to-act and the action stage were on average older, more likely to be female and had a higher BMI compared with respondents in earlier stages. Furthermore, the respondents who were in the decided-to-act and action stage

Table 4.3. Correlates of intention to avoid weight gain based on stepwise logistics regression analysis (n=979): odds ratios (OR), 95% confidence intervals (95%CI) and explained variance (Nagelkerke R2).

Step 1 (R^2=0.113)		Step 2 (R^2=0.455)		Step 3 (R^2=0.494)	
Predictor:	OR (95%CI)	Predictor:	OR (95%CI)	Predictor:	OR (95%CI)
BMI (20-30 kg/m2)	1.30 (1.20-1.42)	BMI	1.22 (1.11-1.35)	BMI	1.04 (0.91-1.19)
Sex (0=man; 1=woman)	2.34 (1.61-3.39)	Sex	1.81 (1.13-2.89)	Sex	1.00 (0.58-1.71)
Age (25-35y)	1.07 (1.01-1.13)	Age	1.09 (1.01-1.17)	Age	1.12 (1.04-1.20)
Education (1=low; 2= high)	1.29 (0.92-1.81)	Education	1.26 (0.89-1.78)	Education	1.19 (0.84-1.70)
Ethnicity (1=Non Dutch origin; 2= Dutch origin)	1.04 (0.58-1.89)	Ethnicity	1.22 (0.60-2.50)	Ethnicity	1.23 (0.58-2.59)
		Attitude	10.10 (6.85-14.89)	Attitude	7.91 (5.33-11.74)
		Subjective norm	1.24 (1.04-1.47)	Subjective norm	1.17 (0.97-1.40)
		Perceived behavioural control	1.00 (0.78-1.27)	Perceived behavioural control	1.12 (0.88-1.44)
				Descriptive norm	1.19 (0.99-1.45)
				Social support	1.10 (0.82-1.47)
				Risk perception	1.24 (1.11-1.38)
				Weight perception	1.36 (0.81-2.30)

Table 4.4. Significant differences between PAPM stages on socio-demographic and psychosocial correlates (n=979)

	UE N=109 (11.1%)	**UD** N=64 (5.1%)	**DN** N=80 (8.2%)	**DA** N=85 (8.7%)	**A** N=641 (65.5%)	**Significant differences***
Demographic variables:						
Age	30.00	30.28	30.35	31.28	30.98	A>UE
Sex (% women)	30.3	29.7	37.5	54.1	64.1	DA, A>UE, UD A>DN
Education (% higher education)	40.4	60.9	45.0	47.1	53.0	-
BMI	22.33	23.12	23.02	24.79	23.97	DA> UE, UD, DN A> UE, DN
TPB constructs:						
Attitude	-0.095	0.35	-0.079	0.42	0.83	A> UE, UD, DN, DA UD, DA >DN, UE
Subjective norm	-1.06	-0.88	-1.14	-0.28	-0.57	A, DA > UE, DN
Perceived behavioural control	0.82	0.87	0.74	0.38	0.96	UE, UD, A > DA
Other psychosocial constructs:						
Descriptive norm	-0.028	-0.078	-0.063	0.035	0.31	-
Social support	-1.49	-1.42	-1.54	-1.02	-0.88	A> UE, UD, DN DA> UE, DN
Risk perception	2.96	3.97	3.89	6.51	6.79	DA, A > UE, UD, DN
Weight perception	-0.46	-0.094	-0.22	0.46	0.23	DA,A > UE, UD, DN UD>UE

*Statistical significant at $P < 0.05$
Note: UE=unengaged; UD=undecided to act; DN=decided not to act; DA=decided to act; A=action

had a more positive attitude towards prevention of weight gain, reported a higher subjective norm, perceived more social support to prevent weight gain, had a higher overweight-related risk perception and evaluated their weight as significantly higher compared to those in the earlier stages. Finally, the results showed that the respondents who were in the decided-to-act stage reported a lower perceived behavioural control towards prevention of weight gain than respondents in most other stages.

DISCUSSION

The present study shows that a majority of Dutch non-obese adults aged between 25 and 35 years had a positive intention to prevent weight gain. Age, attitudes and risk perceptions related to weight-gain were the strongest predictors of this intention. Further, a majority of the respondents reported that they were already acting to prevent weight gain and respondents

in the higher stages of change reported more positive psychosocial factors related to weight-gain prevention than respondents in earlier stages of change. However, respondents who had decided to act to prevent weight gain reported low perceived behavioural control, suggesting that low control was a barrier towards action.

The study indicates that in order to motivate the minority with non-positive intentions to prevent weight gain, interventions should focus on attitude change and communication about the risks of weight gain and overweight. In order to help motivated people in the study population to act on their intentions, it may be important to increase perceived behavioural control. These results are in line with earlier studies in differences on psychosocial factors between stages of change for smoking cessation (32), fat reduction (33), and increasing fruit and vegetable consumption (34), that also concluded that attitudinal information and risk information should be provided in earlier stages of change to increase motivation, while self-efficacy or control information can assist people to move to the action stage. The importance of perceived behavioural control is also highlighted in studies on weight loss (35, 36).

Our results further show that people who have decided to act have higher BMIs than people in earlier stages of change, which shows that people who have more reason to act may also be more ready for action. However, this result is not supportive to the 'prevention of overweight' goal, since it indicates that people become more inclined to prevention of weight gain when they already experience some overweight. The fact that women were more likely to be in later PAPM stages reflects results from earlier studies that show that women are more weight conscious (37, 38). The result from a secondary *t*-test analyses showed that women in the present study were significantly more weight concerned compared to men, which may also explain why the association of sex with the intention to prevent weight gain was non significant after adjustment for weight perception.

The present study shows that a large majority of respondents regarded themselves as acting to prevent weight gain. However, this does not tell us if they have been successful in their self-perceived actions and if their actions would prevent weight gain in the future. Studies conducted in the Netherlands have shown that the prevalence of overweight is still increasing (1). Taking this trend into account, the results of this study suggest that it is likely that respondents overestimated their actions to prevent weight gain or that they applied less effective strategies to balance their energy intake and expenditure. The present study further shows that about a quarter of respondents were still in the earlier stages of behaviour change. They may have perceived less need to prevent weight gain, since most of the respondents do not yet have a weight problem. This illustrates the challenge of prevention of weight gain: we need to encourage the non-overweight population to be attentive to and to act to prevent gradual changes in weight.

For interpreting the results of this study, several limitations should be acknowledged. Firstly, the present study relied on self-reports, which may be subject to social desirability bias. No objective assessments of energy balance related behaviours were included in our measurements. Earlier studies show that errors in self-reporting increases directly with the magnitude of overweight and with age after the age of 45 years (39, 40). Since we studied a non-obese younger population group, self report-bias may have been limited but cannot be ruled out.

Our measures of TPB and PAPM constructs were in accordance with those used in earlier

studies (15, 26), which were further pilot tested in a small sub-sample of the study population and submitted for review to an expert panel. For the present study, we framed all questions as related to 'watching your weight in order to prevent weight gain'. This formulation may not have been specific enough to embrace the complexity of energy balance related behaviour. Furthermore, some measures were based on few or single item assessments, which are more likely to have limited reliability. For future intervention development it will be more informative to investigate indirect measures of behavioural determinants, e.g. to identify what sort of specific beliefs may underlie people's weight gain prevention attitudes and control beliefs. For example, other studies indicate that people believe that low fat diets (an illustration of a specific weight control behaviour) are more expensive, more difficult to prepare and that eating less fat is difficult in general or in certain specific situations such as in the weekends and holidays (41-43). In order to tailor education interventions, qualitative methods such as interviews or focus groups are needed to gain more knowledge about existing underlying salient beliefs of the target population (18). This to determine which beliefs have to be changed by introducing new salient beliefs or by reinforcing existing beliefs (44).

Furthermore, we applied a cross-sectional research design and therefore were only able to study associations, and not causation (45). Despite this limitation, results of meta-analyses revealed that TPB accounts for about 41% of the variance in intentions and 34% of the variance in behaviour across a variety of health-related behaviours (16). These findings may establish to the credibility of behavioural intentions as the main predictor for weight maintenance-actions. Further, we also have to acknowledge limitations of the analyses since so many (85%) of the whole sample was found as having a positive intention. Because of this high percentage, we conducted additional analyses with more conservative data by classifying only those answering 'yes, certainly' as having a positive intention. The results of these analyses revealed that in the final step of the regression model, additional to the variables 'attitude' and 'risk perception' the variables 'sex', 'social support' and 'weight perception' became significant predictors of the intention to prevent weight gain. This means that respondents were also more likely to have a positive intention to prevent weight gain when they were female, be supported more by others and when they rated their weight as higher. For intervention development, these variables may be taken into consideration in order to motivate people who already have positive intentions to prevent weight gain, but who are still undecided on whether they will take action in the near future. Finally, the present study included only relatively few respondents in the earlier stages of behavioural change, and thus statistical power to detect differences between these stages was low. We therefore were not able to show with the present study that the PAPM was more useful than the TTM in order to investigate prevention of weight gain. Nevertheless, the PAPM might give additional information compared to TTM assessments when it is applied to more specific weight related behaviours.

Our study population was a random sample of non-obese 'young' adults in the age group of 25-35 year. The mean BMI of our study population was indeed identical to that of the Dutch population aged 25-35 at large, although women were slightly over-represented and the respondents in this study were somewhat higher educated compared with the source population (46, 47). However, this is unlikely to have serious consequences for the generalisability of the findings, as results of the present study show that sex and educational level were not signifi-

cant correlates of the motivation to prevent weight gain.

Maybe the most striking result of this study is the high proportion of positive intentions to prevent weight gain and the high prevalence of respondents who reported to act in order to prevent weight gain. In this age group, weight gain is highly probable. The present study indicates that this occurs in spite of high motivation and self-perceived actions to avoid gaining weight. Andajani-Surjahjo and colleagues recently reported a lack of motivation related to physical activity and healthy eating for weight maintenance among women in the US (48). This may illustrate the issue that people are motivated to avoid weight gain, but less motivated to engage in more specific actions that help to accomplish weight management. For a further understanding of the correlates of prevention of weight gain we need to investigate motivational factors (e.g. attitudes; subjective norms etc) related to specific weight-management actions such as 'avoiding calories', limiting the amount of food, and participation in regular physical activities (49). Furthermore, we should not restrict our investigations to motivational factors. In the last decade, a number of reports have been published arguing that our present society fosters an 'obesogenic environment', i.e. a physical and social environment that promotes over-eating and discourages physical activity, and that such an environment may provide too high a barrier to avoid becoming overweight, despite high prevention motivation (50). Further research is needed to investigate which energy balance related behaviours can help people deal better with the 'obesogenic environment' and may enable them to effectively act on their positive weight-gain prevention intentions.

Competing Interests

None declared.

Authors' Contributions

BW conceptualised the study, performed the statistical analyses, and drafted the manuscript. SK and BB both participated in the conceptualisation of the study, interpretation of the results and helped to draft the manuscript. JB conceived the study and assisted in the interpretation of the results and drafting the manuscript. All authors read and approved the final manuscript.

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CHAPTER 5

What young adults say they do to keep from gaining weight.

Self-reported prevalence of overeating, compensatory behaviours and specific weight-control behaviours

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ABSTRACT

Objective – The aim of this study was to explore the prevalence of and differences in self-reported occasions of overeating (such as at celebrations and other parties), compensatory behaviours and specific weight-gain prevention strategies among young Dutch adults according to socio-demographics and overweight status.

Design and subjects – Cross sectional data were analysed from Dutch adults aged 20 to 40 years of age, recruited from an Internet research panel(n = 857, response rate = 76.6%). Using electronic questionnaires, self-report data were collected on socio-demographics, body mass index (BMI), occasions of overeating, compensatory behaviours and diet and physical activity used as weight-gain prevention strategies. Associations were tested using multiple linear and logistic regression analyses.

Results – Of the participants, 48.6% reported occasions of overeating at least once a week during the four-week period, 44.6% reported compensating for these occasions and 72.9% reported engaging in dietary and physical activities specifically for weight-gain prevention purposes. Only 32.1% of the respondents reported using the recommended combination of diet and physical activity as a weight-gain prevention strategy. In addition, results showed that overweight people (BMI ≥25) and women were more likely to report overeating than people with healthy body weights (OR = 1.79; 95% CI: 1.32-2.42) and men (OR = 1.50; 95% CI: 1.14-1.97). Overweight people, women and people who regularly reported overeating were also significantly more likely to report compensatory behaviours by eating less and to report specific weight-gain prevention strategies using diet and physical activity.

Conclusion – The present study suggests that people experience frequent occasions of overeating and try to compensate such occasions in different ways. However, the combination of dietary changes and physical activity recommended by experts was seldom reported.

INTRODUCTION

Both diet and physical activity are important to effective weight maintenance (1). Although earlier studies have shown that high percentages of people are engaged in weight-gain preventive action (2), the rising prevalence of overweight and obesity show that these are not always effective. This might be explained by the fact that the duration of engagement in weight-control behaviours is often very brief and therefore not sufficient to prevent weight change over time as suggested by a prospective cohort study on the prevalence and duration of specific weight-loss strategies (3). Another explanation might be that people are engaged in non-effective weight-gain prevention behaviours. To date, little is known about which dietary and physical activity behaviours people apply to prevent weight gain, since most existing work has focused on weight loss or because more detailed information about such behaviours was not obtained (4-7). Exercise and caloric restriction are the two relevant and most commonly studied strategies of weight control. However, these strategies may consist of a diverse range of more specific behaviours including restricting fats, sugar, snacks or soft-drink intakes, eating breakfast and plenty of fruits and vegetables, walking, cycling and participating in a range of sporting activities (3, 8-10).

To try to further explain the discrepancy between reported preventive actions on the one hand and more people becoming overweight on the other, it is important to explore what specific weight-control behaviours people engage in to prevent weight gain and to what extent people combine these behaviours. It is important to explore the latter in particular, because Serdula's study (6) suggests that only a minority of people use the recommended combination of increased physical activity and restricted food intake.

The discrepancy between a high degree of preventive action and the increasing trend of overweight might also be explained by an 'obesogenic' environment with easy availability of palatable, energy-dense foods that may induce overeating despite people's high motivation and self-perceived action to maintain their body weight (11-13). Occasions of overeating (i.e. eating more calories than needed to maintain body weight) are common in many societies with traditions of parties and celebrations. These occasions of overeating can be induced by such obesogenic environments and can be induced still further by negative mood states (12-17). Such occasions of overeating may form a risk for weight gain and eventually for becoming overweight or obese if overeating happens frequently over longer periods of time without effective compensation (17, 18). To date, little is known about the prevalence of occasions of overeating, awareness of such occasions, and possible compensatory behaviours and weight-maintenance strategies, and to what extent people use the recommended combination of physical activity and restriction of food intake in their efforts to prevent weight gain.

This is one of the first studies to explore the prevalence of self-reported occasions of overeating, compensatory behaviours in response to overeating and specific weight-gain prevention behaviours related to diet and physical activity and whether these behaviours differ according to socio-demographics and body weight status. Additionally, this study explored whether people who reported overeating use different or more weight-gain prevention strategies.

SUBJECTS AND METHODS

Study populations

Data were taken from the Balance Intervention study. The Balance Intervention was initiated by the Netherlands Nutrition Centre, and aimed at promoting quick 'caloric compensation': moderating food intake and/or increasing physical activity in response to overeating. To determine whether intervention materials were useful, encouraged information-seeking, and increased motivation and caloric-compensation behaviours, a three-group randomized trial with pre- and post-intervention measures using electronic questionnaires was conducted among participants aged 25 to 40, recruited from an internet research panel (n = 857, response rate 76.6%). To be eligible for the study, participants had to be (1) aged 20-40 years, (2) not currently pregnant, (3) willing to receive a brochure in the post at their home address and be able to listen to recordings of radio advertising on their home computer, and 4) not planning to be on holiday during the four-week intervention and data-collection period. As reward for participating in the study, the members of the Internet research panel received a contribution to a gift voucher (19).

One group received a printed brochure and electronic newsletters (print group), the second group was exposed to radio advertisements (radio group) and the third group was the control group. For the present study we only used the data on the post-measures. We decided to combine the data of the control and intervention groups since we found no differences between groups for any of the relevant variables, including body mass index (BMI) and socio-demographics. The exception was 'compensatory behaviours', which were reported significantly more frequently in both the intervention groups (19). For the descriptive data on the prevalence of compensatory behaviour, we therefore used the data of the control group only.

Measures

The Balance Intervention study made use of a self-developed questionnaire. The questionnaire was tested for reliability by analysing test-retest reliability, and the internal consistency of the scales was established in the sample of the present study with Cronbach's alphas (19).

Socio-demographic characteristics

Information on age, gender, ethnicity, educational level and self-reported height and weight was gathered during the recruitment procedure. Respondents were defined as being of Dutch ethnic origin if both their parents were born in the Netherlands, and otherwise were considered to be of non-Dutch ethnic origin. The information on height and weight was used to calculate BMI (BMI= weight (kg)/ height $(m)^2$).

Prevalence of overeating

People were asked to report the frequency of overeating over the last month, and we included a 12-item self-report measure to assess this. Overeating was defined as 'occasions you eat more than usual and more than you think is really good for you. Overeating can be common in situations that could be labelled as "high-risk", such as at parties and other celebrations, going out, and on public and other holidays and that can be recognized by a feeling of ab-

dominal fullness'. In our study the measure of 'overeating' was not comparable with having a binge-eating episode. Therefore, 'losing control over one's eating' or 'feeling guilty afterwards' were not part of this measure. Respondents were asked how often they experienced occasions of overeating in 12 pre-defined risk situations (see Table 5.2) over the last four weeks on a 5-point scale: (1) almost never; (2) less than once a week; (3) once or twice a week; (4) three to four times a week; (5) five times a week or more (Cronbach's alpha = 0.87; test-retest reliability = 0.70).

Compensatory behaviours

The questionnaire continued with questions on how often participants were engaged in dietary or physical activity compensatory behaviour) over a certain time period before or after situations of overeating. Several examples were given of how people can try to eat less (e.g. eating low-calorie food, limiting sweets and snacks and smaller portion size) or be more physically active in response to occasions of overeating. Respondents were asked whether they compensated overeating at four designated moments for compensation over the last month: 1) the day before; 2) on the same day; 3) the day after; 4) within a few days. These questions were answered on a 5-point scale: (1) almost never; (2) less than once a week; (3) one or twice a week; (4) three or four times a week; (5) five times a week or more (compensation with caloric restriction: Cronbach's alpha = 0.75; test-retest reliability = 0.65; compensation with increased physical activity: Cronbach's alpha = 0.87; test-retest reliability = 0.66).

Specific weight-gain prevention strategies related to diet and physical activity

To investigate self-reported frequency of strategies relevant for prevention of weight gain, we included questions on 28 dietary behaviours and 7 physical-activity behaviours (see Table 5.1). The list of behaviours was based on existing questionnaires used to measure weight-control practices (i.e. reducing the amount of food, snacks, fats and sweets, eating plenty of fruits and vegetables, choosing low-fat or diet versions of foods, high- and moderate-intensity physical activity) (3, 20-22).

In three successive questions for each separate action, the participants were asked about their engagement in these behaviours for weight-gain prevention. First, participants were asked which of the listed behaviours they engaged in over the last month. When the respondents reported they engaged in a specific behaviour, they were asked about the frequency of this behaviour on a 5-point scale (0 = almost never / less than once a week / one or twice a week / three a four times a week / 5 times a week). Finally, they were asked whether they performed this behaviour specifically to prevent weight gain (Yes / No). The scores of respondents who reported they engaged in a given behaviour but not to prevent weight gain were recoded to 0.

We used two principal component analyses to group the 28 weight-gain prevention behaviours related to diet and the 7 weight-gain prevention behaviours related to physical activity into meaningful categories for further examination. Eight factors related to diet and two factors related to physical activity were identified based on examination of item loadings, scree plots and eigenvalues (see Table 5.1). Items with a factor score below 0.4 were excluded from further analyses.

Table 5.1 Factor loadings on newly developed scales for weight-gain prevention strategies related to diet and physical activity, their internal consistency and test-retest reliability (n = 847).

Weight-gain prevention strategies related to diet	Factor loadings
Limiting fat intake (eigenvalue = 17.3; 30.5% of variance; Cronbach's alpha = 0.68; test-retest reliability = 0.65)	
- eating few or no fried foods	0.75
- eating few or no high-fat products	0.72
- eating little or no fat	0.60
- sticking to a weight-loss diet	0.21
Having a regular eating pattern and eating lots of fruits and vegetables (eigenvalue = 4.69; 8.28 % of variance; Cronbach's alpha = 0.68; test-retest reliability = 0.70)	
- having a regular eating pattern	0.83
- eating three meals a day	0.83
- eating lots of fruits and vegetables	0.48
- eating lots of high-carbohydrate products	0.33
- consuming few or no alcoholic drinks	0.30
- not or only occasionally eating out	0.28
Limiting sweets and snacks (eigenvalue = 3.77; 6.67 % of variance; Cronbach's alpha = 0.73; test-retest reliability = 0.66)	
- cutting out sweets	0.80
- eating few or no snacks	0.82
Limiting sugar intake and avoiding sweet foods (eigenvalue = 3.40; 6.01 % of variance; Cronbach's alpha = 0.50; test-retest reliability = 0.72)	
- eating little or no sugar	0.69
- avoiding sweet foods	0.63
- trying to maintain a sugar-free diet	0.22
- eating no or few high-carbohydrate products	0.19
- using meal replacements	0.14
- sticking to a low-fat diet	0.14
Using diet products (eigenvalue = 2.79; 4.93 % of variance; Cronbach's alpha = 0.49; test-retest reliability = 0.78)	
- using diet products	0.92
- eating low-fat products	0.58
- fasting for a day	0.18
Eating few or no desserts and smaller servings (eigenvalue = 2.48; 4.39 % of variance; Cronbach's alpha = 0.48; test-retest reliability = 0.68)	
- eating few or no desserts	0.85
- eating smaller servings	0.56
- skipping a meal	0.27
- eating little or no meat	0.19
Drinking lots of water (eigenvalue = 2.34; 4.14 % of variance; test-retest reliability = 0.66)	0.92
Limiting soft-drink and fast-food intake (eigenvalue = 2.20; 3.89 % of variance; Cronbach's alpha = 0.50; test-retest reliability = 0.61)	
- eating few or no fast-foods	0.62
- drinking few or no soft drinks	0.58
High-intensity physical activity (eigenvalue = 3.7; 38.9 % of variance; Cronbach's alpha = 0.69; test-retest reliability = 0.39)	
- getting lots of exercise	0.93
- engaging in high-intensity exercise and sport	0.73
Moderate-intensity physical activity (eigenvalue = 2.2; 23.1 % of variance; Cronbach's alpha = 0.58; test-retest reliability = 0.58)	
- taking the stairs instead of the elevator	0.95
- walking during leisure time	0.49
- cycling to work instead of going by car or public transport	0.43
- cycling during leisure time	0.36
- gardening	0.16

Note: Items with a factor score below 0.4 were excluded from further analyses.

Table 5.2. Proportion of respondents who experienced occasions of overeating at least once a week over the last month, according to body weight status and socio-demographics (n = 848).

	% of respondents who experienced overeating at least once a week								
	Total population (n = 848)	BMI		Gender		Age		Educational level	
		BMI<25 (n = 567)	BMI >25 (n = 287)	Female (n = 441)	Male (n = 412)	20-30y (n = 652)	31-40y (n = 202)	Low (n = 272)	High (n = 581)
Occasions of overeating:†	**48.6**	**33.7**	**47.4**	**37.8**	**38.9**	**38.4**	**38.1**	**34.9**	**39.9**
in the weekend	22.4	18.5	30.2	23.0	21.8	21.5	25.2	21.3	22.9
when feeling (slightly) depressed	21.5	16.3	31.6	30.1	12.2	20.7	23.8	21.7	21.4
when watching television	19.9	17.2	25.3	21.0	18.8	18.1	25.7	18.4	20.7
during a day off or holiday	16.4	13.0	23.2	16.6	16.1	15.8	18.3	15.8	16.7
after work or school	15.9	13.9	20.0	18.0	13.7	15.3	17.8	11.8	17.9
before going to bed	12.4	10.1	16.8	13.2	11.5	11.3	15.8	11.0	13.0
at a party or birthday celebration	11.9	10.1	15.4	11.4	12.5	10.8	15.3	12.5	11.6
when tired	9.4	7.1	14.0	11.2	7.6	8.4	12.9	8.5	9.9
when reading or studying	8.0	7.8	11.2	10.0	7.6	9.9	5.9	11.0	8.0
when relaxing with family or friends	8.8/7	6.4	13.7	9.1	8.6	8.2	10.9	8.8	8.9
when eating out	8.3	7.1	10.5	8.0	8.6	7.7	9.9	8.1	8.3
at work	8.0	5.2	13.7	7.3	8.8	7.7	8.9	4.8	9.5

† overall % of respondents who regularly (≥1 time a week) experienced overeating in *any* of the listed high-risk situations

Analyses

Descriptive statistics were used to describe the prevalence of people who experienced occasions of overeating regularly during the last month (≥1 time a week) and who reported regularly (≥1 time a week) engaging in compensatory behaviours or other weight-gain prevention strategies related to diet and physical activity over the last month. These descriptives were calculated separately according to socio-demographics, weight status and the frequency of overeating. In addition, we calculated the overall percentages of respondents who experienced overeating regularly (≥ 1 time a week) in *any* of the 12 listed high-risk situations and who regularly (≥ 1 time a week) engaged in *any* of the specific compensatory behaviours related to diet or physical activity and *any* of the 10 identified weight-gain prevention strategies (Table 5.4). Finally, the combination of diet and physical activity was calculated for respondents who reported regularly engaging in any of the dietary activity behaviours together with any of the physical activity behaviours.

We used multiple logistic regression analyses to test for differences in regularly engaging in overeating, compensatory and specific weight-gain prevention behaviours according to socio-demographics, body weight status and the frequency of overeating. Regular occasions of overeating, and regular engagement in compensatory behaviours and specific weight-gain prevention behaviours were the dependent variables (yes = 1; no = 0) in the regression model. Finally, in order to test whether compensatory behaviours negatively or positively predict being overweight or obese additional logistic regression analyses were conducted with overweight status as dependent variable and regular engagement in compensatory behaviours as independent variables, adjusted for the frequency of overeating and socio-demographic characteristics of the respondents.

Since this study was based on an intervention study with two intervention groups and a control group, all analyses were adjusted for group.

RESULTS

Subjects

Participants were 52% female, 91% of Dutch ethnic origin, and 68% had higher educational levels (university degrees or higher professional training). Mean age was 27 years (SD: 5.3); the mean BMI was 24.3 kg/m2, and 33.6% of the participants were overweight (BMI ≥ 25kg/m2). Slightly more men than women were overweight (34.9% versus 32.4%).

Overeating and compensatory behaviours

Descriptive data in Table 5.2 show that 48.6% of the respondents reported they regularly experienced overeating in one of the listed high-risk situations over the last month. The prevalence for overeating was highest in the weekend and when feeling slightly depressed. Overweight people and women were more likely to experience overeating at least once a week when compared with non-overweight people (OR = 1.79; 95% CI = 1.32-2.42) and men (OR = 1.50; 95% CI = 1.14-1.97).

A total of 44.6% of the respondents reported compensating overeating by eating less or

Table 5.3. Proportion of respondents who reported engaging regularly (≥1 time a week) in compensatory behaviours in the last month, according to body weight status and socio-demographics (n = 276).*

	% of respondents who reported compensatory behaviours once a week or more										
	Total population (n = 276)*	BMI		Gender		Age		Educational level		Overeating	
		BMI<25 (n = 186)	BMI >25 (n = 90)	Female (n = 138)	Male (n = 138)	20-30y (n = 201)	31-40y (n = 75)	Low (n = 97)	High (n = 179)	Irregular (n = 146)	Regular (n = 130)
Compensating over-eating by eating less:†	**42.0**	**34.9**	**56.7**	**48.6**	**35.5**	**42.3**	**41.3**	**45.4**	**40.2**	**19.5**	**67.7**
on the day before	2.5	1.6	4.4	2.2	2.9	2.5	2.7	1.0	3.4	0.7	4.6
on the same day	14.1	12.9	16.7	15.9	12.3	13.9	14.7	13.4	14.5	4.8	24.6
on the day after	13.4	12.4	15.6	13.8	13.0	13.4	13.3	12.4	14.0	2.7	25.4
within a few days	12.0	11.8	12.2	14.5	9.4	10.9	14.7	12.4	11.7	2.7	22.3
with breakfast	6.5	4.3	11.1	8.0	5.1	7.0	5.3	8.2	5.6	2.7	10.8
with lunch	9.1	6.5	14.4	8.7	9.4	8.0	12.0	8.2	9.5	4.1	14.6
with dinner	12.7	12.9	12.2	13.8	11.6	12.4	13.3	12.4	12.8	4.8	21.5
between-meal moments	29.3	24.7	38.9	34.1	24.6	28.4	32.0	30.9	28.5	11.0	50.0
after dinner	13.8	12.4	16.7	17.4	10.1	12.4	17.3	15.5	12.8	6.8	21.5
Compensating over-eating by being more physically active:†	**23.9**	**23.7**	**24.4**	**23.2**	**24.6**	**25.4**	**20.0**	**23.7**	**24.0**	**12.3**	**36.9**
on the day before	2.9	2.2	4.4	1.4	4.3	3.5	1.3	10.	3.9	1.4	4.6
on the same day	13.8	12.4	16.7	17.4	10.1	12.4	17.3	15.5	12.8	6.8	21.5
on the day after	14.9	12.9	18.9	13.8	15.9	14.9	14.7	14.4	15.1	5.5	25.4
within a few days	13.4	13.4	13.3	14.5	12.3	13.9	12.0	12.4	14.0	4.1	23.8

* n = 276; for the descriptive data of compensatory behaviours we used the data of the control group only; † % of respondents who were engaged in *any* of the listed compensatory behaviours related to diet or physical activity.

being more physically active. Descriptive data on compensatory behaviours (see Table 5.3) show that people were more likely to compensate overeating by restricting food intake than by increasing physical activity. Furthermore, only 21.4% of the respondents reported to combining compensatory behaviours related to restricting food and increasing physical activity. Multivariate analyses revealed that overweight people and people who reported regular overeating were more likely to compensate occasions of overeating with caloric restriction when compared with non-overweight people (OR = 2.36; 95% CI = 1.28-4.35) and people who only irregularly experience overeating (OR = 8.56; 95% CI = 4.85-15.10). Additionally, analyses revealed that people who reported regular overeating were more likely to compensate overeating with increased physical activity (OR = 4.44; 95% CI = 2.38-8.31) and that compensation of occasions of overeating with caloric restriction was positively associated with being overweight or obese (BMI ≥ 25) (OR = 3.09; 95% CI = 1.54-6.19).

Weight-gain prevention strategies related to diet and physical activity

A total of 72.9% reported regularly engaging in one of the weight-gain prevention strategies over the last month. Nevertheless, the recommended strategies (such as limiting sugar, snack and soft-drink consumption) were seldom reported. Limiting sweets and snacks was most often mentioned as a strategy people engaged in (Table 5.4). Respondents were more likely to report weight-gain prevention strategies related to diet (69.6%) than to physical activity (35.4%); only 32.1% reported the recommended combination of dietary and physical activity behaviours.

Compared with men and non-overweight people, women and overweight people were more likely to report weight-gain prevention strategies. In addition, results showed that older people (aged 31 to 40) were more likely to eat fewer desserts and smaller servings in order to prevent weight gain than younger people (aged 20 to 30) (Table 5.5).

DISCUSSION

The results of the present study revealed that nearly half of the respondents reported regular occasions of overeating and compensatory behaviours and that a majority of the respondents reported engaging in at least one weight-gain prevention strategy related to diet or physical activity. Respondents were more likely to report diet-related weight-gain prevention than strategies related to physical activity, and only a few respondents reported the combination of dietary and physical activity behaviours to prevent weight gain. Recommended diet-related strategies such as limiting sugar, snack and soft-drink consumption did not appear to be very popular. In addition, results showed that women, overweight people and people who experience regular overeating were more likely to report compensatory behaviours in response to overeating and specific weight-gain prevention strategies related to diet and physical activity when compared with men and non-overweight people.

In order to interpret the findings, several limitations of the study must first be acknowledged. Because of the cross-sectional nature of our study, we can only state that although overweight was associated with increased weight-control behaviours, no conclusions about causes and

Table 5.4. Proportion of respondents who engaged at least once a week over the last month in any of the behaviours to prevent weight gain related to diet and physical activity, according to socio-demographic subgroup (n = 847).

Weight-gain prevention strategies related to diet	Total population (n = 847)	BMI		Gender		Age		Educational level		Overeating	
		BMI <25 (n = 567)	BMI >25 (n = 287)	Female (n = 441)	Male (n = 412)	20-30y (n = 652)	31-40y (n = 202)	Low (n = 272)	High (n = 581)	Irregular (n = 146)	Regular (n = 130)
Limiting fat intake	32.9	29.1	40.3	38.6	26.7	31.4	37.6	33.3	32.6	25.2	41.0
Having a regular eating pattern and eating lots of fruits and vegetables	27.3	22.3	37.3	35.6	18.5	25.5	33.2	29.0	26.6	22.9	32.0
Limiting sweets and snacks	44.5	37.2	58.9	51.9	36.5	41.8	53.0	46.0	43.8	36.0	53.6
Limiting sugar intake and avoiding sweet foods	24.5	19.3	34.8	29.0	19.7	22.0	32.7	23.9	24.8	19.7	29.6
Using diet products	23.3	18.4	33.0	29.7	16.5	22.9	24.8	26.7	21.7	16.5	30.8
Eating few or no desserts and smaller servings	31.6	26.3	42.0	39.7	22.9	28.1	42.8	33.6	30.6	25.7	37.7
Drinking lots of water	25.1	17.7	39.7	29.5	20.4	24.0	28.7	26.1	24.7	25.5	25.0
Limiting soft-drink and fast-food intake	30.0	25.3	39.4	34.8	24.8	28.7	34.2	29.4	30.3	23.2	37.4
High-intensity physical activity	21.3	19.7	24.4	22.7	19.8	20.3	24.3	22.8	20.6	19.7	22.8
Moderate-intensity physical activity	22.9	19.5	29.7	27.3	18.2	21.8	26.4	27.3	20.9	16.5	29.9

Table 5.5. Adjusted OR for weight-gain prevention strategies among young Dutch adults according to demographic characteristics, weight status and overeating.

	Limiting fat (n = 855)		Having a regular eat pattern and eating lots of fruits and vegetables (n = 856)		Limiting sweets and snacks (n = 856)		Limiting sugar intake and avoiding sweet foods (n = 856)		Using diet products (n = 855)	
Characteristics	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
Age (y)										
20-30	0.85	0.60-1.21	0.78	0.54-1.14	0.79	0.56-1.11	0.70	0.48-1.02	1.13	0.75-1.69
31-40	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Gender										
female	**1.67**	**1.24-2.56**	**2.45**	**1.79-3.45**	**1.90**	**1.42-2.53**	**1.71**	**1.23-2.38**	**2.09**	**1.48-2.94**
male	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Educational level										
low	1.00	0.73-1.37	0.78	0.66-1.29	0.95	070-129	1.10	0.77-1.55	0.78	0.55-1.10
high	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Weight status										
overweight (BMI>25)	**1.49**	**1.08-2.06**	**1.96**	**1.40-2.75**	**2.21**	**1.62-3.01**	**1.98**	**1.41-2.79**	**2.21**	**156-3.16**
normal (BMI<25)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Overeating										
regularly (>1 a week)	**1.89**	**1.40-2.54**	**1.37**	**1.00-1.88**	**1.81**	**1.34-2.40**	**1.50**	**1.09-2.09**	**2.00**	**1.43-2.81**
irregularly (<1 a week)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)

CI: confidence interval; OR: odds ratio adjusted for age, gender, educational level, occasions of overeating and intervention type used.

effects can be drawn. Furthermore, our results rely on self-reports. Self-reported weight leads to underestimations of true BMI and prevalence of overweight (23) and self-reports of preventive actions may be liable to social desirability bias. Finally, in terms of generalizability of the results it should be noted that the participants in the current study were recruited from an internet panel. Although this resulted in high response rates, our sample included a higher proportion of more highly educated people and under-representation of persons from ethnic minorities when compared with the Dutch population at large in this age group (24). Overweight and obesity rates for this age group were very comparable with the census data. In the present study 33.6% were overweight while in the 30.5% were overweight in the represented group at large (24).

This study was a first step in identifying what people say they do to prevent weight gain. This is especially important for developing future interventions for obesity prevention, since previous studies on weight control were focused mainly on weight loss rather than on preventing weight gain. As in the studies on weight loss, we found that only low numbers of respondents reported the combination of dietary and physical activity behaviours to prevent weight gain

Table 5.5. - continued

	Eating few or no desserts and smaller servings (n = 855)		Drinking lots of water (n = 851)		Limiting soft-drink and fast-food intake (n = 855)		Moderate-intensity physical activity (n = 851)		High-intensity physical activity (n = 849)	
Characteristics	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95% CI)	OR	(95% CI)
Age (y)										
20-30	**0.56**	**0.40-0.79**	1.12	0.76-1.65	0.94	0.65-1.35	0.90	0.61-1.33	0.84	0.57-1.25
31-40	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Gender										
female	**2.35**	**1.71-3.20**	**1.75**	**1.26-2.43**	**1.61**	**1.18-2.19**	**1.61**	**1.15-2.25**	1.17	0.84-1.64
male	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Educational level										
low	0.90	0.65-1.24	0.99	0.70-1.39	1.09	0.79-1.51	0.71	0.51-1.01	0.88	0.62-1.256
high	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Weight status										
overweight (BMI>25)	**1.70**	**1.23-2.36**	**3.40**	**2.41-4.79**	**1.80**	**1.30-2.49**	**1.62**	**1.14-2.30**	1.22	0.85-1.75
normal (BMI<25)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)
Overeating										
regularly (>1 a week)	**1.55**	**1.14-2.10**	0.79	0.57-1.10	**1.79**	**1.31-2.43**	**1.20**	**1.42-2.78**	1.15	0.82-1.61
irregularly (<1 a week)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)	1.00	(referent)

CI: confidence interval; OR: odds ratio adjusted for age, gender, educational level, occasions of overeating and intervention type used.

and that behaviours related to diet were more common (6, 25). Additionally, the results of the present study clearly show that weight-gain preventive behaviours varies according to gender and weight status and frequency of overeating.

As has also been previously reported in studies on weight loss, the results of the present study showed that women are more likely to report engaging in weight-gain preventive behaviours, despite the fact that more men than women are overweight (21, 22, 26, 27). The fact that overweight people were more likely to report occasions of overeating, some compensatory behaviours and weight-gain prevention strategies may be due to the fact that they may be more aware of such issues and try even harder to prevent further weight gain. Furthermore, the results showed that people who are aware of occasions of overeating appeared to use different and more weight-gain prevention strategies. Because of the high frequency of overeating, these people might have more reason to act to prevent weight gain. It could also be that people who actively prevent weight gain report more overeating because they are more aware of these high-risk situations. From the present study there are also some indication that compensatory behaviours related to caloric restriction after occasions of overeating are not protec-

tive for overweight. This might be explained by the possibility that compensatory behaviours induce overeating among people such as 'restrained' eaters, who may be more susceptible to overeating prompted by thoughts, emotions and situational cues (29, 30).

In conclusion, our results suggest that specific high-risk situations for overeating occur frequently, and these may contribute to gradual weight gain. In addition, young Dutch adults who regularly experience overeating are more likely to engage in compensatory behaviours and specific weight-control behaviours. This warrants a prospective study on the nature, frequency and duration of these behaviours to examine whether changes in overeating, compensatory behaviours and specific behaviours are related to energy balance and their impact on body weight change (3).

In addition, the findings of the present study point to the need for interventions that encourage prevention of weight gain by increasing people's awareness of the importance of combining physical activity with healthy food choices. Such interventions should be aimed at men in particular and should also include people who are not yet overweight in the age group in which weight gain is very likely. Furthermore, it would be advisable to give attention to the importance of specific weight-control behaviours, such as moderate- and high-intensity physical activity. Finally, we think that it is important to develop obesity-prevention messages that focus on providing information about types of weight-control strategies that would best support long-term weight control.

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PART 3

Intervention evaluation

CHAPTER 6

The 'Balance Intervention' for promoting caloric compensatory behaviours in response to overeating: A formative evaluation

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ABSTRACT

Background – To help people prevent weight gain, the Netherlands Nutrition Centre initiated the 'Balance Intervention', which promotes moderation of food intake and/or increased physical activity in response to occasions of overeating. The aim of this study was to determine whether intervention materials were appreciated, encouraged information seeking, and increased motivation and caloric compensatory behaviours.

Methods – A three-group randomized trial with pre-intervention measures (N=963, response 86%) and post-intervention measures (N=857) using electronic questionnaires was conducted among participants aged 25-40, recruited from an internet research panel. One group received a printed brochure and electronic newsletters (print group), the second group was exposed to radio advertisements (radio group) and the third group was the control group. Multiple regression analyses were used to investigate the impact of the materials on self-reported prevalence of overeating, attitudes, perceived behavioural control, intentions and compensatory behaviours.

Results – At follow-up we found significantly more positive attitudes, intentions and dietary action in the print and radio group. However, participants who received the radio advertisement had a significantly lower perceived behavioural control. No effects were found on the prevalence of overeating.

Conclusion – The results indicate that the intervention materials have potential for increasing people's attitudes, motivation and self-reported behaviour actions, with a possible negative side effect on perceived behavioural control.

INTRODUCTION

Because weight gain is an important risk factor for overweight and obesity later in life (1, 2), prevention of weight gain may be the key to arresting the obesity epidemic (3). The risk of gaining weight and developing obesity varies over the life cycle and is most likely to occur in young adults because of important events that often occur in that life phase. Starting one's career, getting married and having children can all affect behaviours that influence energy balance (4-8). There is strong evidence that trends in adult weight gain are induced by environments with a high availability of palatable, energy-dense foods and sedentary living (3, 9-11). These 'obesogenic' environments increase the risk of overeating (12, 13). Overeating refers to consuming more energy than is expended. Short-term overeating is a common habit in many societies. It is associated with parties and celebrations and forms a risk for weight gain and, eventually, for becoming overweight or obese if overeating happens frequently over longer periods of time and is not compensated (13, 14).

To help people prevent weight gain in such an environment, the Netherlands Nutrition Centre initiated what is known as 'Balance Intervention', which aims to promote quick 'caloric compensation' – i.e. moderating food intake and/or increasing physical activity in response to occasions of overeating – in order to maintain a neutral energy balance. The 'balance' approach accepts that occasions of overeating are likely to occur and focuses on making people aware of these occasions of overeating, and to motivate and enable them to compensate for them within a short span of time. The intervention is specifically targeted at adults aged 20-40 years, and there are plans to use radio advertisements and printed materials as the communication channels.

The present study was a formative evaluation of the Balance Intervention materials that the Netherlands Nutrition Centre planned to use in a nationwide campaign to promote compensatory behaviours. Since internal valid evaluation of combinations of mass media communications are almost impossible to conduct, especially when such communications are distributed nationwide, it is important to test such intervention materials before a nationwide launch. The aim of the present study was to test the application, appreciation and immediate effects in order to enable further improvement of the Balance Intervention (15-17). The primary aim of this study was therefore to evaluate the media components of the Balance Intervention among young adults aged 20-40 in a randomized experimental design by assessing whether the materials were (1) appreciated and encouraged people to seek further information, and (2) resulted in more positive attitudes, perceived behavioural control, motivations towards compensatory behaviours and self-reported actions related to caloric compensation.

We hypothesized that the radio advertisement was suitable for making people aware of the concept of compensatory behaviours and for motivating people to seek further information on how to apply these behaviours; the print materials were intended to enable people to start using more compensatory behaviours, since they included more practical information on practical skills.

In addition, we looked at possible side effects based on the number of self-reported periods of overeating, especially in those known as 'restrained eaters', who may be more susceptible

to overeating prompted by thoughts, emotions and situational cues (18, 19). Restrained eaters may perceive the Balance Intervention as such a situational cue. It is therefore possible that the intervention may be used as 'permission' for overeating, especially in restrained eaters.

METHODS

Recruitment and procedures

Study enrolment took place in July and August 2004. Participants were recruited from a random sample (n=1119) of an internet research panel. To be eligible for the study, participants had to be (1) aged 20-40 years, (2) not currently pregnant, (3) willing to receive a brochure in the post at their home address and be able to listen to recordings of radio advertising on their home computer, and 4) not planning to be on holiday during the four-week intervention and data-collection period.

A three-group randomized trial with pre- and post-intervention measures was conducted. Data were collected using web-based electronic self-administered questionnaires. Following the baseline assessment that was completed by 963 respondents (86.1% response rate), participants were randomly allocated to a control group (n=309), or to one of two intervention groups (print group, n=330; radio group, n=324). Follow-up data were collected after a four-week intervention period and included questions about the main outcome measures listed below.

A total of 857 participants completed all phases of the study. Analyses were conducted on 286 subjects in the print group (86.7% response rate), 289 subjects in the radio group (89.2% response rate) and 282 subjects in the control group (91.3% response rate).

The intervention materials

The Netherlands Nutrition Centre developed the printed materials and radio advertisements. The intervention materials were designed for Dutch adults aged 20-40 and were based on information gathered by four focus-group interviews and a feasibility study among participants aged 25-35 years. The focus-group interviews were conducted to gain insight into awareness of overeating, the frequency of overeating and engagement in compensatory behaviours. Additionally, a group session was organized to examine the feasibility of caloric compensation in response to overeating among 27 volunteers who were recruited through advertisements. Participants attended a 1.5 hour group training session conducted by dieticians from the Netherlands Nutrition Centre, addressing awareness of occasions of overeating, and possibilities for caloric compensation with caloric restriction or increased physical activity; participants were asked to try this out for one month. At a follow-up meeting (four weeks after the training), participants gave feedback about their experiences and difficulties related to caloric compensation. Responses from the group were used to develop and revise the print materials and radio advertisements. Drafts of the intervention printed materials were further pre-tested among 20 volunteers.

Print intervention

Participants who were randomly allocated to the print group received a printed brochure (in calendar format) at the start of the four-week intervention period, an electronic newsletter in the second and fourth weeks, and one set of low-calorie recipes in the third week of the intervention period.

The brochure and the newsletters contained general information related to prevention of weight gain, and practical information to increase awareness about overeating and skills related to caloric compensatory behaviours. The brochure was entitled 'The Balance Day' with the subtitle 'Don't get fat!' (see Figure 6.1). First, some information was given about the gradual process of weight gain and the importance of taking steps to prevent this. The Balance Day was introduced as a strategy to prevent any further weight gain. Subsequently, information was given in order to explain the concept – in other words, information on how to apply the balance day approach. In addition, several practical recommendations were given on when and how to introduce a balance day approach: *Exercise is the way to expend energy and keep a healthy body weight. Exercise at least five days a week for half an hour. Also, activities at home such as vacuum cleaning and gardening are examples of exercise*. In addition, some examples were included for increasing awareness of when overeating might take place, such as during dinner parties, celebrations, when having drinks and during holidays. To help people choose low-calorie foods on their balance day, four tables were included with information about the caloric content of several foods typically eaten at breakfast, lunch, dinner and between meals, in which low-calorie foods were highlighted.

The brochure explicitly mentioned that people should not misuse caloric compensation as an excuse to overeat more frequently, but that caloric compensation is meant to help them deal with often virtually unavoidable occasions when too many calories are eaten. Finally,

Front Back

Figure 6.1. The front and back cover of the Balance Day brochure.

Note: Translated literally, 'De Balansdag' means 'The Balance Day' and 'Maak je niet dik' is 'Don't get fat!' In Dutch, 'Maak je niet dik!' is also a popular expression that means 'Don't worry!'

participants in the print group received a set of recipes by email for low-calorie, low-fat, high-vegetable main courses, desserts and snacks suitable for caloric compensation.

Radio intervention

Two radio advertisements were developed to encourage people to seek information about caloric compensation. Both advertisements were recordings of a dialogue between two people illustrating an example of compensatory behaviours in response to overeating. During the four-week intervention period, each week the radio intervention group received both radio advertisements by way of an electronic file (as an attachment to an email message). They were asked to open the file on their computer and listen to the advertisement. These emails gave additional information on how to contact the Nutrition Centre if they wanted further information on caloric compensatory measures.

Measurement

A self-developed questionnaire was used for the pre- and post-test measurements. The questionnaire was tested for reliability by analysing test-retest reliability in 47 respondents (who were in the same age group and BMI range as the participants) who were asked to complete the questionnaire twice within a ten-day period. The internal consistency of the scales was established in the sample of the present study with Cronbach's alphas. The participants completed questions on socio-demographics, use and appreciation of the materials, and attitudes, perceived behaviour control and actions related to caloric compensation.

Socio-demographic characteristics

Information on age, gender, educational level and self-reported height and weight was gathered during the recruitment procedure. The baseline questionnaire included additional questions about the respondent's native country and about that of their parents. Respondents were defined as being of Dutch origin if both their parents were born in the Netherlands, and otherwise were considered to be of non-Dutch origin. The information on height and weight was used to calculate body mass index (BMI= weight (kg)/ height (m) ^{2}). Participants were categorized as being overweight (BMI $\geq$ 25) or not overweight (BMI $<$ 25).

Use and appreciation of the intervention materials

The post-test questionnaire differed in length between the intervention groups, because specific questions on attractiveness, appreciation and usability of the intervention materials were added. Respondents were asked whether they had received the intervention materials and whether they had used them (i.e. whether they had read the brochure, newsletter and recipes and whether they had listened to the radio advertisements). In addition, to evaluate the materials, questions were asked on how good, interesting and personally relevant they were (answers were on a 5-point scale).

Attitudes, perceived behavioural control and motivations

The post-test questionnaire contained questions on the two possible compensatory strategies available, in other words, eating fewer calories (caloric restriction) or expending more

calories by being physically active. Both categories of behaviours were measured with four items, referring to four potential periods when overeating can be compensated: (1) the day before, (2) on the same day, (3) the day after and (4) within a few days of overeating. The questionnaire assessed attitudes, perceived behavioural control and motivations with respect to these eight strategies for compensatory behaviours. Scales for attitudes (e.g. 'Do you think it is good or bad to compensate in this way?') and perceived behavioural control (e.g. 'Do you think it is difficult or easy to compensate in this way?') consisted of four items each, which were answered on a 5-point scale ('very bad' to 'very good'; 'very difficult' to 'very easy'). The intention was measured with two single items asking whether the participants intended to compensate overeating with caloric restriction and whether they intended to compensate overeating with extra physical activity; answers were given on 5-point scale ('definitely not' to 'definitely yes'). The Cronbach's alphas (.63 to .91) and the test-retest correlations (.53 to .91) of the psychosocial measures were moderate to high, with the exception of the test-retest correlation for 'caloric restriction attitudes' (.35) and 'increased physical activity attitudes' (.21).

Compensatory behaviours

The post-test questionnaire continued with questions on how often participants were engaged in dietary or physical-activity compensatory behaviours at the four designated periods for compensation over the last month. These questions were answered on a 5-point scale: (1) almost never, (2) less than once per week, (3) one or twice per week, (4) three or four times per week and (5) five times per week or more. A mean score was calculated for the items related to the four occasions of compensation with caloric restriction (Cronbach's alpha = 0.75; test-retest reliability = 0.65) and increased physical activity (Cronbach's alpha = 0.87; test-retest reliability = 0.66) with higher scores indicating that individuals reported higher frequencies of dietary or physical activity compensatory behaviours.

Prevalence of overeating

At pre- and post-test, people were asked to report the frequency of overeating in the last month on a 5-point scale: (1) almost never, (2) less than once per week, (3) once or twice per week, (4) three to four times per week and (5) five times per week or more. At follow-up, we additionally included a 12-item self-report measure to assess the frequency of overeating in situations that could be labelled as 'high-risk' situations for overeating and weight control efforts, such as during the weekends, at birthday celebrations and other parties (see Table 3), again on a 5-point scale. A mean score for these 12 items was calculated (Cronbach's alpha=0.87; test-retest reliability=0.70), with higher scores indicating that individuals experienced higher frequencies of overeating in the previous month.

Restrained eating behaviour

At pre-test, the Dutch Eating Behaviour Questionnaire (DEBQ) (20) was included to measure restrained eating tendency. The restrained eating scale contains 10 items and focuses on usage of strategies for limiting food and energy intake (e.g. 'When you have put on weight, do you eat less than you usually do?' 'Do you try to eat less at mealtimes than you would like to eat?'). All items have a 5-point response format: (1) never, (2) seldom, (3) sometimes, (4) often and (5)

Table 6.1. Recall, appreciation and use of the intervention materials in the print intervention group (follow-up sample only).

Intervention materials:	Print group (n=286) %
Received the brochure	96.5
Read the brochure:	
- completely	51.6
- partially	43.9
Evaluated brochure information as:	
- good	81.4*
- interesting	77.2*
- relevant	65.4*
Received the newsletter	96.9
Read the newsletter	97.4
Evaluated the newsletter information as:	
- good	62.1*
- interesting	50.0*
- relevant	53.5*
Received the recipe	88.3
Evaluated the recipe as good	43.6*
Used the recipe	8.9*
Visited the website for extra information	39.9
Contacted the Nutrition Centre	0.3
Requested further information	1.0

* Note: Only those respondents who read the print materials (completely or partially) were asked to evaluate the materials.

very often. Participants were classified as highly restrained eaters if their score on the restraint scale was above the mean, as proposed by the norms of the DEBQ (20).

Analyses

Chi-square tests and analyses of variance were performed to test for baseline differences between study groups. Descriptive statistics were used to describe the frequencies of engagement in different possible compensatory behaviours; no tests were done to avoid multiple testing. The impact of the intervention on psychosocial factors and self-reported behaviours was tested with multiple linear and binary logistic regression analyses, with group and baseline scores as independent variables. Interaction terms were included to investigate whether the respective intervention effects were different for restrained eaters, women, overweight persons, people living with children and participants with lower levels of education compared with non-restrained eaters, men, participants with a healthy bodyweight, people with

no children and more highly educated respondents. In case of significant interactions, stratified analyses were conducted. Due to the number of statistical analyses, $P<0.01$ was used to indicate significant differences.

RESULTS

Socio-demographic characteristics of the participants

Mean age was 27.0 years (SD = 5.3); the mean BMI was 24.3 kg/m^2 (SD = 4.5) with 33.6% of the participants having a BMI >25 kg/m^2; 51.8% of the participants was female; 68.1% of the respondents had a higher educational level (university degree or higher professional training); 91.2% of the participants were of Dutch origin, 19.4% had children living at home and 68.2% of the participants were classified as restrained eaters. No baseline differences were found in these variables between the three study groups.

Use and appreciation of intervention materials

Table 6.1 shows that almost all the participants in the print group reported they read the brochure and newsletters. Compared with the newsletter and recipes, the brochure was most appreciated. About 40% of the participants in the print group were encouraged to visit the internet site of the Nutrition Centre to seek further information. The recipes in the print group and the radio advertisements in the radio group were less appreciated. Few participants reported they had used the recipes. Furthermore, the results show that the radio advertisement did not encourage participants to seek further information (Table 6.2).

Table 6.2. Recall, appreciation and use of the intervention materials in the radio intervention group (follow-up sample only).

	Radio group (n=289) %
Received the radio advertisements	98.3
Have listened to the radio commercial:	
- completely	90.0
- partially	5.5
Evaluated the radio advertisement information as:	
- good	57.3*
- interesting	51.2*
- relevant	43.9*
Visited the website for extra information	16.3
Contacted the Nutrition Centre	0.3
Requested further information	9.0

* Note: Only those respondents who listened to the radio advertisement (completely or partially) were asked to evaluate the materials.

Table 6.3. Effects of the 'Balance Intervention' on the prevalence of overeating, psychosocial correlates of caloric compensation and on self-reported compensatory behaviours in response to overeating (mean, SDs, regression coefficients/Odds Ratios (OR) and P-values).

	Intervention group:			Intervention effect:	
	Control	Print	Radio	Print	Radio
	Mean (SD)	Mean (SD)	Mean (SD)	β (*P*)	β (*P*)
Prevalence of overeating[†] (range 1 to 5)	2.47 (1.15)	2.58 (1.10)	2.65 (1.13)	0.01 (0.57)	0.01 (0.60)
Psychosocial correlates related to caloric compensation (range –2 to 2):					
- Caloric restriction attitudes (n=843)	0.07 (0.65)	0.32 (0.64)	0.31 (0.63)	0.26 (0.00)	0.24 (0.00)
- Increase physical activity attitudes (n=843)	0.66 (0.72)	0.77 (0.65)	0.76 (0.66)	0.10 (0.08)	0.10 (0.08)
- Perceived caloric restriction behavioural control (n=842)	-0.02 (0.73)	-0.08 (0.74)	-0.17 (0.69)	-0.06 (0.35)	-0.15 (0.01)
- Perceived physical activity behavioural control (n=841)	-0.02 (0.87)	-0.10 (0.87)	-0.15 (0.84)	-0.01 (0.18)	-0.14 (0.05)
- Caloric restriction intention (n=842)	0.43 (1.27)	0.83 (1.21)	0.68 (1.20)	0.41 (0.00)	0.26 (0.01)
- Physical activity intention (n=842)	0.74 (1.11)	0.83 (1.15)	0.73 (0.72)	0.09 (0.36)	-0.01 (0.89)
Compensatory behaviour (range 1 to 5):					
- Caloric restriction in response to overeating (n=844)[†]	1.46 (0.50)	1.61 (0.60)	1.60 (0.60)	0.04 (0.00)	0.04 (0.01)
- Increased physical activity in response to overeating (n=844)[†]	1.45 (0.60)	1.57 (0.70)	1.54 (0.78)	0.03 (0.05)	0.02 (0.25)

Note: β =unstandardized Beta coefficients; * = adjusted for baseline scores; [†] log transformation applied

Table 6.4. Self-reported frequency of overeating over the four-week intervention period.

Occasions of overeating:	% respondents who experienced overeating once or more per week:			
	Control (n=277)	Radio (n=287)	Print (n=284)	Overall (n=848)
Over the past month (overall)	36.8	38.3	39.8	38.3
- during the weekend	20.2	19.2	27.8	22.4
- when you were not feeling well	18.8	21.3	24.3	21.5
- when you were watching television	17.3	20.9	21.5	19.9
- on a day off or during a holiday	13.0	18.1	18.0	16.4
- after work or school	14.8	17.1	15.8	15.9
- before going to bed	12.6	13.9	10.6	12.4
- at a birthday or other party	10.1	10.8	14.8	11.9
- when you were tired	9.4	8.4	10.6	9.4
- when you were studying	5.8	10.8	10.2	9.0
- when you were with family or friends	6.1	8.4	12.0	8.8
- while eating out	6.5	7.7	10.6	8.3
- at work	6.9	8.0	9.2	8.0

Intervention effects on psychosocial factors

Table 6.3 shows that at post-test, the participants in both the print and radio groups had significantly more positive attitudes and intentions towards compensation compared with the control group. However, the participants in the radio group had significantly lower scores on perceived behavioural control related to dietary compensation compared with the control group. No differences were found between the study groups with regard to intentions for physical activity compensatory behaviours.

Prevalence of overeating

Table 6.3 shows there were no differences in post-test scores on overeating between the print and radio groups. Additionally, we found no significant interaction between restraint eating and the radio group (β = -0.03 P=0.51) and the brochure group (β=0.01 P=0.58).

Table 6.4 shows that, overall, 38.3% of the respondents experienced overeating at least once a week during the four-week intervention period. Respondents reported that these occasions of overeating were most common during the weekend, when watching television, or when not feeling well.

Compensatory behaviours

Table 6.3 show that participants in the print and radio groups had significantly higher post-test scores on caloric restriction compensatory behaviours compared with the control group. No differences were found between study groups on physical activity compensatory behaviours.

On average, participants reported that they engaged in compensatory behaviours less than once a week over the four-week intervention period (Table 6.3). The results on the composed

Table 6.5. Self-reported compensatory behaviours over the four-week intervention period.

Compensatory behaviours:	% of respondents who are engaged in this behaviour at least once a week:			
	Control (n=276)	Radio (n=285)	Print (n=283)	Overall (n=844)
Compensation of overeating by restriction of dietary intake:				
- on the day before	2.5	3.9	3.5	3.3
- on the same day	14.1	20.4	15.5	16.7
- on the day after	13.4	22.8	27.9	21.4
- within the next few days	20.0	16.5	15.9	14.8
Compensation of overeating by being more physically active:				
- on the day before	2.9	4.9	5.3	4.4
- on the same day	13.8	15.4	17.3	15.5
- on the day after	14.9	17.2	20.5	17.5
- within the next few days	13.4	17.9	15.9	15.8

measures were reflected in the prevalence of the individual compensatory behaviours (Table 6.5). Respondents reported they most often engaged in caloric restriction or physical activity compensatory behaviours the day after overeating: 21.4% and 17.5% respectively reported doing this for weight-control purposes at least once a week.

Interactions

No significant interaction effects of the study group with age, education level, household size, weight status or restraint eating were found for any of the effect indicators.

DISCUSSION

About 40% of the respondents in the present study experienced occasions of overeating at least once a week. The present study further indicates that the Balance Intervention materials were associated with more positive attitudes, intentions and self-reported compensatory caloric restriction in response to overeating. However, no effects on reported physical activity compensation were found, and a majority of respondents reported using compensatory behaviours less than once a week. There were no indications that the intervention resulted in undesirable side effects, such as more self-reported occasions of overeating. That effects were stronger for dietary compensation probably reflects the fact that the intervention materials were more diet-oriented. This formative evaluation of intervention materials to be used in a nationwide campaign explored the appreciation, use and immediate impacts on self-reported psychosocial variables related to compensatory behaviours in response to overeating and potential determinants of such behaviour. This study was a first step in the phased process of establishing applicable and evidence-based weight-gain prevention interventions (15, 17).

Since internal valid evaluations of mass-media interventions are difficult (if not impossible) to conduct, especially when such interventions are launched nationwide, it is important to test the potential effects of the individual components of mass-media campaigns in randomized trials before the campaign is launched (16, 21, 22).

Several limitations of the study need to be addressed. First, this study was restricted to effects on self-reported behaviour and cognitions and was not designed to investigate effects on body weight. In the present study, we could not investigate the physiological evidence that the compensatory behaviours advocated indeed led to a neutral energy balance. Second, we could only explore short-term effects and have no information about whether the reported behavioural changes were maintained. Third, the self-reports used may be influenced by social desirability bias (23). No measurement of the tendency to give socially desirable answers was included in the present study, so adjustment for this issue was not possible. However, since the present study is a randomized controlled trial, the tendency to give socially desirable answers should be equally distributed over the three groups. Fourth, although the psychometrics of the self-reported measures were mostly acceptable, we found low test-retest correlation for some of the scales used. Such low correlations may be the result of actual change, or may also reflect low reliability of the measure. Finally, in terms of generalizability of the results it should be noted that the participants in the current study were recruited from an internet

panel. Although this resulted in high response rates, our sample included a higher proportion of more highly educated people and an under-representation of people from ethnic minorities in Dutch society (24). However, we found no differential intervention effects according to level of education or ethnic background. Furthermore, the present study tested the intervention materials in a setting that promoted exposure to the materials in a way that might not be possible to realize in nationwide implementation.

Several studies that made use of experimental or quasi-experimental designs to evaluate behavioural interventions offered some insights into effective mass-media strategies. Such studies revealed that well-developed educational interventions using radio and TV broadcasts supplemented with print materials have contributed significantly to public awareness and may help to increase knowledge, influence attitudes, beliefs and motivations. Evidence for behaviour change, however, appeared to be less strong, and only few of these studies reported effects on potential proximal behavioural determinants such as intention and self-efficacy (25-29). We found an intervention impact on intentions as well as attitudes towards engaging in compensatory behaviour. The media messages may have resulted in greater awareness of the possibility of using compensation to try to prevent weight gain- in other words; the media messages may have introduced new ' beliefs' that led to attitude change. For respondents who were already familiar with the compensation approach, the messages may have made these beliefs more important.

Because attitudes and motivations are important precursors for behaviour change (30), we can conclude that the increase in attitude and intentions in the present study can contribute to better compensatory behaviours related to caloric restriction. However, we found lower levels of perceived behavioural control after the radio advertisement intervention. Various behavioural change theories, such as the Theory of Planned Behaviour (31), Social Cognitive Theory (32) and the Health Belief Model (33) indicate the importance of perceived control or self-efficacy in affecting behaviour. Perceived control or self-efficacy have also been found to predict behaviour in a variety of health domains, including weight loss, diet (34-36) and physical activity (37-39).

The present study suggests that both the brochure and the radio intervention led to stronger engagement in compensatory behaviour, but that the radio intervention also resulted in lower perceived control. These results confirm the findings of previous research on mass media, which show that mass-media messages like TV and radio commercials are less appropriate for inducing behaviour change because they do not provide practical information in order to improve people's perceived behavioural control (16). Since the radio advertisement did not provide information to strengthen perceived control, the experience with compensatory behaviours in the radio group may have led to more realistic but lower perceived behavioural control, since compensation behaviours are complex and may be difficult to apply. Combining the radio advertisement with the brochure may help to strengthen perceived control and seems to be essential, since mass media alone is not appropriate for inducing behaviour change. If the materials are implemented on a larger scale, both materials will indeed be combined. The radio commercial will be used especially to motivate people to get the brochure and read it. Nonetheless, the negative impact of the radio advertisement on behavioural

control should discourage the Netherlands Nutrition Centre from using the radio advertisement in its present form in the nationwide campaign, because these advertisements failed to encourage participants to seek further information.

CONCLUSION

The present study suggests that the Balance Intervention materials motivated study participants to seek caloric compensation after occasions of overeating. For the radio advertisement, a possible negative side effect on perceived behavioural control was found. Further research is needed to establish whether promoting compensatory behaviours can indeed help people to keep a neutral energy balance.

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CHAPTER 7

The impact of a national Mass Media campaign in the Netherlands on the prevention of weight gain

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ABSTRACT

Objective – A 5-year nationwide mass media campaign aimed at prevention of overweight was organised from 2002 onwards. The present study evaluates the first campaign that was primary aimed at increasing awareness of weight gain.

Design and subjects – Data were collected by telephone interviews in four independent cross sectional surveys among non-obese Dutch adults aged 25-35 (total N = 1949) for statistical analyses. Awareness of personal body weight status, overweight-related risk perceptions, attitudes towards weight gain prevention, motivation to prevent weight gain, and self-reported BMI were measured in each survey. Campaign exposure was assessed in the post-intervention surveys. To identify intervention effects over time multiple linear and logistic regression analyses were used, adjusted for secular time effects and age.

Results – After the campaign about 65% of the respondents knew about the campaign. The campaign was associated with more positive attitudes towards prevention of weight gain (β=0.15; P<0.01) and higher self reported BMI (β=0.16: P<0.01).

Conclusions – The results suggest that the first campaign reached a large proportion of the population and initiated some positive change in attitudes, but did not achieve significant improvements in other determinants of the prevention of weight gain among non-obese young adults.

INTRODUCTION

The proportion of people who can be classified as 'overweight' or 'obese' is rapidly increasing in western countries (1). Also in the Netherlands the prevalence of obesity has roughly doubled over the last decade and more than 40% of the Dutch adult population is now classified as overweight and more than 10 % as obese (2). Overweight and obesity are strongly related to cardiovascular diseases, diabetes, certain cancers and musculoskeletal disorders and are expected to surpass tobacco as the most important determinant of preventable disease (3-5).

Prevention of gradual weight gain in early adulthood may be a key to arresting the overweight and obesity epidemic since such weight gain is an important risk factor for overweight and obesity later in life (6-8). However, there are indications that people are not actively trying to prevent weight gain, because they may not be aware of gradual weight gain, their body weight status, or their unhealthy eating and physical activity habits (9-12). Further, gradual weight gain may be accepted as a 'fact of life' due to lack of awareness that gaining an extra kilo of weight each year eventually leads to health-threatening body weights (13-15). Increased awareness is therefore regarded as an essential step in prevention of weight gain. In December 2002, the Netherlands Nutrition Center (NNC), the organisation primarily responsible for nutrition education in the Netherlands, therefore decided to initiate a mass media campaign entitled 'Maak je Niet Dik![1]'. This campaign was to be the first of a five-year initiative to promote weight gain preventive action. The first campaign phase of the 'Maak je Niet Dik!' campaign was aimed at placing the issue of weight gain prevention on the public agenda, by creating awareness of a need to act (i.e. behaviour change) to prevent weight gain, and to induce more positive attitudes and intentions towards prevention of weight gain. The first campaign phase was explicitly targeted towards non-obese 'young adults' since the campaign was aimed at prevention of weight gain and not at weight loss, and because there is evidence that weight gain is most likely to occur between the ages of 25 and 34 (15, 16). For prevention of weight gain relative small behavioural changes in physical activity and eating habits are sufficient. This is in contrast with behavioural changes necessary to achieve significant weight loss for treating obesity (17, 18).

As stated by Randolph and Viswanath (19) 'mass media campaigns are usually aimed at influencing the secular or normal trends in the amount of information available on a given topic in a system'. This can be achieved by increasing the amount of information available on the topic of interest (e.g. number of newspaper stories, advertisements, print material etc). To attract the attention of the target audience, campaign planners should attempt to redefine or frame the issue as a public health problem and suggest a solution to resolve it. Past experience has shown us that the success of mass media campaigns has varied greatly. Different factors have been identified as important for the success of public health mass media campaigns. One such factor is that the audience has to be sufficiently exposed to the campaign messages and themes. Other conditions include using social marketing tools to create the appropriate messages for distribution, and using behaviour change theory to tailor messages to important mediators of behaviour change (20, 21).

[1] A literal translation of 'Maak je niet dik' is 'Don't get fat!'. In Dutch 'Maak je niet dik' is also a popular expression to say 'Don't worry'.

Mass media campaigns to promote healthy behaviours and discourage unhealthy behaviours have become a major tool to improve public health. In the past, mass media campaigns were often aimed at behaviour change, but with limited success. More recently, it is recognised that media campaigns are less suited to initiate behaviour changes and should be more focused on influencing public and community agendas and influencing potential mediators of change such as risk awareness, attitudes or risk perceptions, i.e. to set the stage for social, behavioural, and policy changes (22-24). This means that in evaluation of such campaigns changes in such mediators should be monitored (25) in order to improve the evidence base for the potential of media campaigns. The present study therefore aimed to evaluate the first campaign phase of the NNC mass media campaign by investigating:

- the exposure of the target population to the campaign;
- the effects of the campaign on awareness of personal weight status, attitudes and motivations towards the prevention of weight gain prevention and risk perceptions of being overweight.

METHODS

The mass media campaign

Mass media activities were conducted from 11 December 2002 until 9 February 2003. The messages to be communicated were developed to inform people about the fact that gaining an extra kilo of excess body weight each year can lead to a health compromising body weights; about the need for active prevention of weight gain by making relatively small and permanent changes in diet and physical activity, and to improve awareness of gradual weight gain and personal weigh status.

The campaign included: 1) radio advertising (scheduled at intervals of two weeks, spanning 4 weeks), 2) a brochure that included an easy to use BMI self test and that came with a specially designed tape measure with self-explanatory indications to measure and evaluate waist circumference, 3) advertisements in daily newspapers and popular glossy magazines, 4) distribution of free cards and 5) a web-site and a call centre where people could obtain further information. In the radio commercials and newspaper and journal advertising, consumers were referred to the web-site where they could check their bodyweight with a self-test and to the possibility to receive personal feedback about one's body weight on their mobile phone via text messaging. To increase the distribution of the campaign materials, and to optimise information about the campaign, a mail-out was used with an information package to inform public health organisations in order to encourage them to help to spread the campaign message. Campaign materials were pre-tested on acceptability of the message and the content in a small research setting by means of qualitative testing. Furthermore, the campaign was advised by a steering group of representatives from the national government, consumer affairs, nutrition education, food industry and retailers.

Distribution of the campaign materials

Table 1 provides an overview of the distribution of the campaign materials. Most of the bro-

Table 7.1. Quantity of campaign materials distributed and free campaign publicity during the intervention period

	Number
Campaign materials/ activities:	
Radio commercials	2294
Brochures and waistline measures	170500
Paid advertisements in daily newspapers and magazines	45
Free cards	240000
Personal feedback via text message on mobile phones	39655
Calls to telephone information number	594
Web-site visits	150000
Free publicity: information about the campaign on/in:	
Television	7
Radio	9
Newspaper	23
National magazine	6
Specialist journal	12
Web-sites	13

chures with the waistline measures were distributed via the intermediaries such as public health organisations (79%) and smaller numbers of people applied for the brochure via Internet (13 %) and via the text messages on the mobile phone (3.5%). After the start of the campaign about 7500 people visited the website of the NNC per day for further information, this number was twice then usual. About a third of those who received personal feedback about their weight via a text message on their mobile phone received feedback that he or she was overweight.

The start of the campaign regenerated a lot of free publicity. During the campaign period, the campaign was mentioned in total 76 times as news or information on television- and radio programmes, in newspapers/ magazines/journals and on Internet. The free publicity via television and radio was greatest in December, immediately after the start of the first campaign.

Study design and sample

Data were collected at four points in time via telephone surveys of which two were conducted before the campaign in November and December 2002, and two surveys were conducted after the campaign in January and February 2003. Respondents were selected by random sampling from telephone books by means of Random Digit Dialling. The interviews were conducted by trained interviewers and took about fifteen minutes to complete.

The response rate for the four-collection points varied from 66.8% to 79.1% (no significant difference between the response rates). When a potential respondent agreed to participate the interviewer asked about the inclusion criteria: being aged between 25 and 35 years; BMI

between 20 and 30; not being pregnant. This resulted in a study population of 1949 'young' adults.

Measures

Socio-demographic characteristics
Demographic data included sex, age, weight, height, ethnicity, marital status and information on educational level. Body mass index (BMI; kg/m^2) was calculated from the self reported weight and height.

Campaign exposure
In the two surveys after the campaign was launched, campaign awareness was assessed in two ways. First, campaign recall was investigated by asking whether respondents knew about a campaign aimed at the prevention of overweight without further prompting. When respondents reported to know the campaign they were subsequently asked whether they knew the name of the campaign. When respondents did not recall the campaign, campaign recognition was then assessed by asking more explicitly if respondents knew about the campaign of the Netherlands Nutrition Centre called 'Maak je Niet Dik!'. Respondents who recalled or recognized the campaign were then asked how they heard about the campaign (i.e. TV, radio, newspaper, brochure, Internet). Further, and in order to assess message recall, there respondents were asked in an open format whether they knew one of the messages of the campaign. Responses were subsequently categorised into five different categories. People either recalled messages related to 'watching your weight to prevent weight gain', 'healthy eating', 'being active', 'losing weight' and/or the 'increased prevalence of obesity'.

Psychosocial variables
Categorising respondents according to the congruence between their BMI and their self-rated weight status assessed awareness of personal body weight status. Self-rated weight was measured by one item on a bipolar five-point scale, asking whether respondents rated their body weight as low or high ranging from 'far too light' (-2) to 'far too heavy (2). Respondents with BMI>25 who rated their weight as not too high were classified as optimists; respondents with BMI<= 25 who rated their weight as too high were classified as pessimists. All other respondents were classified as realists (26). Attitudes towards the prevention of weight gain were assessed with three items on a bipolar five-point scale ranging from 'very bad/ unimportant/ unpleasant' (-2) to 'very good/ important/ pleasant' (2). Item scores were summed and divided by three to obtain a mean attitude score (Cronbach's α=0.53). Risk perceptions of overweight were based on the perceived severity and vulnerability as defined by the Health Belief Model and Protection Motivation Theory (27). Perceived severity was assessed by asking the respondents how bad they would think it was of they gained weight on a three point scale ranging from 'not bad at all' (1) to 'very bad' (3). Perceived vulnerability was assessed by asking respondents whether they believed they were less or more at risk for weight gain compared with others of with approximately the same age and height on a bipolar five-point scale ranging from 'much less at risk' (1) to 'much more at risk' (5). The multiplication of both

item-scores represented the risk perception score (range 1-15).

The stages of change from the Precaution Adoption Process Model (PAPM) (28) was used to assess the extent to which respondents were motivated to prevent weight gain. We asked respondents to chose one option out of five possibilities: 1) 'I have never thought about actively trying to prevent weight gain'; 2) 'I have thought about actively trying to prevent weight gain but I do not know yet whether I will do so'; 3) 'I have decided not to actively try to prevent weight gain'; 4) 'I have decided to actively try to prevent weight gain but I am currently not doing so (yet)'; 5) 'I do already actively try to prevent weight gain'. Respondents who choose option 1, 2 or 3 were categorised as unmotivated, and those who choose option 4 or 5 were categorised as being motivated to prevent weight gain.

Statistical Analysis

Differences between the four independent surveys were first examined by comparisons, primarily to identify potential confounders, with two-tailed χ^2 tests, ANOVA or the non-parametric tests (Mann-Whitney test), dependent on the measurement level. P-values were set of at 0.008 (0.05/6) in order to correct for multiple testing. We used multiple logistic regression analyses (SPSS version 11.1) to establish the predictive effects of demographic variables (sex, age, ethnicity, education, BMI) on the campaign awareness and message recall.

To investigate the predictive effect of the campaign on the awareness of personal body weight and motivation to actively prevent weight gain, multiple logistic regression analyses were carried out and linear regression analyses were used to investigate the impact of the campaign on attitudes towards the prevention of weight gain, risk perceptions of overweight and BMI. The dichotomous variable 'campaign' was the independent variable of primary interest and was created by coding the time-period before the start of the campaign as 0 and the period after the campaign as 1.

Analyses were adjusted for secular time-trend effects (the changes in outcome measures over time which occur independently of the campaign) by inclusion of an extra independent variable in the regression model, which was defined as 'the number of weeks in time after the first pre test before the campaign'. Furthermore, interaction terms were included to investigate whether campaign effects differed for people who were overweight, women, lower educated and those of non-Dutch origin compared with normal weight, men, higher educated, and of non-Dutch origin. Differences were considered to be statistically significant if $p<0.05$.

RESULTS

Socio-demographic and psycho-social characteristics of the 4 surveys

Table 7.2 shows the results of the four independent samples (pre- and post-tests). No differences in socio-demographic and psychosocial variables were found between the samples except that the mean age in the first pre-test was marginally higher compared with the first post-test.

In all samples the majority of respondents were aware of their weight status. Table 7.2 shows that these high levels of awareness remained constant in all campaign surveys. Risk perceptions of overweight were also constant, and a majority of the respondents perceived

Table 7.2. Description of the study samples: response rates, socio-demographic and psychosocial variables related to prevention of weight gain at baseline (pre-tests), and post intervention (post tests) (n=1949)

	Independent samples				Significant differences between the samples
	Pre tests:		Post tests:		
	1 (n=486)	2 (n=493)	3 (n=487)	4 (n=483)	
	%				
Response rate	71.5	71.4	66.8	79.1	-
Sex, male	45.3	44.6	40.9	42.7	-
Ethnicity, Dutch origin	89.9	89.7	92.4	87.6	-
Education, higher educated	52.3	49.7	48.3	55.8	-
BMI, ≥ 25 kg/m^2	31.1	28.5	33.5	30.4	-
Awareness of personal body weight:					
- realistic	76.7	76.3	74.7	71.6	-
- optimistic	6.0	6.5	5.5	6.8	-
- pessimistic	17.3	17.2	19.7	21.5	-
High perceived vulnerability of weight gain	36.4	30.0	29.6	31.9	-
High perceived severity of weight gain	78.6	75.7	80.9	79.9	-
Motivation to prevent weight gain (PAPM)	74.9	73.4	80.1	80.5	4 > 2
	Mean (SD)				
Body mass index (kg/m^2)	23.9 (2.58)	23.6 (2.60)	24.0 (2.83)	23.7 (2.58)	-
Age (25-35 y)	30.7 (3.03)	30.9 (3.08)	31.2 (3.08)	30.8 (3.10)	3 > 1
Attitude towards weight gain prevention (-2, 2)	0.62 (0.63)	0.56 (0.66)	0.69 (0.63)	0.65 (0.60)	3 > 2
Overweight related risk perception (1,15)	6.07 (3.64)	5.77 (3.74)	5.92 (3.50)	6.11 (3.69)	-

* Significant differences in gender, education, ethnicity, awareness and motivation to act were tested with X^2-test. Differences in age and BMI were tested with Anova. Differences in attitude and risk perception were tested with Mann- Whitney tests. Bonferonni adjustment was applied to all the analyses.

weight gain as serious, but only about one third of the respondents perceived themselves as vulnerable for weight gain. Most respondents had positive attitudes and motivation to prevent weight gain, and the comparisons suggest more positive attitudes and a higher motivation after the first campaign.

Campaign exposure

Campaign awareness and message recall

More than half of the respondents (61% in post-test 1 - 65.6% in post-test 2) were aware of the campaign of whom 39.6% (post-test 1) – 38.1% (post-test 2) of the respondents reported campaign recall and 21.4% versus 27.5 % reported campaign recognition. Among these respondents, about a third knew the campaign from television, but only about 20% in the first post-test were familiar with one or more of the specific campaign activities such as the radio commercial, SMS action, brochure and Internet. The familiarity with specific campaign activities dropped to 10% in the second post-test. Nevertheless, a majority of the respondents aware of the campaign were able to recall one of the campaign messages of which the 'healthy eating' and 'watching weight in order to avoid weight gain' messages were most often mentioned (see Table 7.3).

People of Dutch origin were more likely to be aware of the campaign [OR: 1.66 (95%CI 1.09-2.54)] and were more likely to recall one of the campaign messages [OR: 1.70 (95%CI: 1.11-2.62)] than people of foreign origin or older respondents. The associations with age were also significant, showing that younger respondents were more aware of the campaign and one of the campaign messages [OR: 1.04 (95%CI: 1.00 - 1.09); 1.05 (95%CI: 1.01-1.10)]. No significant differences in campaign awareness were found according to sex, education or BMI.

Table 7.3. Awareness of campaign activities and message recall of respondents who are familiar with the campaign in the post tests (n=614)

	Post tests	
	3 (n=297)	4 (n=317)
Where did you learn about the campaign? % (n):		
- Television or radio programme	36.7 (109)	34.4 (109)
- Radio commercial	18.9 (56)	10.0 (32)
- Newspaper	7.4 (22)	5.0 (16)
- Advertisements for the mobile phone text messages action	6.1 (18)	6.9 (22)
- Brochure	3.4 (10)	3.2 (10)
- Web-site	3.0 (9)	1.6 (5)
What was the campaign about? % (n)	82.2 (244)	83.3 (264)
- Healthy eating	46.1 (137)	51.7 (164)
- Watch your weight to avoid weight gain	32.7 (97)	30.9 (98)
- Being active	21.9 (65)	23.7 (75)
- Prevalence of obesity	9.1 (27)	4.7 (15)
- Weight loss	1.0 (3)	0

Table 7.4. Results from logistic and linear regression analyses to assess the impact of time and campaign on campaign effect indicators * (n=1949)

	Secular Time Trend (1-18 weeks)		Campaign (0-1)	
	OR#	*p*	OR	*p*
Awareness of personal body weight status (0= bias; 1= correct)	0.98	*0.30*	1.08	*0.77*
Motivation to prevent weight gain (0= no; 1= yes)	0.99	*0.66*	1.44	*0.19*
	β#	*p*	β	*p*
Attitude	-0.10	*0.08*	0.16	*0.007*
Risk perception	0.00	*0.97*	0.01	*0.88*
BMI	-0.13	*0.03*	0.14	*0.017*

Note: Analyses are corrected for age differences between the independent samples
OR = odds ratio; β= the standardised regression coefficient.

The impact of the campaign

The first campaign was not significantly associated with changes in awareness of personal body weight status, weight related risk perceptions or motivation to prevent weight gain (Table 7.4). However, it was associated with significantly more positive attitudes towards the prevention of weight gain and higher self-reported BMI.

Interaction analyses indicated that the campaign effects did not differ significantly among people who were overweight, women, lower educated and of non-Dutch origin compared with normal weight, higher educated and Dutch-origin respondents.

DISCUSSION

This study evaluated the first campaign phase of the mass media campaign entitled 'Maak je Niet Dik!'. We found that the majority of the respondents knew about the first campaign, which was mainly due to the free publicity the campaign received, especially on national television and radio. Half of the study population was able to recall at least one campaign message. In addition, the campaign was associated with a more positive attitude towards the prevention of weight gain and a higher self reported BMI, but no effects on awareness of personal body weight, overweight related risk perception and motivation to prevent weight gain were found.

The fact that only moderate effects were detected, despite of the rather high campaign, awareness may be due to the design and measures used for the evaluation study as well as to the campaign itself. Since the campaign was launched nationally, it was not possible to include a control group in this study. In order to strengthen the basis for observing associations between the campaign and the indicators of the effects we conducted repeated pre- and post-campaign surveys. This design provides stronger evidence for the impact of the cam-

paign than evaluations that use only single 'before and after' surveys or studies in which only post-intervention data are collected (29, 30). Our second post-test was seven weeks after the intervention and our study design therefore does not provide information on sustained effects. Longer-term effects of a short, concentrated mass media campaign are, however, not to be expected. Therefore, the present campaign will be continued in the years to come.

The use of self-reports was another limitation, as this study design did not allow the use of objective effect measures. The use of self-reported weight and height tends to result in some under- and over-estimation of BMI. However, underestimation has been found to be limited in non-obese subjects (31, 32). The self-reported measures of attitudes and motivation may be biased because of social desirability. Finally, the external validity of the results may be limited because the response rate for the survey was about 70%. Nevertheless, the samples of the different surveys did not differ in socio-demographics and the socio-demographic characteristics of the samples were comparable to the census data of this population group, with exception of ethnicity. Compared with the census data, the present study included a somewhat higher percentage of people of Dutch origin (33, 34).

The high levels of campaign awareness were comparable to other studies, that used so-called 'small mass media' such as radio-commercials, brochures or other promotion material (20, 35, 36). The present study shows that the campaign awareness and message recall were significantly lower in ethnic minority groups and older respondents within the studied age range. Message recall of the BBC's Fighting Fat Fit campaign was significantly poorer in those with a lower levels of education and from ethnic minority groups in another study (35). In contrast to that study however, the present study did not show that campaign awareness and message recall was lower in lower educated respondents. This may be because the 'Maak je Niet Dik!' campaign created much free publicity via popular TV-shows that draw large audiences, including lower-educated people, and television as a medium for health communication has been found to be better accessible to less-educated groups than other media (37, 38).

The first campaign phase was aimed at agenda setting and creating awareness of a need to act (i.e. change) to prevent weight gain. The fact that during and soon after the campaign period, several national television- and radio programs and a significant amount of national newspaper articles on the issue were published may indicate that the campaign was successful in placing this issue of prevention of weight gain on the public agenda (39). However, the results of our study show that despite the high levels of free publicity and campaign exposure, the campaign was not strong enough to provoke substantial changes in important predictors of behaviour change. Although the original campaign materials were carefully developed and pretested to make people aware of their own body weight status, and to induce more positive attitudes and intentions towards prevention of weight gain, the free publicity the campaign created did not necessarily use the original campaign messages and contents. The free publicity was more focussed on the prevalence of overweight and its health problems, rather than on the possibilities and urgency for the prevention of weight gain.

A remarkable result of this study was that the campaign activities were associated with an increase in reported BMI. This could indicate that the campaign may have led people to check their weights, resulting in more realistic BMI self-reports and possibly in increased awareness of the gradual process of weight gain. However, the present study did not show that checking

such assumed more frequent checking of body weight more realistic evaluations of personal body weight status or risk perceptions. This might be due to already high baseline levels on these variables. Furthermore, more accurate BMI self-reports do, of course, not automatically lead to increased levels of awareness of personal bodyweight status.

The increase in self reported BMI may also rely on the fact that the campaign was conducted in a period that included the Christmas and New Years Eve holidays. As in most western countries, these events are celebrated with consumption of high caloric food. The campaign may also have made people more aware of their likely holiday-induced weight gain leading to higher BMI self-reports (40).

Our study indicates that a rather high proportion of the target population was already aware of their body weight, motivated to prevent weight gain, aware of the severity of overweight and obesity, and reported they watched their weight to avoid weight gain (41). However, most respondents reported that they did not perceive a personal susceptibility to gain weight and may therefore not experience a personal need to change. Further, although most respondents reported having tried to avoid weight gain, Dutch data on trends in BMI indicate that most people in this age group are not successful in their attempts (1). Thus further campaigns should aim at people's awareness of their personal susceptibility for weight gain and at communication of effective weight maintenance practices. Additionally, there is some evidence that people from ethnic minority groups in the Netherlands may be less concerned about being overweight and may experience being overweight as more desirable (42). Since ethnic minority groups may have profited least from the campaign, this group may require specific attention in future efforts.

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CHAPTER 8

The evaluation of a three-year mass media campaign aimed at preventing weight gain in Dutch young adults

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ABSTRACT

Objective – To evaluate a three-year nationwide mass media campaign aimed at preventing weight gain. The campaign was aimed primarily at raising awareness of the importance of weight-gain prevention and bringing these issues to the attention of the Dutch public.

Research methods and procedures – Eleven serial, independent, cross-sectional, population-based telephone surveys were used to assess campaign awareness and impact (N ranged between 483-493 for the 11 surveys). The surveys were conducted before and after six campaign waves. Multiple linear and logistic regression analyses were used to test for trends over time and for differences between subsequent surveys for campaign awareness, message recall, perceived body weight status, overweight-related risk perceptions, attitudes, perceived social support, self-efficacy expectations and motivations for preventing weight gain.

Results – Campaign awareness ranged from 61% after the first campaign wave to 88.4% after the final wave. The campaign's television broadcasting activities were an important source of campaign awareness, both because of the campaign's television commercial and television-based free publicity. Message recall ranged from 41.9% to 68.1%. Small positive differences were found in attitudes, perceived social support and intentions for preventing weight gain. Additionally, the results suggest mixed effects on self-efficacy expectations and a negative effect on risk perception.

Conclusion – The campaign resulted in high campaign awareness, especially as a result of the TV commercial and free publicity on TV. The results suggest the campaign was able to create more positive attitudes and motivation, but lower risk perceptions and efficacy for preventing weight gain.

INTRODUCTION

The prevalence of obesity is increasing rapidly worldwide (1, 2). In the Netherlands, the prevalence of obesity has roughly doubled over the last decade and now more than 40% of Dutch adults is overweight; more than 10% is obese (3). It has been suggested that intervention programmes aimed at preventing weight gain by encouraging relatively small changes in physical activity and energy intake among people who are not yet overweight might be more promising for fighting the obesity epidemic than treatment programmes for overweight or obesity (4, 5). To contribute to prevention of weight gain in young adults with a healthy weight, the Netherlands Nutrition Centre (a government-funded organization for nutrition education) launched a nationwide campaign entitled 'Maak je niet dik!'[1] The main objective of this campaign was to raise attention for the issue of weight-gain prevention and to induce more positive attitudes and the motivation to prevent weight gain (6, 7). The campaign was explicitly targeted at non-obese young adults because a gradual increase in weight typically starts to emerge in this age group (8, 9).

The mass media campaign was launched in December 2002 and included six different campaign waves. The messages to be communicated were developed to inform people of the fact that gaining an extra kilo of body weight each year can, in about ten years, lead to a body weight that compromises health; to stress the importance and relevance of active weight-gain prevention by making relatively small and lasting changes in food intake and physical activity; to increase the personal vulnerability to gradual weight gain and awareness of personal weight status and to increase self-efficacy expectations. Mass media were used as channels to deliver the campaign messages.

Until now little is known about the success of mass media campaigns aimed at prevention of weight gain. The present study therefore aimed to evaluate the campaign by investigating campaign exposure and effects on potential early mediators of motivation and behaviour change.

METHODS

The campaign

Mass media activities were broadcasted from December 2002 through December 2005. The campaign materials were developed and qualitatively pre-tested by the Netherlands Nutrition Centre. In total there were six separate campaign waves within the three-years. During the first two years, three waves of campaign activities were launched aimed at agenda-setting and increasing awareness of the need to prevent weight gain. Additionally, in the third year messages were communicated to increase overweight-related risk perceptions and self-efficacy expectations (Table 1).

The campaign materials were adapted to the specific campaign objectives formulated for each campaign wave and included 1) radio commercials; 2) TV commercials; 3) distribution

[1] Translated literally, 'Maak je niet dik' means 'Don't get fat!' In Dutch, 'Maak je niet dik' is also a popular expression that means 'Don't worry'.

Table 1. Overview of the campaign objectives and media mix used in the different campaign waves.

Campaign	Year/week	Campaign objectives	Main media activities
1	2002-2003: weeks 50-5	- Agenda-setting and increasing awareness of the need to prevent weight gain.	1. Radio advertising about the need to prevent weight gain. 2. Distributing print materials through mailings to intermediaries and organizers of local activities. 3. Mobile phone text-messaging. 4. Advertising in daily newspapers and popular glossy magazines.
2	2003 weeks 27-32	- Agenda-setting and increasing awareness of the need to prevent weight gain.	1. Distributing print materials (flyers, waist circumference tape measures, posters, free postcards) through mailings to intermediaries and organizers of local activities.
3	2003 weeks 43-44	- Agenda-setting and increasing awareness of the need to prevent weight gain.	1. Radio advertising for the online 'future weight predictor' where people can check their weight status for the next ten years if they gain a kilo a year. 2. Distributing print materials through mailings to intermediaries and organizers of local activities. 3. Mobile phone text-messaging.
4	2003/2004 weeks 49-52 weeks 2-4	- Agenda-setting and increasing awareness of the need to prevent weight gain.	1. TV commercial highlighting the danger of gaining 1 kilo a year. 2. Distributing print materials through mailings to intermediaries and organizers of local activities.
5	2004 weeks 20-21	- Agenda-setting and increasing awareness of the need to prevent weight gain. - Increasing awareness of health risks of overweight.	1. Radio commercials about the health consequences of overweight. 2. Advertisements in free newspapers distributed nationally. 3. Website with detailed information on the health risks of overweight and obesity. 4. Distributing print materials through mailings to intermediaries and organizers of local activities.
6	2004 weeks 44-45	- Increasing self-efficacy to prevent weight gain.	1. TV commercial on recommended daily caloric intake (2000-2500 kcal per day). 2. Advertising in free daily newspapers distributed nationally. 3. Distributing print materials through mailings to intermediaries and organizers of local activities. 4. Web-based electronic personal weight coach, web-based caloric intake assessment and call centre for further information.

* All campaign waves were accompanied by local activities, press releases (also to specialist publications) to generate free publicity. Additionally, each campaign wave was accompanied by a website and call centre.

of print materials such as posters, free postcards, brochures (including an easy-to-use body mass index (BMI) self-test and a specially designed tape measure with an explanation of how to evaluate waist circumference); 4) advertisements in daily newspapers and popular glossy magazines; 5) a website and 6) a call centre where people could obtain further information (Table 1). Consumers were referred to the website in the TV and in other communications, where they could use an electronic BMI self-test. A mobile phone service could be called to receive personal text message feedback about body weight status. An information packet was sent to local public health organizations with information about the campaign activities and materials for distribution. To get more media attention for the campaign, press releases were sent to several media stakeholders during each campaign wave.

Recruitment and procedures

Data were collected during telephone interviews in eleven independent cross-sectional population-based surveys, two of which were conducted before the start of the campaign. Each campaign wave was followed by at least one survey before the next wave was launched. Respondents were selected by random sampling from telephone directories using random digit dialling (RDD). The interviews were conducted by trained interviewers and took about 20 minutes to complete. When a potential respondent agreed to participate, the interviewer started by assessing whether the person was eligible to participate in the study. Inclusion criteria were being between 25 and 40 years of age and having a BMI of between 20 and 30; pregnancy was a criterion for exclusion. This resulted in a study population that ranged between 483 and 493 respondents for the 11 surveys. Power analyses showed that 500 persons per wave was enough to assess a yearly trend with a confidence interval that would have a width of about 10%.

Measurement

A self-developed questionnaire was used for the measurements and included items of socio-demographics, campaign exposure and psychosocial constructs related to prevention of weight gain (see below). Our measures of the psychosocial constructs were in accordance with those used in earlier studies (10, 11), which were further pilot test in a small sub-sample of the study population and submitted for review to an expert panel.

Personal characteristics

Information was collected about sex, age, educational level, ethnicity and self-reported height and weight. Respondents were defined as being of Dutch ethnicity if both their parents were born in the Netherlands, and otherwise were considered to be of non-Dutch ethnicity. The information on height and weight was used to calculate BMI (BMI = weight (kg)/ height (m) ^{2}).

Campaign exposure

In the surveys after the first campaign, campaign awareness was assessed in two ways. First, *campaign recall* was investigated by asking, without further prompting, whether respondents knew about a campaign aimed at preventing overweight. If respondents reported they knew about the campaign, they were subsequently asked whether they knew the name of the cam-

paign. When respondents did not recall the campaign, *campaign recognition* was assessed by asking more explicitly if respondents knew about the Netherlands Nutrition Centre's 'Maak je Niet Dik!' campaign. Respondents who recalled or recognized the campaign were then asked how they had heard about the campaign (i.e. TV, radio, newspaper, brochure, internet). To assess *message recall,* respondents who recalled or recognized the campaign were subsequently asked, in an open format, to name one of the campaign messages. *Message recall* was recoded into five different categories that corresponded with the campaign components: recalling messages related to 'watching your weight to prevent weight gain', 'healthy eating', 'being active', 'the increasing prevalence of obesity' and 'don't worry about your weight' (this last one in order to explore whether respondents had misinterpreted the campaign title).

Respondents who were familiar with specific campaign materials were asked to indicate how attractive they thought the campaign materials were, how satisfied they were with the campaign materials and how useful and relevant the information was for them personally (answering options on five-point bipolar scales, e.g. very irrelevant to very relevant).

Psychosocial variables

A variable for awareness of personal body weight status was constructed based on the calculated BMI and perceived body weight status. The participants were first classified as being overweight (BMI≥25) or not. Perceived body weight status was assessed by asking respondents to evaluate their own body weight on a five-point scale ranging from 'much too thin' (1) to 'much too heavy' (5). The self-rated body weight variable was dichotomised as 'being overweight' and 'not being overweight'. The BMI-based overweight classification was combined with self-rated weight status and resulted in three groups: 1) people who overestimated their weight (BMI<25; perceived weight status: overweight); 2) people who underestimated their weight status (BMI>25; perceived weight status: not overweight) and 3) people who were realistic about their body weight status.

Attitude, subjective norms and perceived behavioural control for preventing weight gain were each assessed with single items on bipolar five-point scales ranging from –2 to +2. The specific items were: 'How important do you think it is to keep from gaining weight?' (very unimportant – very important) for attitude; 'How much support do you receive from people who are important to you to keep from gaining weight?' (very little support – a great deal of support) for social support and 'How difficult or easy do you think it is to keep from gaining weight?' (very difficult – very easy) for perceived behavioural control. Risk perceptions for overweight were based on perceived severity and vulnerability as defined by the Health Belief Model (HBM) and Protection Motivation Theory (PMT). Perceived severity was assessed by asking the respondents how bad they thought it would be if they gained weight on a three-point scale ranging from 'not bad at all' (1) to 'very bad' (3). Perceived vulnerability was assessed by asking respondents whether they believed they were less or more at risk for weight gain compared with others of the same age and height on a bipolar five-point scale ranging from 'much less at risk' (1) to 'much more at risk' (5). The multiplication of both item scores represented the risk perception score (range 1-15). Motivation for preventing weight gain was assessed by asking respondents to indicate whether they agreed with one of the following statements: 'I have decided to actively try to keep from gaining weight but I am currently not

doing so'; 'I am already actively trying to keep from gaining weight' (12). Respondents who agreed with one of these statements were categorized as respondents who were motivated to prevent weight gain.

Analyses

Statistical analysis was conducted using SPSS, version 11.1. To identify potential confounders, Chi-square tests or analysis of variance with Bonferroni correction for dichotomous and continuous outcome measures respectively were conducted to test for differences between samples in socio-demographic variables.

The outcome variables – attitudes, perceived social support, self-efficacy expectations and motivations to prevent weight gain – had a non-normal distribution and were recoded into dichotomous variables with positive answers (score of > 0 on the answering scale) coded as 1 and non-positive answers coded as 0.

Multiple logistic regression analyses were conducted to test for an overall trend over the three-year period in awareness of personal body weight status, attitudes, self-efficacy expectations and the motivation to prevent weight gain. Multiple linear regression was performed to test for an overall trend in overweight-related risk perception. To identify secular time trends, a continuous 'time variable' was created by counting the number of weeks after the first measurement (1-118 weeks). The time variable was used as the independent variable in the regression analyses. Sex, age, educational level, BMI and having or not having children were included as confounders. Odds Ratios (OR) and 95% confidence intervals (95% CI) were presented for the differences per year of the proportion of people with a positive attitude, positive perceived social support, positive self-efficacy expectation and positive motivation for preventing weight gain. The linear regression coefficient (β) was presented for the mean change per week in risk perception.

If a secular time trend was found, further regression analyses were conducted to explore whether these differences over time were caused by the specific campaign waves. For these analyses, the continuous time variable was substituted by ten dummy variables for a pair-wise comparison of adjoining surveys. The same covariates were included in these models. Differences were considered to be significant if $p<0.05$.

Secondary exploratory linear and logistic regression analyses were conducted to assess the association of exposure to the most important mass media activities and psychosocial constructs. Therefore, dichotomous variables were constructed: respondents who were familiar with a specific campaign material (coded as 1) were compared to respondents who were not familiar with a specific campaign activity (code as 0). Again, gender, age, educational level, BMI and having children were included as covariates.

RESULTS

Socio-demographics

The response rate and demographic data in the survey samples are shown in Table 2. Analyses showed there were some small differences in sex and BMI between samples.

Table 2. Description of study samples of the 11 subsequent surveys: non-response rate and socio-demographic variables.

	Survey number (number of respondents)										
Measures	1 (n=486)	2 (n=493)	3 (n=487)	4 (n=483)	5 (n=485)*	6 (n=494)	7 (n=487)	8 (n=479)	9 (n=493)	10 (n=475)	11 (n=483)
						%					
Response rate (%)	71.5	71.4	66.8	74.6	67.6	77.7	78.2	71.0	69.3	78.1	80.0
Sex: female (%)	54.7	55.4	59.1	57.3	57.5	58.9	61.0	61.8	57.2	57.9	58.2
Ethnicity: Dutch (%)	90.1	90.2	92.4	87.8	89.9	91.1	87.2	87.8	90.9	88.4	87.6
Education: higher (%)	52.3	49.7	48.3	55.8	57.1	54.7	57.9	54.1	54.7	54.8	56.1
BMI, ≥25 kg m^2 (%) *	31.1	28.6	33.5	30.4	26.0	28.3	24.4	31.1	25.4	30.3	26.3
People with children (%)*	46.9	49.3	56.5	52.4	42.7	45.7	43.5	46.1	47.5	56.2	53.4
						Mean (SD)					
BMI (kg/m^2), mean, (SD)*	23.87 (2.58)	23.58 (2.59)	23.99 (2.83)	23.70 (2.58)	23.65 (2.49)	23.77 (2.54)	23.40 (2.51)	23.72 (2.79)	23.54 (2.53)	23.85 (2.69)	23.61 (2.51)
Age (years)†, mean (SD)*	30.7 (3.03)	30.9 (3.08)	31.2 (3.08)	30.8 (3.09)	30.5 (3.01)	30.8 (3.03)	30.8 (3.00)	30.8 (3.21)	31.0 (3.11)	31.1 (3.05)	31.1 (3.09)

BMI: body mass index; * Chi-square and analyses of variance with Bonferonni adjustment indicate significant differences between samples in BMI and age.
† range 25-35 years.

Table 3. Campaign awareness and message recall of the campaign 'Maak je niet dik!' among Dutch young adults aged 20 to 40

	Independent samples (post-tests)								
	3 (n=487)	4 (n=483)	5 (n=485)	6 (n=494)	7 (n=487)	8 (n=479)	9 (n=493)	10 (n=475)	11 (n=483)
Awareness of the campaign, %	61.0	65.6	57.3	57.3	62.0	84.6	79.7	83.8	88.4
- Campaign recognition	21.4	27.5	36.7	36.2	38.0	28.2	26.6	16.0	16.4
- Campaign recall	39.6	38.1	20.6	21.1	24.0	56.4	53.1	67.8	72.0
Message recall, %	43.1	46.4	46.4	65.4	50.0	49.4	66.4	68.1	41.9
- Healthy eating	21.8	30.0	15.3	19.8	19.1	34.9	31.8	38.7	30.0
- Watch your weight to keep from gaining weight	19.9	20.3	24.5	27.3	25.9	28.6	31.0	30.1	27.3
- Being active	13.3	15.5	7.8	7.7	9.9	16.1	9.5	7.6	13.7
- Prevalence of obesity	4.1	1.0	0.6	7.5	5.5	7.3	2.2	0.0	8.1
- Don't worry about your weight	2.7	2.5	3.1	3.0	4.3	1.3	1.6	0.4	0.6

Differences in campaign awareness, message recall and appreciation and usefulness

Campaign awareness ranged from 61%, after the first campaign to 88.4% at the end of the sixth campaign (Table 3; Figure 1); 39.6% to 72% of the respondents were able to recall the campaign. Respondents were mainly familiar with the television advertisements (33.7% to 48.8%) introduced during the fourth campaign wave; some had also heard about the campaign on the news or a television or radio programme (8.8% to 22.6%). Smaller proportions of respondents were familiar with the radio commercial (9.9% to 11.5%), print materials (< 5%) and information on the website (< 3%).

Message recall ranged from 43.1% to 66.4% between the measurements (Table 3; Figure 1). Most frequently recalled were the 'healthy eating' and 'watch your weight to avoid weight gain' messages (Table 3). Results revealed that more than half of the respondents who had seen the TV advertisement were positive about this (52.4% to 64.4%). However, only half of these respondents (50.0% to 56.0%) reported that the advertisement was personally relevant for them. The main reasons given for this low relevance were that respondents thought they already had a healthy body weight or a healthy diet or did not need to lose weight.

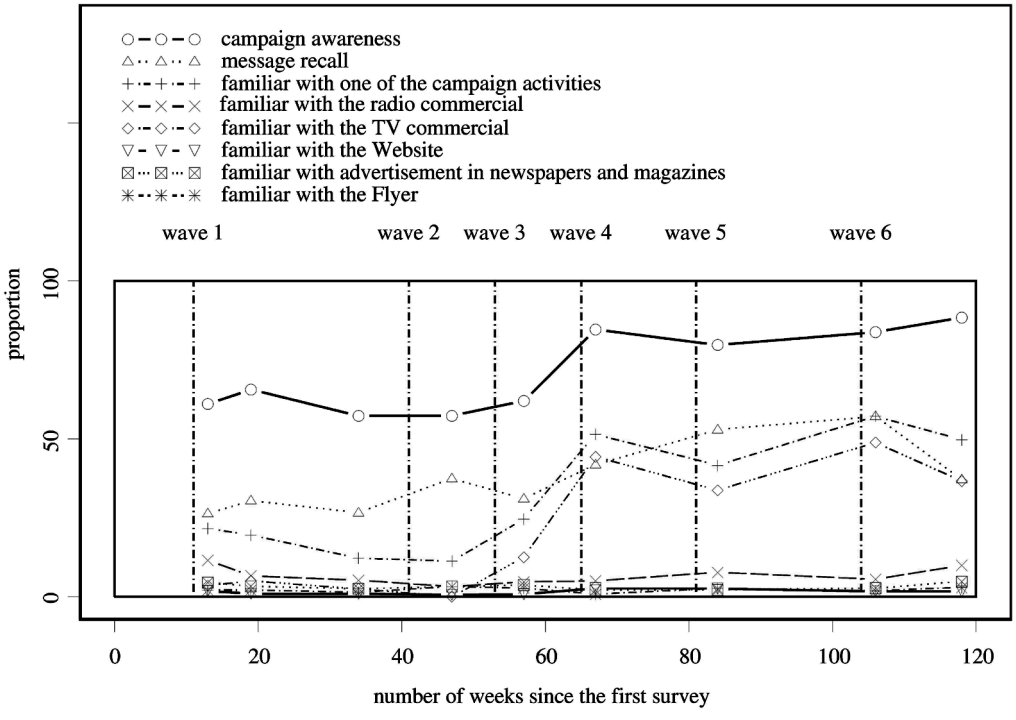

Figure 1. Proportion of respondents who were familiar with the campaign 'Maak je niet dik!', individual campaign activities and the campaign message during the different surveys (N=5345).

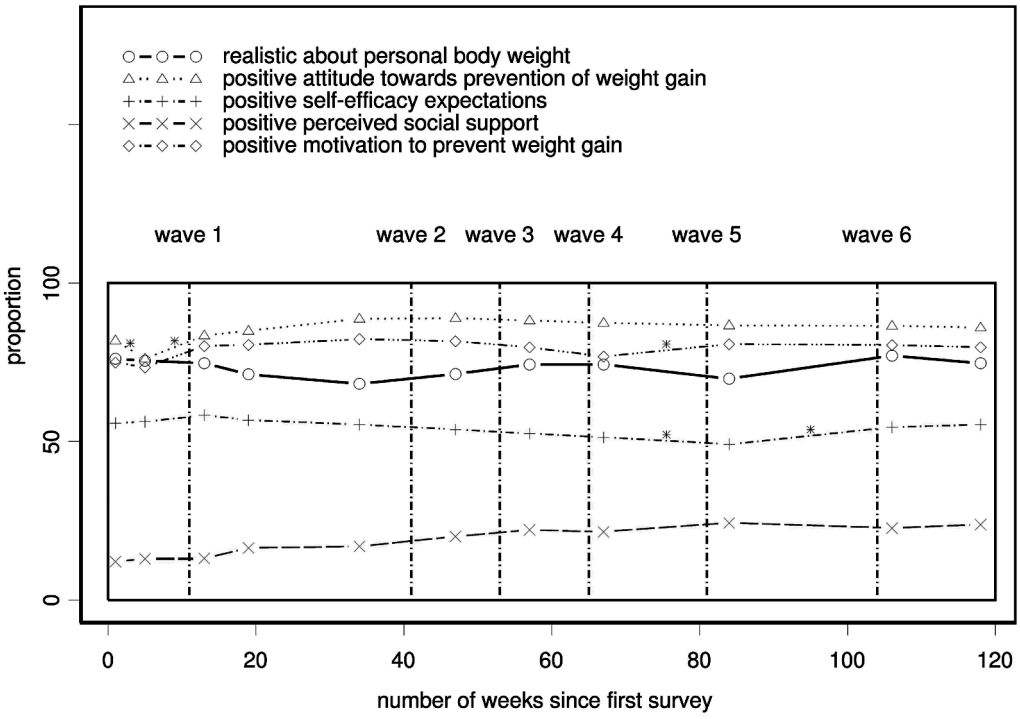

Figure 2. Proportion of respondents with a positive attitude, perceived social support, self-efficacy expectations and motivation to prevent weight gain during the different surveys (N=5345).

* Significant differences in psychosocial variables between samples.

Differences in psychosocial variables

Figures 2 and 3 present the differences in psychosocial variables between the several surveys.

The proportion of people who were realistic about their own body weight ranged from 74.5% to 77.4%. There was no significant time trend in awareness of personal body weight.

The proportion of people with a positive attitude for preventing weight gain ranged between 76.1% and 88.9%. A small positive trend was found per year OR=1.22; 95% P=0.00). Attitudes were significantly more positive in the third survey, which was conducted right after the first campaign wave (O3 in Figure 2), than in the second survey (O2), conducted before that first wave ($OR_{O2\text{-}O3}$=1.45; P=0.00).

The proportion of people with high perceived social support ranged between 12.1% and 23.8%. There was a small positive trend per year (OR=1.45; P=0.00) but no differences were found between adjoining surveys.

The proportion of people with positive self-efficacy expectations ranged between 49.1% and 58.3%. Analyses revealed there was a small negative trend per year in the proportion of people with positive self-efficacy expectations (OR=0.92; P=0.00). Comparison of adjoining samples revealed that the proportion of positive self-efficacy expectations was significantly lower in the ninth survey, conducted after the fifth campaign wave ($OR_{O6\text{-}O9}$=0.74; P=0.03),

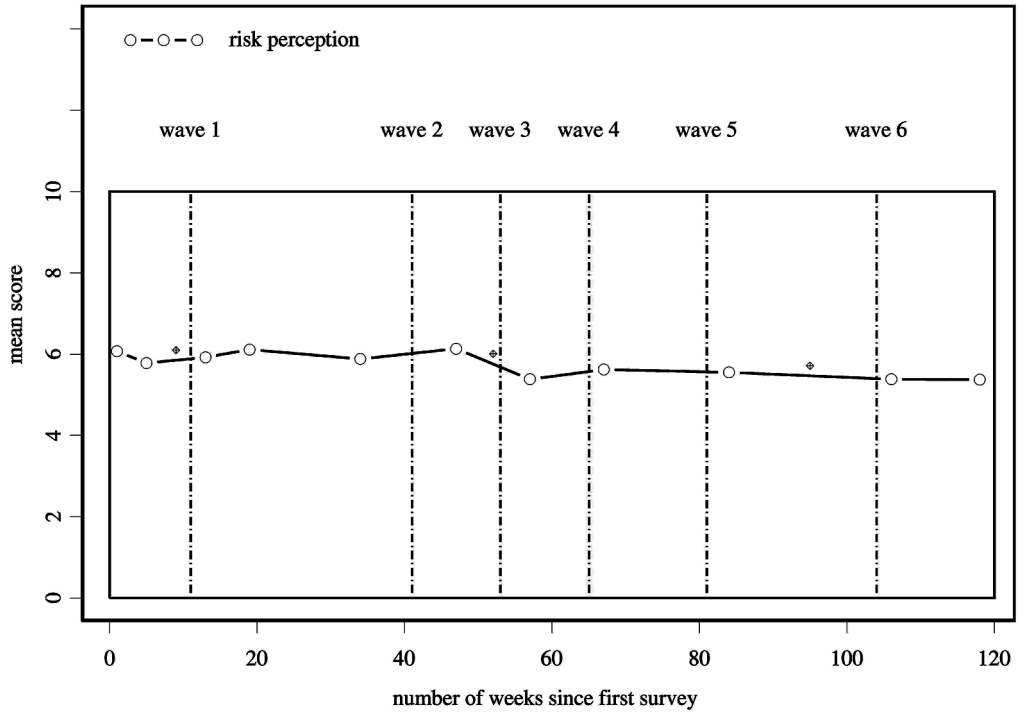

Figure 3. Mean scores on overweight-related risk perception of respondents during the different surveys (N=5345).

* Significant differences in psychosocial variables between samples.

and significantly higher in the tenth survey, conducted after the sixth campaign wave (OR_{O9-O10}=1.42; P=0.01), compared with the surveys preceding these waves.

The mean overweight-related risk perception (Figure 3) varied between 5.37 (SD=3.36) and 6.07 (SD=3.64). There was a significant negative trend in overweight-related risk perception per year time (β=-0.29; *P*= 0.00). Comparison of adjoining surveys showed that overweight-related risk perception was higher after the first campaign wave (β_{O3-O4}=0.39; *P*= 0.04) and significantly lower after the third and fifth campaign waves (β_{O6-O7}=-0.56; P= 0.00)(β_{O9-O10}=-0.41; *P*= 0.03) when compared with the surveys preceding these waves.

The proportion of people with a positive intention to prevent weight gain ranged between 73.4% and 82.3% (Figure 2). Finally, trend test analyses revealed a small positive trend over time (OR=1.10; *P*=0.05). Comparison of adjoining samples revealed that the motivation was significantly higher after the fifth campaign wave (OR_{O8-O9}=1.46; *P*=0.03).

Secondary regression analyses showed that exposure to the TV commercial was positively associated with the perceived social support for preventing weight gain (OR=1.61; P= 0.00) and the motivation for preventing weight gain (OR=1.30; P= 0.01), and was negatively associated with overweight-related risk perception (β=-0.22 P= 0.05). Additionally, exposure to the campaign via news or a TV or radio programme was positively associated with attitude (OR=1.49; P= 0.01).

DISCUSSION

The 'Maak je niet dik!' campaign achieved high campaign awareness and high message recall. People knew about the campaign mainly because they had seen the TV advertisement or had been exposed to the campaign-related information as a result of free publicity on the news or other television or radio programmes. Small positive differences over time were found in attitudes, perceived social support and motivation to prevent weight gain. Additionally, the results suggest the campaign had mixed effects on self-efficacy expectations and was negatively associated with risk perception.

Our study was unique in that we used a trend analysis based on 11 surveys to indicate positive and negative effects of the campaign, separate from time trends. This design is probably one of the best possible ways to monitor effects induced by nationwide campaigns, since a randomised controlled evaluation is not possible in such a case. This design provides stronger evidence for the impact or lack of impact of national campaigns than evaluations that use only single 'before and after' surveys or studies in which only post-intervention data are collected (13, 14).

A limitation of the present study was that the data was based on self-reported measures, which may be subject to socially desirable and inaccurate responses, and which may have led to systematic bias in the information obtained (15, 16). However, the tendency to give socially desirable answers is most probably equally distributed over the samples, and as a result may not have influenced the differences between measurements.

The high campaign awareness levels in the present study were comparable to those found in earlier studies on the impact of mass media campaigns (17-19). In the present study, the campaign awareness rose sharply when the first TV commercial was launched during the fourth campaign wave. Free publicity on TV and radio news programmes was another important source of campaign awareness. Despite the large numbers of people reached through the mass media, which referred people to sources where they could get further information on behaviour change, few people actually obtained this extra information.

The present study does indicate the campaign was able to induce small but significant improvements in attitudes and motivations for preventing weight gain, which are important prerequisites for changing behaviour (20, 21). These findings are consistent with the findings on previous research on mass media campaigns, which show that mass media campaigns on health issues can have small effects on health knowledge, attitudes and motivations (22-24). The fact that we only found small improvements in these variables might be due to the high levels at baseline (i.e. ceiling effect), which may also explain that we found no effects on the awareness of personal weight status.

Furthermore, the results suggest the campaign was less successful in increasing self-efficacy expectations for preventing weight gain and to creating awareness of personal vulnerability to gradual weight gain. The mixed effects on self-efficacy expectations indicate that the campaign was less effective in conveying complex information and in teaching certain skills, especially in the absence of other forms of communication or environmental changes (14). The adverse effect on risk perception may have been induced by exposure to the TV commercial, which used a degree of fear-arousing content and exaggeration to get the audience attention.

Some people may have responded by ignoring the message and believing the problem did not apply to them (25); after the TV commercial was introduced, fewer respondents thought they were personally vulnerable to gain excess weight and half of the respondents who had seen the TV commercial reported that the TV commercial was of low personal relevance for them.

In conclusion, the 'Maak je niet dik!' campaign was successful in raising public awareness of the need to prevent weight gain. However, the small and mixed effects of the campaign indicate the importance of planned intervention development with more attention to needs assessment research that defines specific, relevant campaign goals before a campaign is designed and launched (26, 27). Additionally, to establish behaviour change, it is most likely that more tailored or interpersonal communication and environmental changes are needed (28-30).

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PART 4

General discussion

INTRODUCTION

This thesis reports a series of studies on the development, implementation and evaluation of the Dutch national mass media campaign 'Maak je niet dik!' aimed at preventing weight gain. The purpose of this final chapter is to relate the main findings of the various studies to each other and to discuss several possible explanations for the findings. Methodological and theoretical issues are discussed, as well as implications for future research and practice. In addition, it presents an overall conclusion on the campaign.

MAIN FINDINGS

Needs-assessment research

In our first needs-assessment study we investigated to what extent people are aware of personal body weight. This may be an important predictor of the motivation to avoid weight gain, since overestimating personal weight (BMI <25; perceived weight status: overweight) may lead to unwarranted weight maintenance actions while underestimating weight (BMI >25; perceived weight status: not overweight) may result in lack of motivation to avoid further weight gain. We also reported on correlates of under- and overestimating personal weight status. Results of this study showed that a majority of Dutch young adults were realistic about their weight status while a small but relevant proportion of respondents under- and overestimated their weight *(Chapter 3)*. Overestimating weight status was consistently more likely among women, while underestimating weight was more likely among men, older respondents and respondents from ethnic minorities.

The second needs-assessment study investigated to what extent Dutch young adults are motivated to prevent weight gain and to identify potential correlates of this motivation. Results of this study revealed that a majority of the Dutch young adults had high intentions of preventing weight gain and reported they were already taking action to avoid weight gain *(Chapter 4)*. Age, attitudes and overweight-related risk perception appeared to be important predictors for the motivation to act. In addition, respondents who had decided to act to prevent weight gain reported low perceived behavioural control, suggesting that low control was a barrier to action.

Results of the third needs-assessment study on what people say they do to keep from gaining weight *(Chapter 5)* revealed that despite people's willingness to act to prevent weight gain, many people frequently experience occasions of overeating and try to compensate for such moments in different ways. Overweight people (BMI >25) and women were more likely to report overeating than people with healthy body weights and men. Overweight people, women and people who regularly reported overeating were also significantly more likely to report compensatory behaviours by eating less and to report specific weight-gain prevention strategies using diet and physical activity. Recommended diet-related weight-gain prevention strategies such as limited sugar, snack and soft-drink consumption did not appear to be very popular. Also, only a minority of people reported combining dietary changes and physical activities, as advised by experts.

Balance Intervention pilot testing

To make people aware of occasions of overeating and to motivate and enable them to compensate within a short time span, the Netherlands Nutrition Centre initiated the 'Balance Intervention'. The Balance Intervention was designed as an innovative and potentially easy-to-use approach to help people prevent weight gain in an 'obesogenic environment' in which certain occasions of overeating are hard to avoid. *Chapter 6* reported the results of the formative evaluation of the Balance Intervention approach to test the application, appreciation and immediate effects of the intervention materials in order to enable further improvement.

Results of this study indicated that the intervention materials (brochure, electronic newsletter and radio advertisement) had the potential to improve people's attitude and motivation towards compensatory behaviours and to increase self-reported dietary compensation actions. However, no effects were found on reported physical activity compensation behaviours. A possible negative side effect on perceived behavioural control was found for the radio advertisement. In addition, results showed the radio advertisement did not encourage people to seek further information. These findings should discourage the Netherlands Nutrition Centre from using the radio advertisement or similar short messages in the mass media in its present form in the nationwide campaign.

The outcome evaluation

Chapters 7 and *8* reported the results of the outcome evaluation of the nationwide campaign 'Maak je niet dik!' Results revealed the campaign reached a large proportion of the target population and that there was high campaign awareness and message recall. People knew about the campaign primarily because they had seen the television advertisement or had been exposed to the campaign-related information via free publicity in other television or radio programmes, including news programmes. Although people knew about the campaign, they were not encouraged to seek further information and were not familiar with the more detailed individual campaign materials such as the brochure, advertisements and posters and information on the Netherlands Nutrition Centre website.

The results suggest that although the first campaign initiated some positive changes in attitudes, it did not achieve significant improvements in other determinants of weight-gain prevention among non-obese Dutch adults *(Chapter 7)*. Evaluation of the three-year campaign revealed small positive changes in attitudes, perceived social support and motivation to prevent weight gain. The results also suggest the three-year campaign had mixed effects on self-efficacy expectations related to preventing weight gain and was associated with lower perceived risk of weight gain *(Chapter 8)*.

METHODOLOGICAL ISSUES

The results and conclusions should be interpreted in the light of the potential methodological strengths and limitations for the validity of the research. In this section, the study designs are first discussed for 1) the needs-assessment research, 2) Balance Intervention pilot testing and 3) the outcome evaluation of the 'Maak je niet dik!' campaign. In addition, the meth-

Table 1. Overview of the research designs, data collection and sampling procedures used in the needs assessment, formative evaluation of the Balance Intervention and outcome evaluation of the national mass media campaign.

Study	Design	Sampling	Data collection
Needs-assessment study 1 and 2 *(Chapters 3 & 4)*	Cross-sectional design	Random digit dialling	Telephone questionnaire
Needs-assessment study 3 *(Chapter 5)*	Cross-sectional design	Internet sampling	Electronic questionnaires
Balance Intervention study *(Chapter 6)*	Experimental design	Internet sampling	Electronic questionnaires
Outcome evaluation *(Chapters 7 & 8)*	Serial cross-sectional surveys (interrupted time series)	Random digit dialling	Telephone questionnaire

odological issues are discussed with regard to the sampling and data collection procedures (telephone and internet surveys) used in the studies (Table 1).

Methodological issues related to the research design

Cross-sectional surveys for the needs-assessment study.

Data of two of our needs-assessment studies were based on a cross-sectional research design to study the Dutch population at one point in time (Table 1). A main strength of this design is that it quickly provides information of the measure of interest and characteristics of the target population at a specific time. Such data are of great value to public health administrators and programme planners in assessing the health status and health care needs of a population and identifying population subgroups that are more or less at risk, therefore defining subgroups of the population that should be targeted with the intervention. However, one limitation is that a cross-sectional design is useful for exploring association rather than for testing a hypothesis, since we were not able to study causation (1). Other research designs – such as experimental and longitudinal designs – are more appropriate for gaining a better understanding of the process of behaviour change (e.g. establishing which energy-balance-related behaviours could help people maintain a neutral energy balance) (1, 2).

An experimental design for the Balance Intervention pilot testing.

In order to enable further improvement of the Balance Intervention, the media components of the intervention were tested in a three-group randomized trial with pre- and post-intervention measures on the application, appreciation and immediate effects *(Chapter 6)*. The use of randomized trials is regarded as the most ideal way to test the potential effects of the individual components of mass media campaigns before the campaign is launched, since internal valid evaluations of mass media interventions are difficult (if not impossible) to conduct, especially when such interventions are launched nationwide (3-5). A randomized trial will yield the strongest and most direct evidence on which to base a judgement of whether an observed

association is one of cause and effect. This design also produces the most relevant estimate of an effect size attributable to the causal factor and intervention and allows ascribing observed effects to the intervention with the greatest level of certainty. Equal study groups should be created through randomization, which rules out several threats to internal validity (6, 7).

However, one limitation of an experimental design is that this design is poorly suited to interventions aimed at changing the social context. Research suggests that if programmes work, they are likely to work because they activate a complex process of change in social norms rather than because of knowledge transfer (5, 8). This limitation may also be applicable in the research on the Balance Intervention, since we only tested the components on the use and immediate impacts on psychosocial variables related to compensatory behaviours. Within the controlled research setting, we were not able to test whether the intervention activated a complex process of change in social norms in the long term.

Time trend analyses for evaluating the mass media campaign.

To determine whether a large-scale public health communication programme such as the mass media-based programmes was successful, it is not possible to implement an 'ideal' experimental design, since the nationwide distribution of campaign materials makes it impossible to include a control group, let alone random allocation, in the intervention. Additionally, it may not be desirable to perform a randomized trial of all potential interventions (9-11). This may be particularly true of some large-scale environmental and policy interventions involving changes in urban design, state or national tax policies, or social and political movements (5, 8).

If evaluations are to respect the way public health communication programmes work, they will likely have to depend on alternative approaches. For monitoring changes over time in the subject of interest in the intervention population, a cohort design or a 'time series design' might be used. Cohort or observational studies evaluate users with no comparison or control group. A major advantage of a cohort design is its better statistical power and precision to detect changes than a cross-sectional design. The strength of cohort re-examinations is that each respondent has been present throughout the programme and so provide better estimates of individual change, but they are less able to test the population change hypothesis (12, 13). Although a cohort approach can give more information on the type of changes that have actually taken place, we preferred a time series design for evaluating the 'Maak je niet dik!' campaign, in which repeated independent samples are drawn from the target population to document long-term changes in indicators over time before and after the intervention. This design was the simplest and least obtrusive form of evaluation. In addition, it assesses the magnitude of changes in the whole population better than a follow-up of a cohort; it is more efficient and cross-sectional estimates may be less biased by repeated questioning and attrition, which is an important bias in cohort estimates (12-14).

Time series regression models make it possible to provide an estimate of intervention effect, taking into account the degree of lack of independence among individual observations and the effect of the underlying time trend. The effect sizes for changes in level and slope enable a more informative interpretation of the results: the change in level demonstrates the immediate effect of the intervention and the change in slope indicates the sustainability of the

intervention effects (5, 15, 16). A limitation of our study was, however, that we did not include sufficient data points to perform time series regression models. A total of 11 cross-sectional surveys (interrupted time series) were conducted over a three-year period in which repeated independent samples were drawn from the target population of the campaign to document long-term changes in indicators over time before and after an intervention (interrupted). However, to enable reliable statistical inference, at least 20 pre-intervention observation points are required (16-18). Although we did not include sufficient data points for time series regression models, within the confines of the financial and practical limitations we think our present design was the best possible way to monitor the effects of the nationwide campaign, especially if interventions have already been pilot tested in controlled research settings before they are implemented nationwide (19, 20). In addition, it provides stronger evidence for the impact or lack of impact of national campaigns than evaluations that only use single 'before and after' surveys or studies in which only post-intervention data are collected.

Methodological issues related to sampling and data collection procedures

Telephone survey

Data from two of our needs-assessment studies *(Chapters 3* and *4)* and the outcome evaluation of the mass media campaign *(Chapters 7* and *8)* were collected by telephone-administered questionnaires. We made use of this method because this method is relatively low in cost compared to face-to-face interviews, can be completed very quickly, and the personnel requirements for a telephone survey are less demanding.

In our study, data were collected by means of random digit dialling (RDD) methods to survey a nationally representative sample of Dutch young adults between 20 and 40 years of age. RDD techniques are based on the sampling frame of all possible telephone numbers and make it possible to use telephone interviews in investigations of the general population (21).

Although the use of telephone questionnaires has several practical advantages, it has also several limitations related to the quality of data because of sampling errors (21-23). Sampling errors may have also occurred in our study and consequently may have limited the generalizability because we found that women were slightly over-represented and the respondents in the study were somewhat more highly educated compared with the source population. Our study also included somewhat lower percentages of people who were not of ethnic Dutch origin (24, 25). The lower generalizibilty may be caused by the growing non-response of telephone surveys, in part due to the general non-response trend for all surveys and in part due to the changes in society and technology that influence the contact ability and willingness to answer (26, 27). However, this was less likely to have been a problem in our study, since we found that response rates were quite high (67.6%-80.0%), which might be due to the interest in the topic of preventing overweight and its social relevance. Furthermore, telephone sampling may suffer from under-coverage (21). There is some evidence that certain subpopulations (the unemployed, the elderly, students and young adults between the ages of 18 and 25) are relatively more difficult to reach by telephone because they are less likely to own one or rely solely on mobile phones. Currently, the percentage of individuals with a listed, fixed-line number is estimated to be between 60% and 70%. This means there is a substantial under-coverage of 30%

to 40%. In our study, under-coverage may also have occurred because individuals with only a mobile phone and individuals with no phone were not included in the telephone surveys.

Although we used interviewers who were well-trained in standard interview techniques, errors may have occurred with regard to the measurement if a respondent did not understand a question or did not want to give an accurate answer, or if the interviewer made an error in recording the answer (28). In order to avoid measurement error, we pilot tested the questionnaire in a small sub sample of the study population and submitted the questionnaire for review to an expert panel to check face and content validity. We were, however, not able to test the predictive or relative validity and the reliability of the psychosocial measures for preventing weight gain. Although these measures were based on earlier studies reported in the literature (29-31), the formulation of the questions may not have been specific enough. In order to limit the length of the questionnaire, we also decided to frame all questions to "watching one's weight to prevent weight gain" for measurement of cognitive determinants of energy-balance-related behaviours. However, this formulation may not embrace the complexity of such behaviours, since physical activity and food consumption are in fact collections of various actions such as a diet high in fat and low in fibre, frequent snacking and frequent consumption of soft drinks containing sugar (32). Another limitation was that measures were based on few or single-item assessment, which are more likely to have limited reliability.

Finally, measurement errors may have occurred because data collection via telephone interviews was based on self-reported measures, which may be subject to socially desirability bias and inaccurate responses. Positive responses could, for example, be due to response bias (e.g. 'eager to please'), socially desirable answers or slips of memory (22, 33). Silent pauses in a telephone conversation are generally felt as uncomfortable, both for respondent and interviewers. As a result, respondents will not take a long time to think about their answer or to search their memory. For questions about facts, events and past behaviour, this can lead to under-reporting due to forgotten events, but also to over-reporting when events are displaced in time (28).

Internet survey

To study what people say they do to prevent weight gain *(Chapter 5)* and for testing the Balance Intervention *(Chapter 6),* data was collected from a random sample of an existing Internet research panel (Table 1). The use of an Internet panel is a convenient and attractive method of having repeated measures within a short time interval. Compared to other modes of collecting data, the Internet lowers many of the costs associated with collecting data on human behaviour (34). Online data collection also has several advantages with regard to the actual data-collecting process, which can favour internal validity. In essence, the respondents enter the data directly into the database. The data can then be collected and entered into a statistical package within minutes. Using relatively flexible web-page layouts, researchers can more easily ensure accurate data entry, eliminating errors caused by entry (35, 36). Electronic questionnaires also provide possibilities for optimizing questionnaire design, such as automatic routing of questions or providing audio and visual stimuli to augment survey questions (37). Furthermore, research on web-based surveys has shown that rather high response rates can be established, with the majority of responses returned within a 24- to 48-hour time

period following the questionnaire completion request and may provide a way to include populations that are normally difficult to access (36, 38).

Despite these practical advantages, there are also several limitations related to the sampling and quality of the data collection. First, the data and existing Internet sampling frame may not have been representative, due to the non-representative nature of the internet population and the self-selection of participants (i.e. the 'volunteer effect') (39). Self-selection bias originates from the fact that people are likely to respond to questionnaires if they see items that interest them because the items asked about attract them or because they are attracted by the incentives offered for participating. Internet samples are also likely to under-represent populations that have low access to the Internet (e.g. minorities and the poor elderly). Even in Internet research, recruiting ethnic minorities is not easy. In fact, it can be more complicated and difficult than in traditional research because of the inherent characteristics of internet interactions and the socio-demographics of internet users (38, 40-42). The self-selection bias may have also played a role in the Balance Intervention study, since results showed the sample included a higher proportion of more highly educated people and under-represented people from ethnic minorities in Dutch society (24).

Another limitation of the online data collection was that the data was based on self-reported cognitions and behaviour. No measurement of the tendency to give socially desirable answers was included in the study, so it was not possible to adjust for this issue. However, because a randomized controlled trial was used to evaluate the Balance Intervention, the tendency to give socially desirable answers should be equally distributed over the three groups.

Considering the quality of the outcome measures of the Balance Intervention study, I would also like to mention we made use of a self-developed questionnaire. The questionnaire was tested for reliability by analysing test-retest reliability and the internal consistency of the scales. The reproducibility or intra-method reliability of a measure refers to how consistently a measurement with the same instrument can be repeated on the same subject. More consistent results obtained with repeated trials imply a more reliable measurement instrument, as random measurement errors do not correlate over time (43). The approach employed in the present study was retesting the same subjects with the same survey instrument. The results showed that the internal consistency and the test-retest reliability of the psychosocial measures were moderate to high, with the exception of the reliability of 'caloric restriction attitudes' and 'physical activity attitudes', which may be the result of actual change.

EXPLANATION OF FINDINGS

Needs assessment

Results of the first needs-assessment study on the awareness of personal body weight *(Chapter 3)* confirm the findings of previous studies that especially women who overestimate their weight status and that men were more likely to underestimate their weight status (44-46). Women have been found to be more weight-conscious than men and are also more likely than men to have a weight-loss intention, independent of their weight. Findings also suggest that people from ethnic minorities are more likely to evaluate their weight as not being too

high, despite the fact they are overweight. Some earlier studies have indicated that people from ethnic minorities may prefer higher body weights, in that they reflect more affluence (47-49). Results also show that higher age was associated with a greater likelihood to underestimate weight. The fact that overweight is more common as age increases (50) may reflect that people regard being overweight to be more normal with increasing age, especially since people tend to use social comparison information instead of objective standards to evaluate their own behaviour or health status (51, 52). In addition, people may believe that weight gain and being overweight are inevitable as they grow older (53).

The most striking result of the second needs-assessment study *(Chapter 4)* is the high proportion of Dutch young adults with positive intentions to prevent weight gain and the high prevalence of respondents who reported taking action to prevent weight gain. In spite of high motivation and self-perceived actions to avoid weight gain, weight gain is highly probable in this age group (54). These findings may be due to the fact that these people might be less motivated to engage in more specific actions to help achieve weight management, as was also suggested by a study done by Adnajani-Surjahjo and colleagues (55).

Results of our study showed that attitudes towards weight-gain prevention and overweight-related risk perceptions are the strongest correlates of motivation to prevent weight gain. Several other studies have shown that attitudes affect various sorts of health behaviour, including weight-control behaviours. Behaviour theories such as the Theory of Planned Behaviour and the Health Belief Model have also identified that attitudes, expression of one's positive or negative evaluation of performing a given behaviour, and motivations are important precursors for behaviour change (56). Additionally, the Health Belief Model and the protection motivation theory posit that risk perception is an important predictor of motivation to change (57, 58). According to these and similar theories, weight-gain-related risk perception is defined by perceived severity and perceived vulnerability for gaining weight. People who think they are not personally vulnerable to gain excess weight and/or that weight gain is not severe are less likely to act.

Furthermore, we found that low perceived behavioural control was an important barrier to acting for people who had positive intentions to act to prevent weight gain. The importance of perceived behavioural control is also highlighted in studies on weight loss (59, 60). Other studies indicate that people believe that low-fat diets (as an illustration of a specific weight-control behaviour) are more expensive, more difficult to prepare and that eating less fat is difficult in general or in certain specific situations such as during weekends and on holidays (61, 62). In addition, modern society fosters an obesogenic environment that promotes overeating and discourages physical activity (63). Such an environment may provide a barrier to avoid becoming overweight, despite high motivation and self-reported actions to prevent weight gain.

The results of the third needs-assessment study on self-reported actions to prevent weight gain *(Chapter 5)* suggest that specific high-risk situations for overeating occur frequently, especially among overweight people and women. People who regularly experience overeating are also more likely to engage in compensatory behaviours and specific weight-control behaviours. In line with studies on weight loss, we found that only few respondents reported the combination of dietary and physical activity behaviours to prevent weight gain and that

behaviours related to diet were more common (64-66). In addition, it has been previously reported in studies on weight loss that women are more likely to report engagement in weight-gain preventive behaviours, despite the fact that more men are overweight than women (67-70).

The fact that overweight people were more likely to report occasions of overeating, some compensatory behaviours and weight-gain prevention strategies may be due to the fact that they may be more aware of such issues and try even harder to prevent further weight gain. Furthermore, the results showed that people who are aware of occasions of overeating appeared to use different and more weight-gain prevention strategies. Because of the high frequency of overeating, these people might have more reason to act to prevent weight gain. It could also be that people who actively prevent weight gain report more frequent occasions of overeating because they are more aware of these high-risk situations. The higher frequency of overeating among people who are engaged in preventive action might also be due to the fact that overeating still happens despite people's engagement in weight-control behaviours. The 'obesogenic' environment may be one in which it is too difficult to keep from engagement in occasions of overeating overweight, despite people's willingness to act to prevent weight gain (63, 71, 72).

Intervention pilot testing

The formative study for the Balance Intervention *(Chapter 6)* indicated that the intervention materials like the brochure and radio commercial had positive effects on attitudes, intentions and compensatory behaviours as well. However, lower levels of perceived behavioural control were found after exposure to the radio advertisement intervention. Because attitudes and motivations are important precursors of behaviour change (56), we can conclude that the increase in attitude and intentions in the present study may contribute to more frequent engagement in compensatory behaviours related to caloric restriction.

The lower perceived behaviour control for compensating for overeating in the radio group might be explained by the fact that mass media like TV and radio commercials are not well suited to improve people's abilities and confidence to engage in new behaviours. When such messages do increase intentions as in the present one, people are likely to become more aware of their lack of skills or confidence (5). Also, the results showed that people were not encouraged by the radio commercial to seek further information and did not provide information to strengthen perceived control. Since compensation behaviours are complex and may be difficult to apply, the radio group's experience with compensatory behaviours may have led to more realistic but lower perceived behavioural control.

Outcome evaluation

Results of the outcome evaluation show that the campaign 'Maak je niet dik!' *(Chapters 7* and *8)* was successful in reaching a large segment of the target audience. The high campaign awareness levels in this study were comparable to those found in earlier studies on the impact of mass media campaigns (73-75).

The outcome evaluation does indicate the campaign was able to induce small but significant positive differences in attitudes and motivations for preventing weight gain. These

results confirm the findings on previous research on mass media, which show that targeted, well-executed mass media campaigns on health can have small effects on health knowledge, attitudes and motivations, which are important prerequisites for changes in behaviour (9, 56, 76, 77). In addition, a positive secular trend was found in the perceived social support for preventing weight gain. We cannot suggest that this is an effect of the campaign, since we did not find significant differences directly after the campaign waves. Nevertheless, this finding may indicate that a mass media campaign be associated with to some social changes and changes in social norms, especially if the messages raise a public debate (9-11, 78).

Although we found some positive effects on attitudes and motivations for preventing weight gain, the effects were small. There are several explanations for why these effects were somewhat limited. First, it may very well be that the right goals were not set for the campaigns because of a lack of a more detailed needs-assessment research prior to the campaigns and because the needs assessment studies were not fully used by the Netherlands Nutrition Centre to set their campaign goals. Because preventing weight gain was high on the political agenda, the Netherlands Nutrition Centre decided to start their campaign while the first research results of the needs-assessment study were not yet available to identify possible targets for their campaign. The consequence was that the first years of the campaign were aimed at placing the issue of weight-gain prevention on the public agenda by creating awareness of a need to act (i.e. behaviour change) to prevent weight gain, and to induce more positive attitudes and intentions to prevent weight gain, while the results of our needs assessment showed that awareness of personal body weight, attitudes and motivations for preventing weight gain were already high to begin with, which may indicate ceiling effects. Instead of focusing on agenda-setting, awareness of personal body weight and awareness of the need to prevent weight gain, the results suggest that the campaign should have been aimed at increasing personal vulnerability to weight gain, and self-efficacy to prevent weight gain.

A second explanation for the limited effects may be that the intervention development was done in a short time span, lacking a careful stepwise, evidence-based and theory driven approach. In addition, with the exception of the Balance Intervention, the individual components of the mass media campaign were often not tested for their potential effects before nationwide implementation.

Besides the changes in attitudes and motivations for preventing weight gain, the results also suggest the campaign had mixed effects on self-efficacy expectations and a negative effect on overweight-related risk perceptions. Our results suggest that the adverse effect on risk perception was probably induced by the TV commercial, which used a degree of fear-arousing content and exaggeration to get the audience's attention. After the TV commercial was introduced, fewer respondents thought they were personally vulnerable to gain excess weight and more than half of the respondents reported they thought the TV commercial was of low personal relevance to them.

Some level of anxiety may be desirable to induce motivation to change. Protection Motivation Theory, for example, posits that risk perception is an important determinant of motivation to change. According to this and similar theories, weight-gain-related risk perception is defined by perceived severity and perceived vulnerability for gaining weight (58). However, the results of our study indicated the campaign may have reduced perceived vulnerability. The

negative side effects of the TV commercial in the 'Maak je niet dik!' campaign might have been avoided if the methods had been consequently pilot tested in a controlled setting for their impact before the nationwide implementation.

Furthermore, lower self-efficacy expectations were found after two campaign waves. This may be explained by the fact that mass media are less effective in conveying complex information and in teaching skills in the absence of other forms of communication or environmental changes. To change more complex cognitions and motivations and to improve self-efficacy expectations, it was probably of essential importance that people were exposed to the more detailed and skills-oriented print materials and information on the website containing more complex and practical information on how to check personal body weight and the information necessary to successfully promote weight-gain prevention (79). However, our results showed that the 'Maak je niet dik!' campaign did not encourage people to seek further information. People should also read the brochure and information on the website to learn about skills they can use to maintain a healthy body weight in order to increase self-efficacy expectations. Finally, higher self-efficacy expectations were found after the sixth campaign wave. This might be explained by the fact that during this campaign specific messages were communicated to increase self-efficacy expectations and specific materials were distributed to help people prevent weight gain, such as a personal weight coach and caloric intake assessment tools.

GENERAL CONCLUSION

Results of the needs-assessment study suggest that a majority of Dutch young adults are aware of their personal weight status and the need to prevent weight gain. A majority also reported taking action to avoid weight gain. Attitudes and overweight-related risk perceptions appeared to be the strongest correlates of motivation to act to prevent weight gain. Low self-efficacy expectations were the more important barrier to action for people who were motivated to prevent weight gain. Despite high motivation and self-reported actions to prevent weight gain, the results suggest that people are not engaged in effective weight-gain preventive action, since a minority of young adults reported combining dietary changes with physical activity. The results also showed that overeating occurs frequently despite self-reported actions to prevent weight gain, possibly induced by the obesogenic environment.

Whether promoting compensatory behaviour can help people to act on their intentions to prevent weight gain remains unclear; a longer-term prospective study is needed, with objective measures which examine the impact of changes in overeating and compensatory behaviours on body weight change. Further research is also needed on how to communicate the Balance Intervention message on a wider scale, since results suggest that mass media such as TV or radio are not appropriate to communicate the detailed, complex information.

Furthermore, the somewhat mixed effects of the 'Maak je niet dik!' campaign once again indicates the importance of more thorough needs-assessment research as well as pilot testing efforts before a mass media campaign is launched.

IMPLICATIONS

The results presented in this thesis have several implications for future practice and research. In this section, we will describe several recommendations for practice and research related to the needs assessment, intervention pilot testing and implementing and evaluating effective weight gain prevention strategies.

Implications for practice

The results of our needs-assessment research suggest the following:

1. Despite high levels of awareness Dutch young adults should be encouraged to compare their body weight status to standards that are relevant to public health and not to their perceptions of other people's body weights or 'beauty parlour' standards, since this may lead to unwarranted under-and overestimation of weight status. Therefore, health professionals involved in preventing weight gain and overweight may consider including weight awareness strategies in their interventions. In women, unwarranted weight-loss actions may be avoided by correcting overestimation of their personal weight status. However, in men and with increasing age, underestimating weight status can be a barrier to effective weight maintenance. Easily available self-assessment instruments, such as electronic BMI tests available on the Internet and other computer-tailored feedback instruments, are examples of tools that may help to increase people's awareness of their weight status.
2. In order to motivate the minority of Dutch young adults who have non-positive intentions for preventing weight gain, interventions should focus on attitude change and increasing perceived vulnerability for weight gain.
3. To help Dutch young adults to act on their positive intentions interventions are necessary to improve people's skills and/or help people overcome barriers to performing weight management behaviour .
4. It is important to communicate about effective weight-gain prevention strategies, since Dutch young adults are likely to overestimate their actions to prevent weight gain or apply less effective strategies. Interventions are needed that encourage weight-gain prevention by increasing people's awareness of the importance of combining physical activity with healthy food choices. Such interventions should be aimed at men in particular. Furthermore, it is important to provide information about types of weight-control behaviours that would best support long-term weight control.

The results of the Balance Intervention formative evaluation suggest the following:

1. The Netherlands Nutrition Centre should not use the radio advertisement or similar advertising in its present form in the nationwide campaign, since there were indications of a negative impact on behavioural control of the radio commercial. Also, the radio commercial did not encourage people to seek further information, which is a pre-requisite for learning skills on how to perform compensatory behaviours and prevent adverse side effects such as misinterpreting the campaign message.
2. It is very important to pre-test messages and individual components of the campaign

among the target audience to be sure they are both appropriate and effective. Such research can enable campaign planners to truly understand their target audience in terms of the problem behaviour at hand, their message preferences, and the most promising channels through which they can be reached, as well as preventing adverse side effects (77, 80, 81).

The results of the outcome evaluation suggest the following:

1. It is very important to conduct a process and outcome evaluation that includes monitoring and collecting data on implementation of campaign activities to check efficient message exposure among members of the target audience (9, 77).
2. It is important to use a model for planned health promotion as a guide during campaign planning and implementation. This model is helpful for identifying important and changeable determinants upon which campaign messages might focus and to use research evidence more systematically in planning activities. Applying a simple model for evidence-based health education can help the programme planner to carefully consider each decision in developing interventions and preparing for implementation.
3. Our findings and previous research on past campaigns indicate that mass media such as television and radio are only appropriate when there is a simple message that can be presented in a single uniform way to all the people in the audience, and when few or no skills are necessary to enable the individual to perform the desired behaviours. A mass medium such as television should be used to stimulate information-seeking on the part of the audience rather than to provide behaviour-change information. Print media (possibly including web-based 'print'), on the other hand, are more effective in communicating more detailed, complex information but less effective in getting attention. Therefore, the combination of television or radio with print is potentially much more effective in getting attention, motivating people and providing them with detailed information than either of the media on their own (82, 83).
4. Mass media campaigns may have small effects on attitudes and motivations, which are important prerequisites for changes in behaviour. However, inducing change in beliefs and motivation is only a first step, and strategies other than mass media are needed to help people prevent weight gain, because mass media campaigns appeared to have less clear benefits for changing behaviours (73, 84-86). More tailored or interpersonal communication, additional supports and complementary actions will be required for long-term behaviour change as the long-term goal of a sustained campaign (9). Several studies have suggested that campaigns are most likely to be effective when they are supplemented by school- or community-based interventions, primary health professional actions, and environmental changes to offer abilities and good opportunities for making healthy choices (8, 87) (see also *Chapter 2* of this thesis). It is therefore important that campaigns are carefully planned, well-executed, attain adequate audience exposure and are implemented in conjunction with other ongoing prevention activities (88-90).

Implications for research

We can make the following recommendations based on the needs-assessment research:

1. Further research is needed to explore which specific behaviours people are engaged in to prevent weight gain to further explain the discrepancy between the high motivation for preventing weight gain and reported preventive actions on the one hand and more people becoming overweight on the other.
2. It is important to test whether associations found in the cross-sectional study can be confirmed by longitudinal data with more objective data to study the true level of people who under- or overestimate their body weight status. It is also important to further study which energy-balance-related behaviours can help people deal with the obesogenic environment and which may enable them to effectively act on their positive weight-gain prevention intentions.
3. Research is needed to investigate the motivational factors (including attitudes and subjective norms) related to specific weight-management actions to further understand the correlates of weight-gain prevention.

Based on the Balance Intervention pilot testing, we can make the following recommendations :

1. A prospective study with objective measures is warranted to examine whether changes in overeating, compensatory behaviours and specific weight-management behaviours are related to energy balance and their impact on body weight change before a Balance Intervention should be implemented on a larger scale.
2. Further research is also needed to decide whether the Balance Intervention materials can enable people to effectively act on their positive weight-gain prevention intentions without undesirable effects in people who are susceptible to overeating, such as restrained eaters.

Based on the outcome evaluation research, we can make the following recommendations:

1. More research is needed to identify more precisely how the new public health message on preventing weight gain can best be framed and to assess the most effective way to distribute materials, programmes, communication products and other resources in order to improve the way programmes are implemented, because results suggest the 'Maak je niet dik!' mass-media campaign did not encourage people to seek information and the exposure to individual campaign components was very low.
2. It is important to find ways for practitioners and researchers to work in close cooperation and find ways to implement research findings to perform research that is highly likely to advance science and/or provide information for policy. Also important are practices that will prevent implementing new strategies and policies with no evidence of efficacy or effectiveness that may lead to large investments of resources, efforts and time and that may or may not result in any benefits (91).

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Summary
Samenvatting

SUMMARY

The prevalence of overweight and obesity is increasing rapidly. In the Netherlands, the prevalence of obesity has roughly doubled over the last decade and now more than 40% of the Dutch adult population is overweight and more than 10% obese. To promote weight-gain preventive actions among non-obese Dutch young adults, in December 2002 the Netherlands Nutrition Centre launched the nationwide campaign 'Maak je niet dik!'[1]. Mass media, such as television and radio (commercials), newspapers and magazines, a brochure and posters were used to convey the campaign messages.

The aim of this thesis was to contribute to the planned development, implementation and evaluation of weight-gain prevention strategies to be used in the mass media campaign. To promote systematic, evidence-based and theory-driven development and implementation of the 'Maak je niet dik!' campaign, a basic, simple model for planning and promoting health education was used during the research. The first three phases of this model refer to the 'needs assessment' used to identify serious health problems as well as to identify the most important and appropriate changeable determinants of risk factors for these problems. The needs assessment is followed by the 'development of the intervention'. In this phase, those intervention methods that induce change in the determinants identified by the needs assessment are ascertained and developed. These methods are then translated into deliverable intervention strategies and evaluated for their efficacy.

Part 1 of this thesis is an introduction to this model. This model was also applied to healthy eating to improve population health *(Chapters 1* and *2),* followed by studies on the needs assessment (Part 2, *Chapters 3, 4* and *5)*. Part 3 deals with research on 'intervention pilot testing' in which we tested the 'Balance Intervention'. The Balance Intervention was initiated by the Netherlands Nutrition Centre and promotes moderating food intake and/or increasing physical activity in response to occasions of overeating *(Chapter 6)*. Part 4 deals with the results of the outcome evaluation of the 'Maak je niet dik!' campaign (Part 4, *Chapters 7* and *8)*.

Needs assessment

Three needs assessment studies were conducted to investigate the awareness of personal weight status, to get a better understanding of the needs and motivations of the target audience and to explore the prevalence of and differences in self-reported occasions of overeating (such as at celebrations and other parties), compensatory behaviours and specific weight-gain prevention strategies according to socio-demographics and overweight status *(Chapter 3)*. Findings of the needs assessment studies revealed that a majority of Dutch young adults were realistic about their weight status while a small but relevant proportion of respondents was too optimistic about their weight status *(Chapter 4)*. In addition, a majority of the Dutch young adults had positive intentions to prevent weight gain and reported they were already taking action to avoid weight gain. Attitudes and overweight-related risk perception appeared to be important correlates of the motivation to act and low perceived behavioural control was identified as a barrier that kept people from acting on their positive intentions *(Chapter 4)*.

[1] Translated literally, 'Maak je niet dik' means 'Don't get fat!' In Dutch, 'Maak je niet dik' is also a popular expression that means 'Don't worry'.

Despite people's willingness to act to prevent weight gain and a high prevalence of action to prevent weight-gain, results also showed that many Dutch young adults frequently experience occasions of overeating and try to compensate such moments in different ways. Furthermore, a minority of people reported combining dietary changes and physical activities, as advised by experts *(Chapter 5)*.

Pilot testing the Balance Intervention

Chapter 6 presents a formative evaluation research for qualitatively pre- and pilot testing the Balance Intervention, which the Netherlands Nutrition Centre planned to use in the nationwide campaign. The Balance Intervention, initiated by the Netherlands Nutrition Centre, promotes moderating food intake and/or increasing physical activity in response to occasions of overeating. Before the intervention was implemented nationwide, a formative evaluation study was conducted to test the application, appreciation and immediate effects to be able to further improve the Balance Intervention. Results of this study indicated that the intervention materials (brochure, electronic newsletter and radio advertisement) had the potential to improve people's attitude, motivation and self-reported dietary compensation actions. However, no effects were found on reported physical activity compensation. A possible negative side effect on perceived behavioural control was found for the radio advertisement. Results also showed the radio advertisement did not encourage people to seek further information.

Outcome evaluation

Chapters 7 and *8* deal with the results of the process and impact evaluation of the nationwide mass media campaign 'Maak je niet dik!' The outcome evaluation plan was intended to guide the assessment of the effects of the nationwide campaign. Results revealed that the first campaign had reached a large proportion of the target population, mainly due to the TV commercial and free publicity on TV and radio, including on news programmes. Although Dutch young adults knew about the campaign, they were not encouraged to seek further information. Evaluation of the campaign revealed small positive changes in attitudes and motivation to prevent weight gain. In addition, the results suggested the campaign had mixed effects on self-efficacy related to preventing weight gain and resulted in lower perceived risk of weight gain.

In the general discussion (Part 4), the results are discussed and integrated. Methodological and theoretical issues are also discussed, as well as implications for future research and practice. We concluded from the needs assessment that a majority of Dutch young adults were aware of their personal weight status and the need to prevent weight gain. Additionally, the results suggest that Dutch young adult act ineffectively in preventing weight gain because they do not combine the weight control strategies of diet and physical activity and frequently experience moments of overeating. Further we can conclude that although the Balance Intervention materials may have the potential to promote weight control behaviours related to caloric restriction, they had a possible negative effect on perceived behavioural control. Further research is needed to study the impact of changes in overeating and compensatory behaviours on body weight change and how to communicate the Balance Intervention message on a wider scale. From the outcome evaluation we can conclude that although the 'Maak je niet dik!' campaign

successfully reached a large proportion of the target audience, but did not encourage people to seek information. Furthermore, the campaign generated not only more positive attitudes and motivations but also lower risk perceptions towards preventing weight gain.

SAMENVATTING

In de gehele westerse wereld stijgt het aantal mensen met overgewicht, Nederland niet uitgezonderd. Van de volwassen Nederlanders is inmiddels ruim tweevijfde te zwaar. Preventie van overgewicht kan een aanzienlijke gezondheidswinst opleveren. Overgewicht vergroot namelijk de kans op een groot aantal gezondheidsproblemen, zoals hart- en vaatziekten en diabetes mellitus type 2 (suikerziekte). Ook hebben mensen met ernstig overgewicht vaker last van verschillende vormen van kanker en van aandoeningen aan het bewegingsapparaat en de ademhalingsorganen. Overgewicht hangt bovendien samen met lichamelijke beperkingen en een slechtere kwaliteit van leven.

Om een bijdrage te leveren aan de preventie van overgewicht begon het Voedingscentrum in december 2002 de meerjarige voorlichtingscampagne 'Maak je niet dik!' Deze campagne was erop gericht om 'jongvolwassenen' die nog geen (ernstig) overgewicht hebben, te stimuleren om te voorkomen dat ze geleidelijk zwaarder worden. De campagne was in de eerste fase vooral gericht op 'agendasetting' en 'bewustwording'. Het doel was daarbij om ervoor te zorgen dat het voorkomen dat je ieder jaar wat zwaarder wordt, een relevant onderwerp werd voor veel Nederlandse jong volwassenen. Daarnaast moesten de Nederlandse jongvolwassenen zich meer bewust worden van hun lichaamsgewicht en erkennen dat een geleidelijke stijging van het lichaamsgewicht niet vanzelfsprekend is en te voorkomen is.

Dit proefschrift beschrijft de resultaten van het onderzoek naar de onderbouwing en evaluatie van voorlichtingscampagne 'Maak je niet dik!'. Voor de uitvoering van dit onderzoek is gebruik gemaakt van het planmatige voorlichtingsmodel waarbij globaal 3 fasen te onderscheiden zijn: 1) determinantenonderzoek om de doelstellingen van de campagne verder te specificeren en relevante doelstellingen voor de campagne te identificeren, 2) pilot-testen van interventiematerialen en 3) effectevaluatie van de campagne 'Maak je niet dik!'. Deel 1 van dit proefschrift bevat een inleiding *(hoofdstuk 1)* en een toelichting op het gebruik van een voorlichtingsmodel ten behoeve van planmatige gezondheidsvoorlichting *(hoofdstuk 2)*. Deel 2 gaat in op de gedrags- en determinantenanalyse *(hoofdstuk 3, 4* en *5)*. Deel 3 bevat het pilot- onderzoek naar de Balansdag-interventie die het Voedingscentrum heeft ontwikkeld in het kader van de campagne 'Maak je niet dik!' *(hoofdstuk 6)* en de effectevaluatie van de campagne 'Maak je niet dik!' *(hoofdstuk 7* en *8)*.

Determinanten analyse

Ten behoeve van het determinanten onderzoek zijn er drie studies uitgevoerd: *Hoofdstuk 3* beschrijft een studie waarin is onderzocht in hoeverre mensen bewust zijn van hun gezond en ongezond gewicht. De meerderheid van de Nederlandse 'jong volwassenen' van 25 tot 35 jaar blijkt al een juiste inschatting maakt van het eigen lichaamsgewicht. Een gering deel van de respondenten, 6 procent, vond zichzelf goed van gewicht, terwijl de BMI groter dan 25 was, 17 procent vond zichzelf te zwaar, terwijl de BMI lager dan 25 was. Vrouwen overschatten hun gewicht significant vaker, terwijl mannen hun gewicht vaker onderschatten. Ook bleken lager opgeleiden vaker hun gewicht te onderschatten.

Hoofdstuk 4 beschrijft een studie waarin is onderzocht in hoeverre Nederlandse jongvolwassenen gemotiveerd zijn om op hun gewicht te letten om niet zwaarder worden en welke

demografische en psychosociale factoren hiermee samenhangen. De voormetingen van het evaluatieonderzoek naar de effecten van de campagne 'Maak je niet dik!' zijn gebruikt om deze factoren te identificeren. De resultaten van deze studie geven aan dat een meerderheid van de ondervraagden (85%) een positieve intentie had om op het eigen gewicht te letten. Die motivatie was vooral positief bij mensen die de risico's van overgewicht hoger inschatten, en voor mensen die veel voordelen, maar relatief weinig nadelen van gewichtsbeheersing verwachten. Tevens wezen analyses erop dat mensen die gemotiveerd zijn op hun gewicht te letten, maar dit (nog) niet doen, weinig vertrouwen hebben in hun vaardigheden en mogelijkheden.

Hoofdstuk 5 beschrijft de resultaten van een verkennend onderzoek naar de frequentie van momenten van te veel eten gedurende de afgelopen maand en in hoeverre compensatie optrad binnen een bepaald tijdsbestek met minder eten of extra beweging. Aanvullend is onderzocht welke andere gewichtsbeheersende maatregelen Nederlandse jongvolwassenen rapporteren om op hun gewicht te letten. Dit onderzoek toont aan dat momenten van te veel eten frequent voorkomen. Ongeveer de helft van de ondervraagde Nederlandse jong volwassenen (49%) geeft aan tenminste één keer per week te veel te hebben gegeten gedurende de afgelopen maand; slechts 45% rapporteert momenten van te veel eten te hebben gecompenseerd met minder eten of extra beweging. Tevens rapporteert het merendeel van de ondervraagden (73%) één of meerdere gewichtsbeheersende maatregelen. Maar een derde van de ondervraagden (32%) rapporteert voedings- en bewegingsgerelateerde maatregelen te combineren. Mensen met overgewicht en vrouwen bleken vaker momenten van te veel eten te ervaren dan mensen met een gezond gewicht en mannen.

Pilot onderzoek naar de Balansdag interventie

Hoofdstuk 6 beschrijft de resultaten van een pilot-onderzoek naar de 'Balansdaginterventie'. In de zoektocht naar mogelijk effectieve interventiemethoden voor preventie van gewichtstijging heeft het Voedingscentrum in het kader van de campagne 'Maak je niet dik!' de 'Balansdag-interventie' geïntroduceerd. Het concept 'balansdenken' omvat het aanleren van 'compensatiegedrag', waarbij momenten van overconsumptie worden gecompenseerd met 'onderconsumptie' binnen een bepaald tijdsbestek. De Balansdag-interventie bestond uit een brochure, wekelijkse nieuwsbrieven en een radiocommercial. Voordat de interventie landelijk werd geïmplementeerd is met een experimenteel onderzoek onderzocht of de interventie heeft geleid tot aandacht voor, bewustwording van specifieke balansdag strategieën, en een positieve attitude, eigen effectiviteit en motivatie ten aanzien van compensatiegedrag. De Balansdag interventie resulteert in een verbetering van de houding en motivatie ten aanzien van het toepassen van compensatiestrategieën en tevens in meer zelfgerapporteerde compensatiegedragingen. Mensen die enkel zijn blootgesteld aan een radiocommercial blijken na de interventieperiode echter een significant lagere eigen effectiviteit te hebben, en de radio boodschap stimuleerde heb niet om extra informatie aan te vragen over toepassing van 'balansdagstrategieën'.

Effect evaluatie

Hoofdstuk 7 en *8* van dit proefschrift beschrijven de resultaten van de evaluatie van de massa-

mediale campagneactiviteiten van de campagne 'Maak je niet dik!'. Deze waren voornamelijk gericht op bewustwording van eigen lichaamsgewicht en het belang van het voorkómen van gewichtsstijging. Op basis van onafhankelijke cross-sectionele surveys middels telefonische enquêtes die voor en na de campagne werden uitgevoerd konden zogeheten 'trendanalyses' worden gedaan om de effectiviteit van campagne te meten. De bekendheid met de campagne varieerde tussen de 61%-88%. Vooral de TV-commercial en daarnaast ook 'free-publicity' via TV en radio resulteerde in een hoge bekendheid met de campagne. Een klein deel van de ondervraagden (<15%) was bekend met de specifieke campagnematerialen en activiteiten zoals de brochure, poster, advertenties in krant en tijdsschriften en specifieke informatie op de website. Uit de resultaten blijkt dat de campagne heeft geresulteerd in kleine positieve veranderingen in de attitude en motivatie om op gewicht te letten. Tevens bleekt dat de campagne zowel positieve als negatieve effecten te hebben gehad op de eigen effectiviteit ten aanzien van het voorkomen van gewichtsstijging. Tot slot blijkt dat risicoperceptie ten aanzien van de kans en ernst van gewichtsstijging te zijn gedaald na de campagne.

Tot slot worden in het laatste deel van dit proefschrift (Deel 4), de algemene discussie, de resultaten van de verschillende studies geïntegreerd.. Tevens worden in dit hoofdstuk de methodologische en theoretische aspecten bediscussieerd, evenals de implicaties voor toekomstig onderzoek en aanbevelingen voor de praktijk.

De conclusie van het determinantenonderzoek is dat het merendeel van de Nederlandse jongvolwassenen een goede inschatting kan maken van hun lichaamsgewicht, gemotiveerd is om op gewicht te letten, maar in praktijk in onvoldoende mate een combinatie van voedings- en bewegingsgerelateerde maatregelen toepast. Verder kunnen we uit het pilot-onderzoek naar de 'Balansdag-interventie' concluderen dat de interventiematerialen tot positievere attitudes, motivaties en zelfgerapporteerde compensatiegedrag hebben geleid, maar een negatief effect hadden op de eigeneffectiviteit ten aanzien van compensatiegedrag. Voordat de Balansdag interventie landelijk wordt ingezet is meer onderzoek nodig om na te gaan of compensatiegedrag effectief is ten aanzien van het behoud van een gezond gewicht. Tevens is meer onderzoek nodig naar hoe dit principe massa mediaal gecommuniceerd kan worden. Tot slot kunnen we uit de resultaten van de effectevaluatie concluderen dat de campagne 'Maak je niet dik!' heeft geleid tot grote bekendheid bij Nederlandse jongvolwassenen, hoewel een minderheid van de doelgroep bekend was met specifieke campagneactiviteiten. Verder blijkt dat de campagne Nederlandse jong volwassenen kan motiveren om op gewicht te letten, maar ook heeft geresulteerd in lagere risicopercepties ten aanzien van de ernst en de kans op gewichtsstijging. Deze resultaten benadrukken het belang van het gebruik van een voorlichtingsmodel voor een planmatige ontwikkeling en uitvoering van een massa mediale campagne. Op deze manier kunnen toekomstige voorlichtingsinterventies op het gebied van preventie van gewichtsstijging beter worden afgestemd op de behoeften van de doelgroep en wordt de kans op effectieve gezondheidsvoorlichting vergroot.

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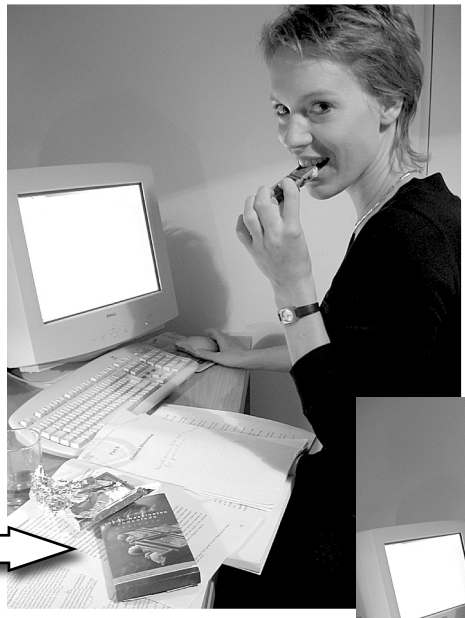
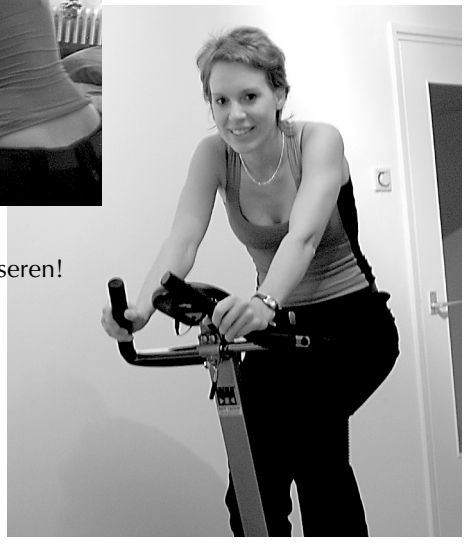
En tot slot!



Dit proefschrift had niet tot stand kunnen komen zonder:

Om de moeilijke momenten door te komen...



...zonder wie ik dit nooit had kunnen compenseren!

CURRICULUM VITAE

Birgitte Wammes was born on November 7, 1977 in Warnsveld, the Netherlands. In 1997 she passed secondary school (Gymnasium β) at the Isendoorn College in Warnsveld. Birgitte Wammes received a Master of Science degree in human nutrition at Wageningen University in 2002 with the specialization's communication and innovation studies and lifestyle and health. Her thesis was an implementation study to support the development of evidence based dietetic care for oncology patients in the Academic Hospital in Utrecht. For her second thesis she went abroad for doing a research project at Liverpool University and John Moores University. This research project was for the North West Food and Health Task Force to get an overview of the important food and nutrition issues in the North West of England, in preparation for the WHO First Action Plan for Food and Nutrition Policy.

In 2002, she started working on the present thesis as a PhD-student at the Department of Public Health at Erasmus University Rotterdam. The main research project she worked on is described in this thesis. During her PhD she obtained her Master of Public Health degree at the research school NIHES from Erasmus University Rotterdam.

From June till December 2006 she was employed as a senior researcher at the RIVM (National Institute for Public Health and the Environment) in Bilthoven to work on the scientific foundation of a nationwide action plan entitled 'Energie in Balans' aimed at prevention of overweight in the Netherlands.