

## **Executive summary:**

TEMPEST is a research project that has been running from 2009 to 2013 in nine European countries: Belgium, Denmark, Finland, Germany, Netherlands, Poland, Portugal, Romania, and UK. TEMPEST stands for Temptations to Eat Moderated by Personal and Environmental Self-regulatory Tools, which represents the main aim of the project: find out in what way adolescents (10-17 years of age) can learn to regulate their food intake in a food replete environment. Almost 15,000 adolescents participated in the project.

The TEMPEST projects entails six Work Packages (apart from a management WP): Assessing health-related self-regulatory competence (WP2), Macro-environmental influences on self-regulatory competence and weight-related behaviours (WP3), Meso-environmental influences on self-regulatory competence and weight-related behaviour (WP4), Impact of incentive schemes on weight-related temptations, self-regulatory competence and weight-related behaviours (W5), Impact of weight-related temptations on self-regulatory competence and weight-related behaviours (WP6), and Dissemination and exploitation (WP7)

Generally, findings support the TEMPEST conceptual model and show that the use of appropriate self-regulation strategies may help adolescents to effectively navigate today's obesogenic environment.

Specifically, TEMPEST research reveals that adolescents employ six distinct strategies for self-regulating their food intake - avoiding or controlling temptations; suppression, distraction, goal and rule setting, goal deliberation - implying that they have the skills to navigate the obesogenic environment successfully. Interventions should take account of this and speak to the self-regulatory competence adolescents possess. To assess the use of self-regulation strategies and to evaluate interventions, the Tempest Self-regulation Questionnaire for Eating (TESQ-E) questionnaire was developed and validated in nine European countries.

Our research further suggests that adolescents' use of self-regulation strategies is critical in understanding the role of environmental factors in eating behavior: the use of self-regulation strategies was shaped by the influence of, for instance, eating-related practices and norms of parents and peers, family food cultures, and exposure to food-related advertising. The use of self-regulation also attenuated the influence of access to unhealthy foods on eating behavior, illustrating that health promotion should not solely focus on the complex task of changing the food environment, but that young people also need to be

taught strategies to effectively deal with today's access to excess. Finally, it was demonstrated that pre-exposure to food temptations may help to build self-regulation. Adolescents in schools that allow unhealthy food but at the same time encourage healthy consumption (e.g., by providing healthy alternatives or price discrimination of unhealthy foods) show decreased intake of unhealthy foods. These findings lend themselves for application in novel 'behavioral vaccination' interventions. Main TEMPEST findings have been described in a TEMPEST handbook (available in nine languages) that is specifically aimed at informing health professionals, parents and teachers about the role of self-regulation in the prevention of overweight.

## **Project Context and Objectives:**

The majority of European children and adolescents find themselves living in 'obesogenic environments' characterized by a multitude of unhealthy and easily accessible temptations, which have had a profound impact on their dietary habits and physical activity. Healthy diets are being replaced by fast foods, snacks and soft drinks, while sports and outdoor activities are increasingly competing with computers and other sedentary activities. This tempting environment is largely responsible for the dramatic increase in the number of overweight children and adolescents across Europe, making overweight one of the most important health issues in the European Union (e.g., World Health Organization, 2007). The possibilities to restrict such weight-threatening temptations are limited and, as such, these temptations place a great demand on youth's self-regulatory competence; that is, their ability to regulate their behavior in the midst of competing options that challenge commitment to a personally relevant goal such as adopting healthy weight-related behaviors. Self-regulatory competence, which includes controlling one's impulses for immediate gratification and planning for long-term goal pursuit, can greatly influence one's ability to continue to strive for and achieve a healthy lifestyle in spite of the many temptations from the environment. The TEMPEST project aims to analyze both existing and novel incentive schemes for the prevention of overweight and highlights the role of self-regulatory competence as the key concept for explaining and beating the epidemic of overweight in European youth.

The primary aim of the TEMPEST project is to investigate to what extent the improvement of self-regulatory competence will allow children and adolescents to deal with unhealthy temptations in their environment. This approach places young individuals centre stage, thereby taking an alternative approach from traditional prevention programs which are generally aimed at making unhealthy temptations in the environment less available. Such environmental interventions for regulating health behavior at a population level (e.g., by employing (non)financial incentive schemes, such as pricing of foods or banning products) hold great promise for a public health approach to the problem of overweight in youth, but so far they have had only modest success. In the present project, it is argued that positive effects of environmental approaches are contingent upon how young people respond to such encouragements for altering their behavior.

The main idea of the TEMPEST project states that self-regulatory competence is a crucial element in learning to deal with food temptations that are almost unavoidable in the modern environment. This hypothesis is derived from theories which state that external regulation (i.e., by means of environmental interventions) may have counteractive effects and corrupt intrinsic motivation for health behavior, if applied without simultaneously increasing the ability for self-regulation.

The project has four specific major objectives:

- 1) To develop a TEMPEST Self-Regulation Questionnaire for Eating (TESQ-E) for adolescents (10-17 years of age) that is culturally valid across Europe and assesses to what extent and in which ways adolescents deal with unhealthy weight-related temptations in their environment.
- 2) To determine the impact of (non)financial incentive schemes, based on an analysis of existing schemes that are currently employed in programs for the prevention of overweight, as well as macro- and meso-level socio-economic and socio-cultural factors on self-regulatory competence, weight-related behavior, and weight status.
- 3) To examine the influence of new experimental incentive schemes on weight-related temptations, self-regulatory competence, and weight-related behavior.
- 4) To determine the impact of temptations on self-regulatory competence and weight-related behaviors in social contexts that differ in their appreciation of self-regulatory competence and to test experimental preventive interventions based on the results.

The model emphasizes how (non)financial incentive schemes, operating at the macro- or the meso-level, may affect the way young people perceive unhealthy temptations in their environment and deal with them. The model also highlights the role of self-regulatory competence for dealing with temptations as a proximal determinant of weight-related behaviours in terms of activity and eating, and subsequent weight status.

Nine countries participate in the TEMPEST project: Netherlands (Utrecht University), Belgium (Katholieke Universiteit Leuven), Denmark (Aarhus University), Finland (National Institute for Health and Welfare), Germany (University of Konstanz), Poland (Warsaw School of Psychology), Portugal (Technical University of Lisboa), Romania (Babes-Bolyai University), and UK (University College London).

## **Project Results:**

### **4.1.3.1 TEMPEST Highlights**

#### **Identifying and assessing self-regulation strategies to ensure healthy eating**

Our research reveals that adolescents recognize and employ six distinct strategies for self-regulating their food intake - four relating to food temptations (avoiding or controlling temptations; suppression; distraction) and two relating to healthy eating goals (goal and rule setting; goal deliberation) - implying that they have the skills to navigate the obesogenic environment successfully. Interventions should take account of this and speak to the self-regulatory competence adolescents possess. To assess the use of self-regulation strategies and to evaluate interventions, the TESQ-E (Tempest Self-regulation Questionnaire for Eating) was developed and validated in the nine European Tempest countries. The instrument is available in eight different languages.

#### **Macro- and meso level environmental influences on self-regulation and eating**

Our research suggests that young people's use of self-regulation strategies is critical in understanding the role of environmental factors on their eating behaviours. Specifically, the use of self-regulation strategies was shaped by and attenuated the influence of a diversity of factors in young people's environment, including the eating-related practices and norms of parents and peers, family food cultures, and exposure to food-related advertising. The use of self-regulation also attenuated the influence of access to unhealthy foods on young people's eating behaviours, illustrating that health promotion should not solely focus on the complex task of changing the food environment, but that young people also need to be taught strategies to effectively deal with today's access to excess.

#### **Social images of food among adolescents**

Sweets and snacks have a great positive social value, which may unintentionally promote the consumption of these products. For example, young boys assumed that popular in comparison to unpopular peers have a pronounced preference for sweets and snacks but that they chose fruits only rarely when given the choice. Complementing this picture, young girls also assumed that popular boys in comparison to unpopular ones show a pronounced tendency to choose sweets and snacks rather than fruits. Children who ascribed popular peers a greater consumption of unhealthy food items reported a greater consumption of these snacks. Importantly, our research also demonstrated that the valence of the foods' social image can be successfully adjusted, which may in turn affect the spontaneous intake of these foods.

### **Pre-exposure to food temptations to enhance self-regulation of eating**

In a series of experimental studies it was demonstrated that pre-exposure to food temptations may help to build self-regulation. By pre-exposing youngsters to sweet temptations (while they do not consume the sweets to which they are pre-exposed), they seem to alter their perceptions of these foods. Youngsters subsequently ate less from foods from the same food category they were pre-exposed to. Schools that allow unhealthy food at school but encourage healthy consumption (by for instance providing healthy alternatives or price discrimination of unhealthy foods) appear to produce similar behavioral effects as the lab situation. The effect of temptation appears to cumulate across occasions and over time. We found preliminary evidence that this pre-exposure effect may be implemented into a behavioral vaccination program.

#### **4.1.3.2 Main findings**

### **The role of self-regulation in healthy eating**

Eating healthily requires a great deal of self-regulation. Self-regulation refers to everything people can do to adjust and change their own thoughts, feelings, and behaviors in order to achieve a personally valued long-term goal (e.g., eating healthily, maintaining a healthy weight). For example, self-regulation is required when we find ourselves confronted with a conflict between the urge to indulge in delicious but unhealthy food and our intention to maintain a healthy weight. As human beings, we are not simply slaves of our drives and impulses. Instead, we can use our mind to choose to pursue alternative behavior. To give a simple example: most adolescents are aware that by studying hard in high school, their chances of success later in life are likely to increase. On a day-to-day basis, however, many adolescents have problems overcoming their impulse to, for instance, play videogames. In order to successfully forego this impulse, there are self-regulation strategies at our disposal that enable us to choose behavioral alternatives for our primary drives. Adolescents, too, possess such self-regulation strategies, although not all adolescents are equally skilled at self-regulation. Some adolescents are better able to regulate their behavior, while others find it more difficult to resist immediate temptations.

Self-regulation is related to, yet different from what is often talked about as 'willpower'. Willpower is defined as the ability to forego an immediate pleasure (for example, a nice-tasting piece of cake) in the service of achieving longer-term goals (such as staying healthy and keeping a normal weight). Being able to 'delay gratification', as this ability is referred to, can be considered a central goal of self-regulation and self-regulatory strategy use. Delaying gratification is not easy for adolescents (nor for their parents, but that is a different story). This is mostly due to the fact that, for instance, eating some crisps when watching TV is very attractive in the here and now, while the benefits of an alternative will only pay off in the future. As the ability to oversee long-term consequences of an action does not fully develop

until adulthood, adolescents are typically more focused on the present and short-term gratification. If they want to eat something that tastes good now, it is hard for them (even harder than it already is for adults) to contrast this short-term pleasure with its longer-term consequences. Nevertheless, (some) adolescents are able to successfully delay gratification. Moreover, there are ways to help adolescents achieve delay of gratification.

### Self-regulation strategies

One of the main objectives of the TEMPEST project was to identify self-regulation strategies that adolescents can, and indeed do, employ to pursue healthy eating habits while navigating the tempting food environment. TEMPEST research with adolescents identified three basic categories of self-regulation strategies. More specifically, self-regulation may be directed to:

- 1) reduce the temptations we face in our daily food environment,
- 2) reduce the value that is given to a temptation, or
- 3) support the healthy eating goal. Each of these three categories can be further subdivided in two specific self-regulation strategies. These categories and strategies are further explained in Box 1.

#### Box 1: Categories of self-regulation strategies

Category	Strategy	Example
Reduce the temptations	Temptation avoidance (Strategy 1)	Avoid the candy department in the supermarket
	Temptation control (Strategy 2)	Make sure the crisps are stored in the cupboard and out of sight while watching TV
Reduce the value of the temptations	Distraction (Strategy 3)	Keeping busy with something else, when feeling hungry before dinner
	Suppression (Strategy 4)	Ignore the smell of tasty food when passing a bakery
Support the healthy eating goal	Goal and rule setting (Strategy 5)	Make a rule about how many candies you can have per day
	Goal deliberation (Strategy 6)	Think about whether you really want it, when you feel to urge to snack unhealthy

These six self-regulatory strategies that were identified in TEMPEST research with young people across Europe formed the basis of the Tempest Self-regulation Questionnaire for

Eating (TESQ-E) which was the center point of the TEMPEST research project. In the following, we will first explain what each of these strategies entails, provide important research results and describe the experiences and points of view of adolescents themselves, as well as the suggestions of parents and health professionals. Also, some examples are provided about how the use of the self-regulatory strategy at hand may be bolstered in youngsters.

### **Strategy 1: Temptation Avoidance**

Temptation avoidance explained: A temptation exists when a short-term goal (for example, to eat something tasteful like chocolate) competes with a long-term goal (for example, to stay lean and fit). Temptation avoidance refers to different ways of distancing oneself from situations that may challenge the intention to eat healthily. Rather than entering such a situation and then hoping for the best, temptation avoidance is a preemptive strategy that keeps people from entering the situation at all. Examples of ways to do so are diverting one's gaze when walking past alluring fast food stores or physically staying away from places known to have particularly appealing, unhealthy foods. Importantly, staying away from tempting situations prevents people from having to exert immense amounts of willpower to handle a tempting situation, thus saving willpower for other tempting situations that cannot easily be avoided. TEMPEST research showed that almost 40% of adolescents frequently use the strategy of avoiding temptations. To get a feeling of what adolescents reported to do in order to avoid temptations, see Box 2.

### **Box 2: TESQ-E temptation avoidance items**

1. If I am in town, I make sure that I don't go by fast-food places
2. If I pass a bakery, I avoid looking at display in the window
3. If I go to the supermarket, I avoid the candy department
4. If I am bored, I stay away from the kitchen

Important research results: There are simply too many temptations in our environment to be able to resist them all. In order to successfully regulate eating behavior, it is therefore important to teach oneself smart ways of avoiding part of these temptations. Research shows that the mere opportunity to eat unhealthy food can affect intake (for example, we know that people who live close to fast food outlets weigh more than people who live further away from one), so if there is a way to avoid walking past these outlets on the way home, this already will impact eating behavior in a positive way.



What adolescents say: Unhealthy foods, such as chips, candy and pizza, are things that adolescents identify as “temptations” because they taste so good. Knowing that these high-calorie, low nutrition foods are not good for them, adolescents told that they would sometimes avoid situations in which such foods are present as a strategy for eating more healthfully, stating, for example, that they could 'keep themselves away from places where junk food is sold'. In other words, adolescents felt that they could remove the temptation to eat unhealthy by physically staying away from it and thereby avoiding the tempting situation altogether. On the other hand, adolescents also noted that it is simply not always possible to avoid temptations. They say that at parties, for example, snacks and treats are unavoidable. In those situations, additional self-regulation strategies are thus required.

How to use and improve temptation avoidance: Temptation avoidance can be improved in adolescents by helping them apply this strategy at the right moments. Adolescents need to learn at what points in time they are especially vulnerable to temptations. Parents can support them by, for example, helping them to recognize the effects that hunger and tiredness have on their self-regulatory capacity. Monitoring might be useful to gain insight into these crucial moments. A practical tool for helping youngsters learn to monitor their eating behavior is to keep a simple snack monitoring diary for a particular period of time (see Box 3). The diary will, after keeping it for some days, help adolescents recognize certain patterns in their eating habits - including the situations in which they typically give in to temptations and that would thus be better to avoid.

### **Box 3: Example of a snack monitoring diary used in adolescents**

Where were you?      With whom?      What feeling?

- home
- school
- train station
- on the road
- bar or cafe
- fast-food place      ☐ shopping mall
- park
- cinema
- visiting someone
- party

- different, namely
- alone
- class mates
- boy/girlfriend
- friends
- family
  - acquaintances
- strangers
- different, namely:
  - bored
  - tense
  - sad
  - excited
  - nervous
    - happy
  - afraid
  - aroused
- different, namely:

Were you really hungry?

- yes - no

## **Strategy 2: Temptation Control**

Temptation control explained: Temptation control is a strategy that can help youngsters decrease the lure of tempting foods. This strategy deals with removing cues that prompts unhealthy eating and with adding cues that encourage healthy eating. Without necessitating big changes to daily lives and living environments, this strategy entails making smart and small adjustments that can gently steer behavior in the right direction. Importantly, such small adjustments are easy to implement and, perhaps even more important, are also easy to follow - without usually requiring much conscious effort. Temptation control is different

from temptation avoidance in that it is not about avoiding temptations, but about restructuring one's food environment so that it becomes less tempting. More than half of the adolescents in our research said to frequently use the strategy of controlling temptations (see Box 4).

**Box 4: TESQ-E temptation control items**

1. If I want to have a treat, I take a little bit and put the rest out of sight
2. If I am watching TV, I make sure that the crisps are out of reach
3. If I am behind the PC, I make sure there is some healthy food within reach
4. If I want to eat candy, I take a few and put the rest of the bag away

Important research results: There are different ways to go about temptation control. When adolescents are young, the easiest and most effective way may seem to forbid unhealthy foods all together, and thus restrict access to any kind of temptation. Research indicates, however, that such complete restriction can get adolescents into trouble later on: adolescents who were restricted may consume much more of unhealthy foods when these become available at a later point, than adolescents who were allowed to eat sensible portions of unhealthy foods. In a similar vein, although we would think that larger portions of unhealthy food are dangerous and smaller portions less so, this does not necessarily seem to be the case. For people who want to watch their eating habits, a small (and therefore seemingly rather harmless) portion of unhealthy food may not trigger any alarm bells. If such warning signs are not present, people may not feel the need to arm themselves against the temptation. In the case of a large temptation, on the other hand, alarm bells are more likely to go off, thus activating self-regulation strategies to resist the temptation - resulting in less consumption. TEMPEST research indeed showed that girls who have the goal to watch their eating habits consumed more from a candy which they previously indicated was not that tempting, and less from a candy which they previously indicated to find very tempting. This was only found in girls who had the goal to watch their eating behavior; girls who did not have such a goal consumed equal amounts of both types of candy.

It thus seems that, to learn to deal with temptations, at least some exposure to temptations is necessary. Of course, such exposure should happen in a supportive and supervised environment, where parents help their children to learn to control their eating behavior and to deal with temptations in a smart way. Rather than omitting all tempting foods from our environment, it seems more important to reduce the 'temptingness' of these foods. TEMPEST research demonstrated that one way to expose adolescents to temptations in a supportive manner, and that helps adolescents to effectively control temptations, is by making the temptation more abstract. For example, when asking adolescents to make a

flower out of small candies, they subsequently ate less of this candy than a group of adolescents who first made a flower out of Lego blocks. In other words, looking at the candy first as 'building blocks' for a flower, rather than as something delicious and attractive, helped adolescents resist its temptation (see Box 5).

#### **Box 5: Candy as building blocks**

TEMPEST researchers asked adolescents to make a flower either from small pieces of candy or from Lego blocks. After they had done so, they were allowed to eat as much candy as they liked from a bowl. The adolescents who had already used the candy as building blocks for the flower ate less than the adolescents who had built the flower out of Lego and had thus not yet been exposed to the candy. The idea behind this finding is that the children who constructed a flower from candy were exposed to the very subtle message that candy is not for eating and that they should not eat from the candy. Below is a graph showing the results and a picture taken from the flowers the adolescents created with the candy pieces.

What adolescents say: Through our communication with adolescents it is clear that they understand what food temptations are and that they also realize how tempting foods can influence their eating behavior. They also describe several methods for trying to deal with these temptations in a good way. For example, adolescents said that they could 'put out healthy things when they start watching TV, so that you can reach them easily.' In this manner, adolescents actually suggest creating a nudge for healthy eating, simply by making healthy foods easily accessible. They also use food (in)visibility as a cue to remind them what they 'should' eat. For example, they suggest 'putting the candy jar in the cupboard, so that you're not tempted by its sight'. What is important to note is that adolescents themselves also do not suggest removing temptations altogether (by not buying candy at all, for example). Rather, they suggest handling these temptations in a way that makes it easy to keep the temptations under control. Adolescents thus have rather good knowledge of temptation control strategies. However, they do not always follow their own advice. The role of parents and health professionals should then be, firstly, to model use of these strategies, and secondly, to help adolescents to actually implement these strategies and implement them at the right time (namely, when they are confronted with a temptation).

How to use and improve temptation control: Parents are often in doubts about the best ways to teach adolescents to deal with temptations. As was mentioned above, a total 'no-go' approach in the long term is likely to be counterproductive. Instead, some level of exposure seems to be important. Mere exposure however is not enough; parents cannot just put some unhealthy food in front of their child and hope for the best. In this manner, exposure to temptations is likely to backfire and actually cause a child to overeat. Optimal results are obtained when parents create a supportive, supervised environment in which to expose adolescents to temptations.

It is important to consider the synergies between the strategies of temptation avoidance and temptation exposure, which may, on first sight, seem to contradict each other. This is, however, not the case. Common sense teaches that it is impossible to always avoid temptations. The research on temptation control teaches that this is also not desirable, as adolescents need to learn how to handle tempting situations: avoiding temptation is the best option when adolescents are vulnerable to giving in to temptations, for example when they are hungry or tired (at times, in other words, when their self-regulatory capacity is momentarily low). Exposure, on the other hand, should be most effective when this capacity is high and when the environment is self-regulation supportive.

### **Strategy 3: Distraction**

Distraction explained: In the current obesogenic environment, people sometimes encounter food temptations that they cannot simply control or avoid, because they are out of their hands. Other strategies aimed at diminishing the impact that the temptation has on people (rather than aiming to control or avoid the temptation itself) are in place in those cases. A powerful tool human beings have at their disposal for this is attention: people can control what they pay attention to in their environment. Temptations, with their attractive and luring properties, typically draw attention and make it hard to resist them. However, if people are able to move attention away from the luring temptation, it will be easier to forego the impulse to consume the tempting food. A strategy to take attention off of temptations is distraction, allowing to focus attention on something else than the appealing but unhealthy and high-calorie foods and drinks that find their way into the immediate environment. About 45% of the adolescents said to use the distraction strategy regularly; see the items included in the TESQ-E (Box 6).

#### **Box 6: TESQ-E distraction items**

1. If I feel tempted to buy candies, I distract myself
2. If I feel like eating something, I call a friend instead
3. If I am getting hungry before dinner, I try to keep myself busy
4. If I have the urge to eat candy, I find something else to do

Important research results: Attention allocation and distraction have long been identified as supportive of successful self-regulation in adolescents. In the groundbreaking research on delay of gratification by Mischel et al., children were presented with a choice between an immediate but smaller attractive reward (e.g., one marshmallow) and a delayed but larger reward (e.g., two marshmallows). Several strategies were identified that can help adolescents hold out for the larger reward. One of the most potent strategies was distraction. Children who spontaneously directed more of their attention to other aspects of

the room in which they were waiting than to the reward could delay gratification for longer than children who focused more of their attention on the reward.

**What adolescents say:** Adolescents indicate that food temptations can be very attention-drawing. Some say that it is almost impossible not to pay attention to their favorite snack or a bowl of nice-looking candies. This shows that youngsters understand the lure of tempting food. Nevertheless, adolescents know that by distracting themselves, they can decrease that attention-grabbing spell that unhealthy food can place on them. On the basis of our work with almost 100 young people who helped us with identifying eating-related self-regulation strategies, we distinguished several prototypical instances of the use of distraction to 'stay on track' as far as resisting food-related temptations is concerned.

**How to use and improve distraction:** Distraction is a self-regulation strategy with which many youngsters and their caretakers presumably are familiar. The child that is hungry before dinner, for example, can be helped to take his mind off of the food that is still some time away by engaging him in a game or giving him a book to read. Beside such external distraction provided to the child by a parent or other adult, adolescents can also be taught ways to distract themselves (i.e., how to use internal distraction). Forming if-then plans can facilitate distraction (see Box 7). In simple 'if-then' plans one specifies what one should do in a certain situation. As an example, an adolescent could make the plan that 'if I feel tempted to have a snack, then I will distract myself by reading a book'.

### **Box 7: If-then plans**

If-then plans are simple devices that help people to enact something they find important. For example, if Sarah would want to eat more healthily, and stay away from the unhealthy snacks in her home, she could formulate the goal 'I want to eat less unhealthy snacks'. However, simply specifying a goal is not going to help much because people tend to forget about their goals when they get busy with other things. Formulating an if-then plan can be a great help in making these goals better achievable. Specifying an if-then plan means that you name an opportunity for, in Sarah's case, eating less unhealthy snacks (the if- part) and link this opportunity to the desired behavior (the then-part). Sarah could say: 'If I am watching television at night and I feel like a snack, then I will call my friend Rosie'. Numerous studies have proven the effectiveness of the simple plans. For example, when if-then plans are made to decrease the consumption of unhealthy snacks, the amount of calories consumed from unhealthy snacks decreases by as much as 100 calories per day. It is important to mention that forming if-then plans is not useful for distraction only, but can also be helpful to facilitate other self-regulation strategies such as avoiding temptations ('If I am at a party, then I will stay away from the table with treats') or controlling temptations ('If I want a snack, then I will take a little bit and put the rest out of sight').

#### **Strategy 4: Suppression**

Suppression explained: An important way to support the self-regulation of eating behavior is by not paying attention to temptations. One way to do this is to distract oneself. Another important strategy that centers on attention is the strategy of suppression. Suppression entails everything that can be done to ignore and reject temptations with the strength of mind: pushing out of our mind any thoughts about both the food itself and its tempting qualities (e.g., its taste) and thoughts about ourselves in relation to that food (e.g., wanting to eat it). Suppression also entails the psychological techniques that can be used not to engage with a temptation (e.g., to tell yourself 'no' every time you feel like a snack). The technique of suppression thus relies to a large extent on willpower; or the higher 'executive' to put a stop on what impulses might suggest and be cognitively strong enough to control behavior. Frequent use of the suppression technique was reported by almost 40% of the adolescents (see Box 8).

#### **Box 8: TESQ-E suppression items**

1. If I pass a bakery, I ignore the smells of tasty foods
2. If I want to eat unhealthy things, I just tell myself 'no! '
3. I use willpower to stay away from unhealthy snacks
4. If I go to a party with lots of snacks, I ignore the food

Important research results: While suppression is likely to be beneficial in some instances, its applicability may be limited. Important research has shown that suppressing thoughts, feelings and emotions does not happen automatically but require what is referred to as self-control strength to not think about tempting foods and eating them. People do not have a limitless supply of self-control strength; when it is used too much, the self-control resource gets depleted. This is why Tempest researchers suggest using other, less depleting self-regulatory strategies for healthy eating whenever possible. This way, self-control resources can be saved as much as possible for those instances when other self-regulatory strategies really cannot be applied. There are indications that suppression of thoughts and feelings in general (even if not directly related to eating) may be bad for healthy eating intentions. Tempest researchers showed people a sad or scary movie and told them to suppress all their emotions while they were watching. People were being told that there was a camera on their faces, and people watching their face should not be able to see any signs of emotional distress. When these people were then placed in a situation in which there was good-tasting but unhealthy food available, they ate more of this food than people who watched the same movie but who did not have to suppress their emotions.

What adolescents say: Interestingly, adolescents indicate using suppression most often of all strategies, together with temptation avoidance. They told things like: 'in order to ensure that I eat healthily, I just tell myself 'no' when I want to have a snack'. As just described, however, such suppression of temptations using willpower can only be successful for a limited period of time. The fact that adolescents indicate using this strategy most often may thus not be very positive; it may mean that they tend to fall back onto suppression, a strategy that is beneficial only in the short run, too often, leaving them vulnerable in situations where temptations endure or quickly follow each other. That they rely on suppression so much could be an indication that the self-regulatory competence of adolescents is not yet fully developed. Moreover, it may also be an indication that youngsters cannot yet always estimate accurately how luring tempting foods are, and how enduring this temptation can be: they may feel that simply suppressing an urge to consume unhealthy foods will be sufficient to withstand the temptation, whereas in reality their suppressive power will quite often not be forceful enough to withstand the temptation. Ideally, adolescents should rely more on other strategies, and use suppression only sparingly.

How to use and improve suppression: Suppression is a strategy that consumes a lot of mental energy. It can therefore only be applied for short periods of time, after which the energy needs to be recovered. Adolescents should be made aware of this limited applicability of suppression and that relying on suppression too much will leave them vulnerable to temptations. On the other hand, suppression is not a useless strategy by any means. There are certain situations in which a temptation cannot be avoided or controlled and distraction is impossible. In such cases, suppression is a valuable savior and should certainly be put to good use. Box 9 describes how self-control may be improved.

### **Box 9: Training the self-control muscle**

Researchers have discovered in experiments with late adolescents (university students) that suppression is difficult to maintain, because it consumes so much energy. However, suppression is easier if you train the self-control muscle that helps to inhibit undesired urges and impulses. This training is easy: just engage in doing something that you don't like very much for a few minutes every day for a couple of weeks. Why is this simple exercise so effective? The idea behind repeated training of willpower is that you get used to doing things that are not your primary urge or desire. By doing so, you learn to resist competing desires and continue doing the thing you might not actually want to do most. Importantly, training the self-control muscle in one domain transfers to other behavioral domains. So, when an adolescent would lay the table for dinner in the evening (something he hates to do) for several weeks in a row, instead of sitting in front of the television right up to the start of dinner, chances are higher that he would also become better in his efforts to resist his bad habit of having candies while watching television.



### **Strategy 5: Goal and rule setting**

Goal and rule setting explained: Goal setting is a way of considering what someone would really like to accomplish in the future and putting this into a clear and concise statement. A healthy eating goal entails more than a vague intention to eat more healthily. From our conversations with adolescents, it is known that most of them will express such intentions. Nevertheless, only some of them show behavior that is in accordance with these vague intentions. Adopting a healthy eating goal means that someone has thought about what he doesn't like about his eating habits and has a genuine desire to change it. A good goal helps to achieve this because of the inspiration that people can get from the idea that things will be different in the future. Of course, just having a goal in mind is not sufficient for making changes, even if this goal is concrete and inspiring. Goals themselves set a standard for change, but they don't specify what should be done on a daily basis to make progress toward that goal. One way of staying on track is to create rules that indicate appropriate moments to act in accordance with the goal or that determine what kind of behavior is off-limits. Setting rules means that someone has thought about specific ways and moments to take action toward the goal and has decided to behave in line with those rules. Especially for youngsters, breaking up a 'large' long-term goal into simple and specific rules will help them stay on top of their game.

See Box 10 to get an idea of what goal and rule setting contains. It is very common to use goal and rule setting; about 47% of the adolescents reported frequent use of this strategy.

#### **Box 10: TESQ-E goal and rule setting items**

1. I plan to bring a piece of fruit to school
2. I have an agreement with myself about how many candies I can have per day
3. If I want to eat a snack, I take a piece of fruit first
4. I set goals to eat healthily for myself

Important research results: Not all goals are good goals. For instance, the goal 'I want to eat more healthily' is not a good goal, since it is very hard to determine when you are making progress toward that goal: is adding one apple per day to your diet goal progress? Goals only help to realize healthy eating ambitions if they are concrete and specific. This is important especially for adolescents, who have an even stronger need for concrete, measurable goals. Grasping abstract or vague goals that are set far in the future is hard for them to do. The goal to eat two pieces of fruit per day for the next month is thus better than the less specific goal 'I want to more fruit for the rest of my life'. Goals with a clear timeframe are also more helpful. A child aiming to eat more fruits by the end of the week has a better chance to succeed than a child who wants to eat more fruits without specifying when this has to be

accomplished. Importantly, goals should also be attainable. It makes no sense to aim for the impossible and state 'I will never eat candy again'. A child setting such a goal will set himself up for failure, even if it has true healthy eating intentions. Our research has shown that another important aspect of goal setting is that adolescents should not set goals without considering whether they are really committed to these goals. Even when attainable, a goal that actually does not represent a desired endpoint to a child or adolescent will not motivate him to adapt his behavior. This also means that goals should not be imposed upon adolescents; goals work best if they are self-determined and represent something that is desirable for the child himself.

What about rule setting? While goals are an expression of commitment and motivation to accomplish a personal ambition, there are numerous situations that challenge goal striving on a daily basis. For instance, adolescents may forget about their goal because there are competing activities. In such cases, rules are a great help to persist in goal pursuit. With a rule in mind, one does not have to deliberate all the time whether or not to act in accordance with the goal; rules allow for sticking to a routine. Our research has shown that adolescents are very creative in formulating their own rules and have a good understanding of the situations that pose suitable opportunities to enact their goal.

What adolescents say: In our conversations with adolescents, we have learned that many of them do not spontaneously name specific goals that they would want to pursue, although they are aware of the importance of goals. This indicates that they might benefit from some support in formulating healthy eating goals. Adolescents do, however, recognize the importance of setting rules to regulate their food intake, instead of relying on momentary decisions at difficult moments. One particularly popular type of rules adolescents name is the creation of routines or habits, such as 'take a piece of fruit every day right after school'. This kind of rule stipulates typical times and places that make it easier to adhere to a goal, in this case a fruit consumption goal. A related category of rules specifies healthy alternatives at difficult moments, such as when watching television or when being bored or stressed. Apparently adolescents have a good sense of situations in which they tend to forget about their goals and know how to create specific rules or 'coping plans' for handling those situations. Another type of rule adolescents expressed relates to allowing themselves unhealthy foods at special occasions, rather than banning these foods altogether, such as 'only eat crisps in the weekend'. Adolescents also repeatedly referred to their parents in helping to create a healthy eating-friendly home environment that would make it easier for them to stick to healthy eating goals and rules. For instance, adolescents told us that they would want their parents to bring less candy and crisps to the home or to help them to prepare a healthy school lunch.

How to use and improve goal and rule setting: Various parents expressed concerns about their own role in helping adolescents to formulate goals and rules for eating healthy. Parents

were reluctant to impose goals and rules that their children would not agree with. Many parents indicated fearing that such authoritarian parenting would backfire, with adolescents eating unhealthily behind their parents' backs. Indeed, research has indicated that goals must be self-determined at least to some extent; youngsters are motivated to change behavior only if this leads to the achievement of a goal that matters to them personally. On the other hand, however, parents do feel the need to impose some standards because a complete laissez-faire attitude would likely also not lead to the best eating behavior in their adolescent child. An important middle road between these two paths is being 'authoritative' (not authoritarian and not laissez-faire). This means that, as a parent, one's role is to help adolescents set goals and rules that reflect their own desires, within a framework of standards that parents find important. Adolescents also expect such guidance from their parents, indicating that they are generally not able to ensure a healthy lifestyle all by themselves.

From our conversations with adolescents we have learned that they are very eager to formulate goals that help them in eating healthily, but find it difficult to specify such goals in appropriate terms. Because their ability to consider the future is still limited, adolescents may need some help in thinking about what they find important to accomplish when it comes to healthy eating. The 'do's and don'ts' in goal setting (listed in Box 11) provide some guidelines for formulating a goal that motivates youngsters to make realistic and age-appropriate changes in their eating behavior.

#### **Box 11: Do's and don'ts in goal and rule setting**

When it comes to goal and rule setting, the best advice is to be SMART and set Specific, Measurable, Attainable, Realistic, and Timely goals. Specific means that it is better to state that you want to 'eat an apple everyday' rather than 'eat more fruits'. Setting a specific goal means that you can determine whether you have accomplished the goal, which is easier to eat in case of a goal specifying the exact number and types of fruits. Attainable and Realistic means that there should be a fair chance that you can attain your goal: Never eating candy again is not going to work; eating candy in weekends only is. Timely means that there is a clear endpoint for evaluation of your progress, which should not be too far away in the future. That means that eating one piece of fruit everyday in the next two weeks is a good goal, but eating one piece of fruit without a specific timeline is not. Setting SMART goals is important, but don't forget - whatever type of goal you specify - that goals should represent something that you really desire. It makes no sense to formulate a healthy goal if it concerns something that other people tell you to do. After all, goal striving takes some effort and you should be ready to face that effort to avoid disappointment. Remember that goals shouldn't make adolescents worried but rather inspire them. Also, eating goals should not be dominating adolescents' lives as they have other important business to take care of, such as schoolwork, friends, and hobbies.

Adolescents can also be encouraged to think about rules. In fact, our research found that adolescents were very enthusiastic about the concept of rules. We were impressed by their ingenious rules that sometimes very neatly corresponded with recent research in psychology. For example, many adolescents are aware that they often eat mindlessly when watching television or playing computer games, which makes it almost impossible not to eat in those situations unless they have made a rule to prepare themselves for such dangerous moments. We therefore recommend that adolescents should be encouraged to reflect on and take (some) responsibility for their own situation. Schools and teachers play an important role here, as adolescents can learn from each other and together come to good and useful rules to achieve healthy eating goals. Schools can also help adolescents by imposing certain clear rules of their own, such as a fruit break at 10 am in primary school or serving hamburgers at the school cafeteria only on Fridays. Such rules will set a healthy example and, because the eating behavior of peers is of large influence on adolescents, (see Box 12), its effects can snowball. Witnessing one's peers leave unhealthy foods alone and grab instead for healthier alternatives will help other youngsters make healthier choices too.

#### **Box 12: The impact of peer eating behavior**

TEMPEST research has shown that the eating behavior of peers is of influence on youngsters' eating habits, indicating that implementing healthy eating rules in schools (but also in, for example, cafeterias of sports facilities) is of high importance. Whether adolescents snack and how much they snack is much more strongly influenced by their peers' snacking behavior, in some cases even more so than by the actual availability of unhealthy food items. When a popular peer eats unhealthy snacks, other adolescents will often snack too. In contrast, when a popular peer eats healthy fruits, most of them do not start to eat unhealthy snacks even if these unhealthy snacks are right in front of them.

#### **Strategy 6: Goal deliberation**

Goal deliberation explained: Once adolescents have formed goals and rules, it is sometimes necessary to do something to make sure that these goals remain important. In everyday life, most people have many goals that they want to pursue. Adolescents want to do well in school, be kind to others, fit in with their peers, and have an enjoyable time. Eating healthily may not always be the number one goal for adolescents. What's more, eating healthily may sometimes be in conflict with other important goals: if a child wishes to eat healthily but sees that his peers are all eating fast food during lunch break, the goal to fit in with these peers will compete with the goal to eat healthily. To make sure that youngsters will keep paying attention to their goals and rules for healthy eating, particular exercises exist that help to remind them of these goals. Such exercises are referred to as goal deliberation. Goal deliberation might help youngsters to stick to their healthy eating goals, even when they may feel tempted to violate these goals. Box 13 provides some of examples of goal deliberation that were mentioned by adolescents. Goal deliberation is the strategy that adolescents use most often. More than 53% report to frequently use it.

**Box 13: TESQ-E goal deliberation items**

1. If I want to have a snack, I try to realize that snacks are bad for your health
2. If I think I may be overeating, I think of how this may compromise exercising
3. If I want to take a snack, I remember that I want to stay attractive
4. If I feel like eating something unhealthy, I think about whether I really want it

What research has found: In our studies we found that adolescents who are concerned about their weight and who are motivated to eat healthily apply goal deliberation strategies most frequently. TEMPEST research has also found that the strategy of goal deliberation is used most often by adolescents who are able to resist indulging in immediate pleasures (such as a nice cake at a birthday party) with the aim to attain long-term goals (e.g., to keep a healthy body weight). An important prerequisite for being able to deliberate on goals is the ability to think about the future. If youngsters are not yet able to take the future consequences of their current acts into account, it is very hard for them to act upon these anticipated consequences. Research indeed showed that goal deliberation is used more frequently by children who think about the future (see Box 14 on future time orientation research).

**Box 14: Future time orientation**

Some people seem to think only about the present when making decisions. Imagine the adolescent who spends all of his pocket money on clothes, without considering that there will be no money left for later activities such as a game computer. Opposite to them are adolescents who seem inclined to scrutinize what might be the consequences in the future of taking a particular action today. Take for example a high school student who gathers information about the future career prospects of selecting a specific line of education. People like this high school student are said to have a future time orientation. Typically, people with a strong future time orientation value planning and might get worried if things don't get done in time. They generally approach big tasks by dividing it into subtasks and systematically complete these tasks before the deadline. Future time orientation develops between the ages of 10 to 25. Given that the future is very distant at a young age, it is not strange that youngsters are not strongly oriented towards the future. Thinking ahead 10 years in time is very different for a 10-year old child than for his or her 40-year old parent. Nevertheless, a future time orientation already pays off in the present. Our research showed that adolescents who had a relatively strong future time orientation, used goal setting and goal deliberation also more often than their peers who were less oriented towards the future. Moreover, future oriented adolescents were better able to delay gratification. Adolescents were allowed to choose between a small amount of candy that they would get immediately, or the double amount of candy which they would receive one week later. Those with a stronger time orientation were double as likely to wait a week for their reward.

What adolescents say: When TEMPEST researchers asked adolescents what they could do to eat healthily, many of the answers they gave reflected goal deliberation strategies. A distinction can be made between three types of such strategies. First, adolescents mentioned different ways in which they thought about the negative consequences of unhealthy eating or the positive consequences of healthy eating, and this would help remind them of the importance to eat healthily. For example, adolescents mentioned that if they wanted to avoid unhealthy foods, they reminded themselves that they did not want to become fat or they imagined what they would look like if they were overweight. A second type of strategies can be referred to as mindful eating. As we mentioned before, eating unhealthy foods often occurs in a mindless way. This means that sometimes eating goals and rules are violated without being aware of that. A great number of adolescents mentioned using strategies increasing the awareness of what and where they were eating. For example, they reported to take a moment to consciously consider whether they were really hungry before they decided to take a tempting snack. By taking such a short conscious break when in a tempting situation, adolescents make sure their healthy eating goal is not forgotten. A third type of goal deliberation strategies that some adolescents mentioned to maintain goals in focus is monitoring where, when and why they were eating healthy and unhealthy foods. Monitoring can be helpful in goal deliberation: when people keep track of what they are eating and in what situations, it also becomes clear when they lose sight of their goals and when they are violating their rules.

How to use and improve goal deliberation: There are several ways to improve goal deliberation. Goal deliberation strategies are often spontaneously promoted by parents and other caregivers, even if they may not realize that they are indeed promoting goal deliberation. Adults often urge adolescents to consider the negative consequences of their eating behaviors: 'Don't eat so many crisps or you will end up too fat' or 'Take some fruits because that will help to avoid getting a cold' can be common parental expressions. The underlying message seems to be absorbed well by adolescents, as they provided the same kind of statements when asked what they do to ensure their healthy eating. Since adolescents who think about the future consequences of their current dietary patterns are better able to control their eating behavior, it certainly is a good thing that parents repeatedly point to the importance of a healthy diet for a healthy (future) life. Another way of strengthening goal deliberation is to apply mindful eating exercises. When adolescents feel tempted to eat an unhealthy snack, it is good to take a small thoughtful break from that situation. Youngsters could take a moment to answer the following kind questions: 'Am I really hungry?' or 'Do I really want to have this food?'. Food cravings usually last only a few minutes and if a child is able to bridge these few minutes by taking a mindfulness break, he or she will be less likely to end up eating a snack, as the urge to have it will have faded away.

### **Improvement of self-regulation in the context of health promotion**

Various strategies exist that can help children and adolescents to adopt and maintain a healthy diet. In our research we further found that adolescents who used the strategies

more often, also reported to eat more fruits and vegetables, to eat less snacks and to drink less soft drinks. This illustrates that it indeed seems useful to apply the strategies. Importantly, already many adolescents seem to apply these strategies. In general girls are more likely to make use of strategies self-regulate their eating behavior than boys. This may be because girls tend to be more concerned with the importance of healthy eating. We also found that younger adolescents were more likely to make use of self-regulation strategies than older adolescents. While there are several possible explanations for this, it may in particular be the case that older adolescents, who generally spend more time away from home and experience more eating opportunities out-of-home than younger adolescents, are therefore more likely to run into tempting situations. While they may, in absolute terms, employ self-regulatory strategies as frequently as younger adolescents, the larger number of temptations would then mean that there are also more situations in which they fail to successfully employ self-regulation. The TEMPEST research further found indications that motivation and autonomy are important prerequisites for the use of self-regulation strategies. Adolescents were more likely to make use of self-regulation strategies if they were motivated to eat healthily desired to gain responsibility for their own behavior.

Parents might sometimes question to what extent they can still have an impact on their child's eating habits, in particular with older adolescents. Adolescence is characterized by a strong desire to gain autonomy and independence, and parents may feel that friends have a much stronger influence on the behavior of their child than they do as a parent. However, adolescents consider their parents important with respect to in healthy eating. Parents have an important influence on their children also through the food-related attitudes and practices they transmit to their children, which may reflect important differences between countries in food cultures (see Box 15).

#### **Box 15: Have your cake and eat it too? An exploration of differences in food culture**

The prevalence of overweight and obesity has been found to increase among adolescents (and adults) across wealthy nations. At the same time, substantial differences remain in the extent to which different societies are affected by weight problems and their health consequences. One such difference that has received much attention is the difference between the United States of America and France. Already several decades ago, researchers noted what has become known as the 'French paradox': the French consume more fat than Americans, but are less affected by cardiovascular disease. In an intriguing program of research, American psychologist Paul Rozin and French sociologist Claude Fischler jointly explored how differences in food culture may explain the weight-related differences observed between the USA and France.

In a series of studies, Rozin and Fischler first documented substantial differences in food-related attitudes between countries. They noted that for the French, food is a source of

pleasure in life, while for the Americans it is a source of concern over health. Through observations in restaurants and supermarkets, as well as analyses of cookbooks and restaurant guides, Rozin and Fischler also found evidence for differences in the food environment in France and the US. Explaining why the French may be thinner, they observed differences in portion size that suggest that the French eat less and value quality of quantity, while for the Americans quantity is most important. Observations in McDonalds food outlets in Paris and Philadelphia showed that the French spend more time eating and hence have more and more pleasurable food experiences.

In a further study, Rozin and Fischler found that Americans expect and value more choice of food on offer, such as in tastes of ice cream and in items on the menu in a gourmet restaurant. This may reflect a higher importance attached to catering to differences in individual preferences in the US, compared to a stronger focus on communal food values in France. In the Tempest project we found that when adolescents experienced a family food culture of shared meals, dinner in particular, that are eaten with attention and are seen as important, pleasurable, social events, they consumed significantly less snacks and soft drinks. Like the French, these adolescents experience a food culture that promotes moderation and enjoyment, suggesting they can have their cake and eat it too.

Moreover, research by the TEMPEST team has shown that the eating standards that parents have for their children are of stronger influence on adolescents' eating habits than the eating standards of friends. We therefore emphasize that parents continue to play an important role in their adolescent child's eating behavior. Naturally, other parties, like schools and (local) governments, may also influence the diets of adolescents through the services they provide and the rules they implement. When we asked the opinions of adolescents about different approaches that might help support their healthy eating, the important role that parents play was again apparent. Asking adolescents' opinions about various approaches further taught us that adolescents oppose approaches that limit their freedom of choice. Moreover, adolescents did not favor approaches such as increasing the price of, limiting the availability of or banning advertisements for unhealthy foods. (See Box 16).

#### **Box 16: Adolescent's views on approaches to improve their diets**

In the Tempest project, we asked almost 3000 adolescents from the Netherlands, Poland, Portugal and the United Kingdom about their opinions regarding of a number of approaches to support healthy eating in adolescents.

Resistance may occur when adolescents feel limited in their freedom of food choice. It is therefore important to be sensitive to this when attempting to influence food choice and to



provide supportive 'nudges' rather than to impose clear restrictions. Nudges are gentle and subtle hints to refrain from unhealthy eating without explicitly forbidding it, so that adolescents still can decide for themselves what they will do (see Box 17). Using nudges to influence food choices (called 'nudging') seems to lead to better eating behavior in adolescents than prohibiting the consumption of unhealthy food or than saying nothing and enacting a 'laissez faire' attitude. For parents, these findings are an important indication that while children certainly do not benefit from too much permissiveness, too much explicit restriction also does not bring about the best results. Youngsters do not want to be told what to do, but they do need guidance from their parents (and they also expect such guidance). Subtle nudges seem a promising route for providing such effective and acceptable guidance.

### **Box 17: Nudging**

Tempest researchers wanted to find out whether subtly nudging adolescents to refrain from temptation may be better for subsequent self-regulation than explicitly telling them to refrain from eating a temptation. To investigate this, we placed different types of candy and different types of wrappers in front of children, and asked them to perform a linking task: they had to identify which taste belonged to which wrapper. We explicitly said 'do not eat candy' to a first group of children (explicit condition). A second group of children did not receive additional instructions (nudge condition), but we expected that the linking task would provide a subtle nudge that eating from the candies might not be appropriate in this research setting. A third group of children received a similar task but without any candy present (control condition). Participants who were nudged not to eat candy subsequently ate less of similar candies than participants who were explicitly told not to eat candy or who were not exposed to candy. This suggests that it is better to nudge adolescents not to consume a tempting treat when they are exposed to it, than to forbid them to eat it.

## **Potential Impact:**

The main objective of the TEMPEST project is to gain insight into the interplay of characteristics of the obesogenic environment and the individual competencies of youth that may promote dealing with that environment. Whereas the majority of research has focused on one of both aspects, either highlighting specific environmental features to encourage healthy choices or highlighting individual self-control strategies to withstand the temptation of unhealthy food, the central notion of the TEMPEST project states that both components should be addressed in order to understand and beat the epidemic of overweight amongst youth. Specifically, after having completed the planned research we have convincingly demonstrated that self-regulatory competence plays a vital role in dealing with food temptations and that self-regulatory competence may be enhanced if young people have the opportunity to deal with their obesogenic food environments rather than banning food temptations from their environment which would prevent them from having experience with such temptations. These insights have been extensively discussed with national representatives from the participating countries at the final TEMPEST conference, leading to a call to action to various stakeholders (see below; also published in the Final TEMPEST Newsletter and at the TEMPEST website) and to a comprehensive TEMPEST Handbook explaining self-regulatory strategies for dealing with the obesogenic environment in adolescents to health professionals teachers, and parents (see below). Finally, TEMPEST research on social images of food and behavioural inoculation by guided exposure to food temptation has contributed to the identification of innovative prevention strategies that may support self-regulatory competence in the midst of plenty.

### **4.1.4.1 Impact**

An important aim of the TEMPEST project is to examine in what way self-regulatory competence for eating a healthy diet in adolescents can be improved. Self-regulatory competence has a key role in the health behavior change process that is considered most problematic, i.e. putting into practice one's good intentions for a desired behavior change. Many adolescents intend to behave more healthily, but postpone actual initiation of action, reflecting the so-called intention-behavior gap. When they do initiate action, they often fail to maintain the newly adopted behavior for prolonged periods of time because it takes much effort and continued motivation to persist in the new behavior. Self-regulatory competence is an effective tool to overcome both problems with actual behavior change because it may boost intrinsic motivation once people learn that they are able to regulate their behavior successfully themselves. Studies from the TEMPEST consortium provided convincing indications that self-regulation and autonomous decision making are essential in achieving desired behavior change. For example, it was demonstrated that refraining from a unhealthy snack was more difficult for individuals who were explicitly told not to have that snack than for individuals who were mildly suggested not to have that snack leaving room for individual decision making. Moreover, it was demonstrated that once individuals had the opportunity to have the formerly restricted snack, those previously explicitly restricted

indulged more than those only mildly suggested to refrain from that snack (De Vet, Stok, and De Ridder 2013). Similar results were found among adolescents. Adolescents were less motivated to eat fruits when they were told that it would be good for them than when they were subtly pointed out that their peers also regularly eat fruits (Stok, De Ridder, De Vet, and De Wit, 2013).

There is a strong and widely shared interest in health policies that go beyond patronizing practices that tell people how they should behave. Parties involved in top down, choice architectures (e.g., governments, schools) seem to struggle to find a balance between their responsibility to promote health in society and individuals' responsibility for their own health. Politicians and policy makers avoid enforcing health promotion regulations upon people, because of the negative perceptions of a paternalistic government. Similarly, adolescents do not want to be told how to behave and place strong value on autonomous decision making. Interventions that are perceived as patronizing run a serious risk of creating reactance in society or, even worse, making the unhealthy alternative ('forbidden fruit') more attractive. Finding a balance between top-down strategies imposing explicit regulations upon individuals and bottom-up strategies leaving health-related decisions entirely up to individuals, is a challenge that many parties in different domains struggle with, as is evident from debate on promoting healthy food choices. Governments debate whether taxes should be introduced to discourage choosing unhealthy products, and whether advertising unhealthy foods targeted at underage populations should be prohibited. At an organizational level, employers or school boards question whether unhealthy products should be banned from their worksite or school cafeterias, or whether employees and students should regulate their eating behaviors themselves. At the micro level, parents might be wondering about the best way to raise their kids when it comes to health behavior practices. Should they install clear rules and prohibitions about crisps and candy, or will their growing child eventually learn more from making their own choices in the presence of a variety of foods. In each of these areas, improving self-regulatory competence for dealing with food choices may suggest solutions that go beyond the rigid distinction of either dictating an alternative or leaving a decision entirely up to people themselves. That is, the promotion of self-regulatory competence implies that adolescents can be supported in making the desired choice in such a way that their sense of autonomy is respected.

### **Specific recommendations:**

#### **Taking advantage of self-regulatory competence**

TEMPEST research on self-regulatory competence for dealing with food temptations shows that many adolescents already apply the strategies when they try to adopt healthier eating patterns. Our results also suggest that the use of self-regulation strategies correlate significantly with dietary patterns, and use of the strategies is positively associated with

healthier eating behaviours. This means that adolescents who use self-regulation strategies tend to eat more fruit and vegetables and consume less snacks and soft drinks. The findings suggest that girls apply the strategies more often than boys and younger adolescents use the strategies more actively than older adolescents. The latter may be due to the fact that older adolescents spend more time outside home and have more pocket money to spend on unhealthy foods. The research results also indicate that those adolescents who were more motivated and ready to take responsibility for their own behaviour were more likely to use the self-regulation strategies. The TEMPEST project has produced a valid and reliable 24 item self-report questionnaire assessing the use of self-regulation strategies (TESQ-E) that is available in PDF format from the TEMPEST website. The TESQ-E can be used as a diagnostic tool for assessing self-regulation competence in children and adolescents. The TESQ-E may also be used to evaluate whether interventions successfully improved adolescents' use of self-regulation strategies. Insight in self-regulatory competence in children and adolescents may contribute to the design, tailoring, and evaluation of interventions aimed at the prevention of overweight. The self-regulation strategies addressed in the TESQ-E are central to the TEMPEST Handbook (available in eight languages) which provides readers with a full description of what these strategies entail and how they can be improved.

### **Taking advantage of adolescents' perception of the obesogenic environment**

One of the TEMPEST objectives was to determine the role of environmental factors and interventions in the overweight epidemic among young people with a specific focus on how these factors and interventions affect self-regulation of youth. Four systematic umbrella reviews of more than 200 environmental factors that were addressed in previous research revealed that factors relating opportunity (availability of exercise facilities) and self-evidence (peer and sibling physical activity) were most consistently associated with physical activity in children and adolescents. With regard to factors relating to healthy eating, it was found that primarily family and parenting variables, such as modelling of healthy eating and parental monitoring, were most consistently related to healthy eating in children and adolescents. Also school-based overweight prevention programs were associated with children and/or adolescents' healthy eating. Furthermore, there is also evidence for a negative effect of macro-level factors on children and/or adolescents healthy eating, in particular for exposure to food advertising on TV and food prices.

Our analysis of 76 selected European programs for the prevention of overweight in children and adolescents further revealed a strong emphasis on reaching young people through schools and, to a far lesser extent, through their parents. Typically only a minority of programs has been evaluated, mostly using weak designs and not assessing impact. To empirically assess how social, cultural, physical and policy environments are perceived by youth and how they relate to their weight-related self-regulation efforts, a survey was conducted. This survey indicates that no country stands out in terms of the healthy or

unhealthy eating behaviours of young people, but that specific concerns regarding adolescents' eating behaviour may vary across countries. With respect to the question how adolescents deal with access to an excess of unhealthy foods in their environment, the survey provides important evidence that they are not simply victims of their food environment. Rather, the use of self-regulation strategies may facilitate healthy eating in adolescents, even if the food environment tempts them to do otherwise. This implies that health promotion should not solely focus on the complex task of changing the obesogenic food environment, but that adolescents should also be taught strategies regarding how to effectively deal with today's access to excess. Findings from the survey also illustrate differences in self-regulation across the stages of adolescence, with associations between the use of self-regulation strategies and lower intake of snacks and soft drinks becoming stronger with age and adolescents using more cognitive and less behavioural strategies as they age.

These findings hold important implications for parent support for effective self-regulation of young people's eating behaviours, the role of autonomy in adolescents' use of self-regulation strategies, the association between family food cultures and adolescents' self-regulation and eating-related behaviours, adolescents' perceptions of food-related advertising, and adolescents evaluations of environmental policies and programs to prevent overweight. Specifically, these findings show that adolescents (perceptions of) environmental factors and policies and programs play a significant role in their eating behavior, either direct or indirect, via the use of self-regulation strategies to support healthy eating.

### **Taking advantage of social images of food.**

One of the TEMPEST objectives was to determine the impact of socio-economic and socio-cultural incentive schemes on the subjective experience of weight-related temptations and their subsequent effect on weight-related behavior. The central idea behind this objective is that youth's evaluation of the social image of food reflects the socio-cultural and socio-economic incentive value of the food item and that the social image of food items in turn makes their consumption more or less tempting. The Food Image Database Inventory (FIDI) assesses the social image of food in a natural context with factual popular peers (Giese et al., 2013) and with hypothetical peers. The FIDI is developed to provide an open-access set of standardized food images for scientific investigations and is distributed by the health psychology group at the University of Konstanz. The FIDI allows to assess ascribed consumption patterns to hypothetical and factual high and low social status peers in a standardized manner and to compare the ascribed patterns with the (self-reported) own consumption pattern. Furthermore, FIDI pictures can be applied to implicitly assess attitudes towards certain kinds of food.

### **Examples of food categories and food pictures of the Food Image Database Inventory.**

Manipulations of the social image of food had a significant impact on food consumption. Through manipulating the valence of the social image (positive vs. negative), the likelihood of food intake increased (indulge effect) or decreased (hands-off effect) significantly. Moreover, results showed that social image manipulations were effective regardless of children's self-regulatory capacities and general habitual food intake.

### **Results of the implicit-positive 'popular peer' (right panel) and the implicit-negative 'unpopular peer' approach (left panel).**

This provides evidence for the automatic processing pathway that does not require conscious cognitive effort. In the implicit manipulation approach it was shown that healthy eating behavior can be facilitated through positive social images even without mentioning 'health' once! Considering that supermarkets offer up to 60.000 products, food choice is a highly complex task for young consumers. Nutrition facts and food labeling is objectively useful information for decision making but rather complex for most consumers and, in particular, for children and adolescents. As information about the social image of food is processed in an intuitive and effortless way, and even without being aware of it, social image approaches in health promotion have great potential.

### **Taking advantage of pre-exposure to food**

One of the TEMPEST objectives was to identify the processes through which pre-exposure to food temptations increases young people's capacity to resist subsequent temptations under supportive conditions. To that purpose, a general experimental paradigm was employed in which participants are either or not exposed to food temptations (or not) to determine whether exposure affects self-regulatory competence (by means of an allegedly unrelated taste test of unhealthy food, liking, motivation, attention, or observation measures). In three studies it was established that participants consumed significantly more in the control condition than in the pre-exposure condition. Importantly, explicit prohibition of consumption did not result in decreased consumption compared to a condition that pre-exposed participants to foods in a supportive manner. These findings suggest that the effect occurs only under high autonomy conditions and that the underlying process that drives the inoculation effect relates to temptation of food becoming less important (Grubliauskiene et al., 2012).

Several studies were conducted to replicate the inoculation effect in the natural school environment of children (8-11 years). When exposing children to candy with a subtle hint not to consume the candy (by instructing them to make a flower of candies), they ate less of this candy in a subsequent taste test compared to children who were required to make a flower of Lego bricks. Importantly, the children who were required to make a flower from

candies indicated less liking of the candy than those in the control condition. In another school experiment, we compared children from schools that varied with respect to the availability and accessibility of food temptations and found that children from schools that ban food temptation, had a higher BMI and reported higher snack intake. These findings hold promise for developing novel interventions in school based on the principle of inoculation via pre-exposure to food under supportive circumstances. One already existing intervention format that has been tested in schools is the so-called saving game, exposing children to candy on four consecutive days while giving them the choice to either consume the candy or save it in order to have more at a later stage (derived from the delay of gratification paradigm).

### **Call to action: setting that lend themselves for dissemination**

During the TEMPEST conference in small-group meetings with representatives from a variety of settings (e.g., science, government, health professionals, food industry), the possibilities for dissemination of TEMPEST findings were explored. These discussions resulted in a call to action, speaking to different types of settings. The following recommendations were given for each of the parties influencing adolescent eating behavior.

Parents: Family meals, which (amongst other important functions) facilitate communication about eating behavior, are quintessential and should continue right through adolescence.

Schools: Concrete strategies for school-based interventions should be developed, including increasing self-regulatory competence and creating a health-supportive choice architecture. These interventions will then need to be rigorously tested to build evidence of their long-term effectiveness in promoting healthy eating using a range of appropriate indicators (e.g. use of self-regulation strategies, eating practices, weight). This evidence building should also address whether beneficial effects generalize to other health domains.

Prevention and health promotion: The evidence-base needs to be strengthened and more research is required. Testing of interventions in real-life settings should be done in a multi-disciplinary way, taking into account the local and cultural context, and should be included in ongoing initiatives (such as EPODE, JOGG, healthy schools network). Promising venues for research are: pre-exposure to food temptations; social images and food advertising; negative effects of restrictions; and training self-regulation capacities and transfer of these capacities in different domains (food, being active, alcohol use, studying).

Food industry: In order to be more appealing to industry, TEMPEST findings (especially regarding social images and focusing on healthy choices rather than unhealthy options) need to be replicated in a professional manner in a joint effort with industry.

Government: The government should invest in finding ways to promote self-regulatory competence in a variety of manners, especially in underprivileged groups.

#### **4.1.4.2 Dissemination**

Tempest website. The website was visited about 5500 (unique visitors) during the course of the four year run of the TEMPEST project. The website includes information on important achievements of the project, project publications (in PDF format), the TESQ-E questionnaire in eight languages (in PDF format), columns by TEMPEST researchers and general information about the project for children and adolescents, parents, teachers, professionals, and scientists.

#### **Example: Column from the TEMPEST website, posted in 2012**

##### **Be smart and don't use your willpower! By Denise de Ridder, Utrecht University**

When talking with adolescents about the things they do to eat more healthily, they often tell us that they "just need to be strong and resist unhealthy foods". Being strong means that you use your willpower to override an urge to do what you really would like to do but better shouldn't. Relying on willpower is a popular strategy for regulating your behavior. However, psychological research has repeatedly demonstrated that willpower is a scarce resource and that you should save it for situations when you have no other strategies available. So if you really want to eat more healthily, the best thing to do is to prepare yourself by thinking of smart strategies that help you to not eat from foods you would want to avoid. Do like the Dutch who cherish the saying "If you are not strong, you should be smart". These are wise words that I agree with. Why, then, do I find myself thinking "Show Some Willpower!" when I see someone eating a whole bag of chips or an XL portion of ice cream? Probably because it is difficult to be smart while it is so easy to keep hoping that willpower will help you.

National meetings. All participating countries have organized national meetings in 2012 to discuss TEMPEST findings with an audience of scientists and health professionals. A total of about 2000 participants attended these meetings; some meetings were organized in collaboration with ongoing national conferences or other activities relating to obesity prevention.



Tempest Newsletters. Three Tempest newsletters have been published during the course of the project (March 2010, November 2011, and March 2013), informing a large audience about the objectives of the project, main research findings and their implications. Each of these newsletters were distributed amongst an audience of about 400 scientists, health professionals and other people who expressed their interest in the project.

Final conference and pre-conference workshops. The final conference was organized in Utrecht, Netherlands at January 25th, 2013 and aimed to inform a broad audience of about 100 participants (scientists, health practitioners, health policy makers, and food industry) about the main findings of the project and their potential for dissemination in health promotion. The conference started with a keynote lecture by Professor Pierre Chandon (INSEAD, France) on the underestimation of large portion sizes (one of the key characteristics of the obesogenic environment). Other contributions involved the presentation of findings that have arisen from the TEMPEST project, such as the newly developed youth-specific TESQ-E scale for dealing with weight-related temptations, incentive schemes and different social contexts on self-regulatory competence and weight-related behaviors. Moreover, the conference included dissemination workshops to discuss the implications of the project findings for health promotion policy (resulting in the call to action referred to previously), a debate with various stakeholders from different European countries (science, health promotion, health policy) and the launch of the TEMPEST handbook. The conference was preceded by a one-day program of pre-conference workshops discussing topics such as, for example, Protection from food temptations: Behavioral inoculation in schools and Food cultures in the family environment: Meals as social events or TV dinners in an interactive format with the audience.

TEMPEST Handbook. The TEMPEST Handbook was written by Marijn Stok, Denise de Ridder, Emely de Vet and John de Wit (Utrecht University), and translated by country-specific research teams; the book was published in eight languages. The handbook describes the research conducted in the TEMPEST and aims to inform health professionals, teachers, and parents about opportunities for encouraging self-regulation strategies in adolescents that may help them to regulate their food intake. The book highlights the six self-regulation strategies that are also central to the Tempest Self-regulation Questionnaire for Eating (TESQ-E). Each of the following six strategies is covered in a chapter: avoiding temptations, controlling temptations, distraction, suppression, goal and rule setting, and goal deliberation. For each of the six strategies, it is discussed what the strategy entails, what is known from scientific research, what adolescents say about it, and how the use of the strategy could be improved. At the moment of reporting, 1600 copies of the handbook were distributed.

Cover of the Dutch version of the TEMPEST handbook, distributed by the Netherlands Nutrition Center.

Review of the TEMPEST Handbook by Alet Wijga PhD, Senior scientist (epidemiology)  
National Institute for Public Health and the Environment Center for Nutrition, Prevention  
and Health Services, Netherlands

I enjoyed reading the TEMPEST handbook. It is written in an attractive style, combining results of scientific research with examples of how adolescents themselves say they deal with food temptations. Six different self-regulation strategies are explained clearly in practical and positive terms, giving readers confidence that they will be able to apply these strategies in real life situations. I expect that many readers will be tempted to try out one or more of these self regulation tools in their own family's 'chocolate factory'.

Scientific publications. During the course of the TEMPEST project 18 scientific articles were published in international peer reviewed journals and eleven in national peer reviewed journals. Many more publications are underway. All published articles are available (in PDF format) from the TEMPEST website.

Other dissemination activities. Other dissemination activities involve national scientific publications, scientific presentations at conferences, seminars and other meetings, as well as broadening contacts with policy makers, health professionals, parents, and children/adolescents by publications on websites, interviews in national newspapers, radio and television interviews, and participation in public debates about healthy food choices. A full list of all these activities is included in the Appendix to this report.

#### **4.1.4.3 Exploitation**

The TEMPEST final conference resulted in a call to action to various stakeholders to incorporate main TEMPEST findings in their activities. (see section 4.1.4.1) This call to action is relevant for participation of TEMPEST researchers in OPEN and DEDIPAC (see below).

Other opportunities for exploitation are the following:

TEMPEST Handbook: The Handbook is important for making available scientific insights into the role of self-regulation of eating behavior to a wide audience of health professionals, parents and teachers; and to inform the development of novel approaches for the prevention of overweight. The examples below describe the potential of the Handbook to be exploited in intervention programs.

Example 1: The Handbook will be used for developing new healthy eating interventions in schools by the Netherlands Nutrition Centre (in collaboration with Dutch researchers from the TEMPEST consortium). In addition, the National Institute for Public Health and the Environment Center for Nutrition, Prevention and Health Services (Netherlands) will use the Handbook as a starting point to develop new intervention policies for promoting healthy living in general.

Example 2: The Handbook will also be used by Weight Concern, a registered charity concerned with weight management in UK, to develop on-line resources on healthy eating for adolescents and families. An obesity specialist dietician will write new material, derived from the TEMPEST handbook, which will be tested with adolescents and families before a website consultant is employed to make it accessible in its final web format. Weight Concern will also promote the new on-line resources to adolescents, families, schools, health professionals and youth organizations through a variety of strategies.

Example 3: In Finland, the e-print version of the Handbook will be made available to schools and educational councils, as well as to the Finnish Heart Association to support their training of health care professionals in child and maternity clinics and school health care. Moreover, the handbook is part of THL's official open archive Julkari (see <http://www.julkari.fi> online) and will remain permanently available to the public. In collaboration with the Finnish National Overweight Prevention Program educational videos have been produced and are freely available from [videonet.fi/thl/2012-neuvolapaivat/](http://videonet.fi/thl/2012-neuvolapaivat/).

Implementation activities: The TEMPEST consortium participates in the OPEN (Obesity Prevention through European Network) network that facilitates implementation of findings from European research projects on childhood obesity prevention through tailored capacity building workshops, open symposia aimed at best practice sharing, and make guidelines for social marketing campaigns to disseminate results. There will be a presentation of TEMPEST findings at the first OPEN symposium in Bucharest, Romania (scheduled October, 2013). Also, researchers from the TEMPEST consortium (UKON, WSP, UU) participate in DEDIPAC (Determinants of diet and physical activity). DEDIPAC is the first action of the Joint Programming Initiative (JPI) 'A healthy diet for a healthy life'. A network of selected research groups and scientists from 12 JPI member states will conduct a program of joint multidisciplinary activities for a better understanding on how individual, social and environmental determinants influence food and physical activity choices.

New research projects: researchers from the TEMPEST consortium collaborate in the Marie Curie initial training network CONCORD project (PI DeWitte, KUL). CONCORD is centered

around the theme of consumer competence, i.e., a broad set of abilities, intuitions, knowledge and skills consumers need in order to make decisions that help them navigate successfully in the economic environment. Experts in behavioral economics, health psychology, and consumer science, join with pioneers in advanced behavioral measurement techniques to build a theoretical foundation to the study of consumer competence, create interventions to enhance it, and document spontaneous occurrence of consumer competence. Improving healthy eating from a consumer competence perspective is an important component of CONCORD as three projects of the CONCORD address this topic, following up on TEMPEST findings by highlighting the role of self-regulation in response to environmental cues (e.g., using distance to foods as a nudge to improve self-regulatory competence).

Partners of the TEMPEST consortium (UU, KUL) have, in collaboration with other European partners (Denmark, Norway, Portugal), prepared a proposal for a research program on novel interventions that builds on the main findings of TEMPEST, highlighting the concept of nudges (subtle environmental cues) as a way to speak to self-regulatory competence regarding weight-related behaviors (eating and physical activity/sedentary behavior). Specifically, the HINTS (Health Improvement through Nudging Techniques in the Social environment) was submitted to the FP7-HEALTH-2013-INNOVATION-1 call (final evaluation expected in May 2013).

Finally, TEMPEST researchers from the Netherlands have prepared a national research program in collaboration with main partners from the food industry that operate on a global scale (Unilever, FrieslandCampina) to promote healthy eating by the use of nudges. Collaboration between academic and food industry partners was inspired by findings from the TEMPEST research project, as is witnessed by presentations of Unilever Research and Development (R&D) at the final TEMPEST conference.

#### **4.1.5 Contact details**

Further information about the project, the research findings, and dissemination activities can be obtained from the project website: <http://www.tempestproject.eu>

Contact information:

Prof.dr. Denise de Ridder

Department of Clinical and Health Psychology

Utrecht University

PO Box 80140

3508 TC Utrecht

The Netherlands

Phone: /31302531470

E-mail: d.t.d.deridder@uu.nl

#### **4.2 Use and dissemination of foreground**

All activities that have been described under sections 4.1.4.2 (Dissemination) and 4.1.4.3 (Exploitation) are summarized in the Appendix.

#### **List of Websites:**

<http://www.tempestproject.eu>