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Self-Control in Weight Loss Process

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Abstract

Classical motivation theories assumed that the probability of success in goal striving process (including weight loss) depended on two factors: likelihood of success and attractiveness of the result. However, research referring to obesity showed that motivational factors are not sufficient in effective weight loss. In other words, obese people value anticipated weight loss but still do not succeed in this process. It is implied by the fact that effectiveness and persistence of this process depend also on volitional factor. This factor refers to self-control mechanisms, which mediate between intention to reach the goal and its enactment. The current empirical data suggest that implementation intentions and mental simulations are especially beneficial techniques of self-control enhancement. This chapter will unveil main theories and research concerning self-control mechanisms and influence of various mental simulations and implementation intentions in weight loss process and weight-related behaviors. Moreover, our empirical data concerning individual differences in self-control of weight loss process are presented.

Keywords: weight loss, self-control, mental simulations, implementation intentions

1. Introduction

According to the World Health Organization, overweight and obesity serve as a serious potential health risks [1]. Statistics shows that since 1970 the number of people suffering from overweight or obesity has tripled, and its prevalence is still growing. It is proved that weight problems are responsible for several chronic diseases such as diabetes, cardiovascular diseases or even cancer [2]. Both global institutions, as WHO, and local governments strive for actions directed to stop this pervasive and threatening trend. Majority of those actions are

informative in their form—they convey information concerning benefits of healthy lifestyle, including diet and physical activity, or negative consequences of excessive fat accumulation.

However, everyday observation and research data [2–4] suggest that mere knowledge referring to what is healthy and, on the contrary, what is insalubrious is not sufficient to change peoples' behavior. In other words, people know they should consume fruits and vegetables but they grab for chips and sweets. They also know they should go jogging, but instead of that they lie down on the sofa and watch TV. Interestingly, when asked, most people say they would like to change their unhealthy habits, but they do nothing or almost nothing to enact their intentions. At this point, one question may arise in our minds—where is our rationality? The problem is that we often identify consciousness with rationality or even confuse them [5]. In other words, people assume that since one is aware of some phenomena, e.g. knows that it is recommended to drink two liters of water per day, she or he should drink each day at least this amount of water. “Rational mind” takes into account all available data, processes the information and as an output makes the best decision which is subsequently implemented into ongoing behavior. Unfortunately, this is just a desired ideal construction, having not much in common with everyday observation. The proverb says, “the road to hell is paved with good intentions.” What does it mean? It means that there must be another than just a desire factor (formulation of intention) responsible for effective goal pursuit. In the psychological literature, this phenomenon is being called volitional factor, volitional processes or volitional strategies [6–8].

This chapter presents theory and empirical data considering psychological processes mediating effectiveness and persistence in intention enactment, especially significant in area of weight loss and weight loss maintenance. It also unveils theory and research concerning influence of techniques of self-control enhancement (various mental simulations and implementation intentions) in weight loss process. Moreover, our empirical data concerning personality characteristics that may possibly differentiate the effectiveness of self-control in area of weight loss process will be overviewed.

2. Volitional factor in effective intention enactment

Imagine the situation of a person who decided to abandon junk food and shift toward healthy eating. Let us assume that the decision was made autonomously, which means that is based on personally relevant needs and values, and is perceived by the person as a free will choice [9]. The person is highly motivated, speaks loudly about his or her eagerness to improve diet and become healthier. It seems like all requirements are fulfilled to lead this person to effective goal attainment. This expectation is in accordance with classical model of motivation [10, 11], which assumed that probability of turning into action is based on the expectancy of success and perceived value of desired outcome. However, after two successful days of dieting, the person experiences stressful situation at work. Everything around her or him seems sad and helpless. The mood is going down and the natural human reaction is attempting to regulate own mood in order to resume previous emotional state. What were the most commonly used stress and mood strategy for this person in the past? For many people, it is eating or even binging on tasty and unhealthy foods. At this point, the person faces not one but two

intentions simultaneously: to eat healthy (distal and long-term intention) and to eat chocolate (proximal and “here and now” intention). Interestingly, and unfortunately, both intentions are internally contradictory. Even though in “cold” conditions the person was determined to stick previous intention, now, in “hot” conditions gets very close to the breakdown. Which intention will win? The question is not so easy to answer, but undoubtedly refers to one’s “willpower” to overcome temporal temptation and persist in goal congruent actions.

2.1. What does volitional mean?

The term “willpower” and its role in the motivational process, though present in psychology from the very beginning [12, 13], are one of those which are not easy to define. Ach [13] wrote about the *efficiency of will* which meant cognitive activities dedicated to the reduction of discrepancy between present and anticipated states. James [12], however, distributed self-management skills into *regulatory motivation* and *regulatory competence*, which state for respectively motivation to reveal willpower and actual capacity to do it successfully. Contemporary authors, e.g. Kuhl [14, 15], prefer to use term volition, which refers to the central coordination of cognitive, motivational and emotional processes.

What is the difference between motivation and volition? The answer is absolutely crucial to understand, explain and prevent peoples’ failures to attempt their goals, especially difficult like losing weight or maintaining appropriate weight. Indeed, setting the goal and strong motivation to achieve are not sufficient to succeed. Heckhausen [16–18] and Gollwitzer proposed a model of action phases, which addresses Levin’s distinction for goal setting and goal-striving process [19]. According to this model [20, 21], action includes two distinct stages. The first is a motivational or deliberative phase during which the individual cognitively processes the expenses and profits of prospective behavior. The second is volitional phase during which the subject generates the strategies and plans subordinated to enact the intention. Therefore, proposed model denotes that intention enactment is most probable when the subject is not only motivated to act but also produced strategies and plans which foster intention attainment [7]. The main objective for those plans and strategies is to control own behavior in order to successfully achieve the goal. This mode of control dedicated to goal maintenance activities is called self-control [14].

3. Self-control mechanisms which mediate between intention to reach the goal and its enactment

In accordance with processual approach to willpower, researchers are trying to find an answer considering mechanisms and processes engaged in action control process. In other words, they try to demystify the notion of willpower, identifying psychological mechanisms which are responsible for intra and inter-individual differences in self-control. In the following sections, we will focus only on selected concepts and models, which, in our opinion, due to their empirical value, are significant in self-control mechanisms in weight loss process and in weight-related behaviors.

3.1. Willpower as self-regulatory strength

According to the *Self-Regulatory Strength Model* developed by Baumeister [22, 23], the willpower is served by internal energetic resources of organism. The main assumption of this model implies that the ability to regulate responses actively (thus to move the self closer to a desired state) depends on a restricted and depletable self-regulatory resource. When regulatory resources have been depleted, self-regulation failure is more probable.

As Baumeister and his colleagues assume [22], the main cause of undesired behaviors, also diet related leading to obese, is insufficiency of self-regulatory processes. The term “self-regulation” is understood as an effort undertaken by the subject, directed to change the reactions of self, what in fact means self-control. Effective functioning of the self is possible due to the energy, which is served by specific, limited resource sufficient for limited acts of will. Self-control can be then compared to the muscle which as a result of intensive exercise gets tired, hence its efficiency in subsequent task decrements. To renovate the resources time and rest is required, thus many acts of self-control losses happen at night when people are tired after all day long regulation of own behavior [24].

In the study conducted by Vohs and Heatherton [25], ego depletion in dieting behaviors was induced and measured. Dieters were exposed with temptations, either strongly depleting—sitting very close to the bowl of candies, or weakly depleting—sitting quite far away from the same temptation. The study showed that after strong depletion of ego resources subjects indeed exerted less self-regulatory strength. In more detail, subjects consumed more ice cream and persisted less in the cognitive task after sitting closer to the bowl full of candies than those participants who were sitting more far away.

The vast number of studies conducted in the typical schema for Baumeister’s ego depletion model (see meta-analysis, [26]) as well as the study referring to everyday experiences measures by *experience sampling* method [27] acknowledge, in their authors’ opinion, the existence of ego depletion phenomenon. Although Baumeister’s model provides with a simple and opportune explanation of self-control loss, researches confirming its legitimacy also have some shortcomings. In our opinion, one of them is an excessive liberty in understanding what actually self-regulatory acts and tasks which document ego depletion are. Also reductionist form of Baumeister’s model meets with attention of critics. Bandura [28] for instance notices that the loss or lack of control over behavior not necessary is tied to ego strength but can be rather imposed by the perception of personal standards or engagement level according to those standards. Moreover, studies which tested relation between the type of regulation and ego depletion conducted by Muraven et al. [29, 30] showed that non-autonomic regulation performed in the conditions of internal or external pressure depletes ego resources more than autonomic regulation. Similar conclusions can be posed by the research results of Moller et al. [31]. Summarizing the research results mentioned above, comprehension of self-regulatory failure or loss only in terms of ego depletion is not sufficient to explain the difficulties in the behavioral control area. As the studies show, the distribution of willpower (defined by Baumeister et al. [22] as an ability to put effort to control own behavior) to different behaviors depends on the character of regulation or autonomy level of standards which drive the behavior.

3.2. Willpower as the central coordination system: the role of affect regulation

According to *Personality Systems Interactions Theory* [15], willpower coordinates functioning of cognitive, motivational and emotional processes. The basic function of volitional processes is to enable performance in accordance with the goal and to maintain the self-system integration as well. In Kuhl's theory [15, 32], the self-system can be identified with extension memory, which is served by the implicit system representing own needs, values' preferences and autobiographical memory. This system contributes to the integrated knowledge about self and personal experience. The effective intention enactment requires an access to extension memory, and the significant factor which limits this access is stress [33]. Thus, it becomes clear that effective affect regulation is a must for volitional efficiency [33, 34].

Demands-related stress (e.g. stress implied by the conflicts of goals, difficulty of the task, monotony or lack of favorable circumstances) is tied to the lack of positive affect [32, 33]. This lack of positive affect activates intension memory (which includes cognitive representation of goals, and its main goal is to maintain intention in working memory), and at the same time, it impedes the access to extension memory (self-system). As a result, the subject is excessively focused on the goal and unable to move to the core phase of the action which is intention implementation [21]. The ability to arouse positive affect enables both intention implementation and starting the activity [35].

In turn, *threat-related stress* (which is caused by the threats, failures and serious life changes) is accompanied by negative affect [32, 33]. This negative affect concentrates the subject's attention on ongoing negative experiences and inhibits an access to extension memory (self-system). In such situations, the subject is unable to stop contemplating the unfavorable situation (rumination) and is unable to detach from it in order to make a decision about further action. The ability to neutralize negative affect allows the accessibility to extension memory (self-system) and enables integration of the experiences into consistent whole with account to self-system [36, 37].

The mechanisms described above, function differently under two, differentiated by Kuhl self-management modes: self-regulation and self-control [14, 15].

3.2.1. Paradoxes of self-management processes

Baumeister and his colleagues [24] identify terms "self-regulation" with "self-control" thus they use them interchangeably. However, this approach seems to be misleading, what was emphasized by Kuhl in the 1996 article titled *Who controls whom when I control myself* [14]. The author recalls, among others, paradoxes of the self-regulatory processes, which are worthy to be noted at this point. Let us consider the situation of a woman who decided to lose weight and as one of the strategies she planned to jog everyday after work. It is winter, she comes back home tired and cold. The day at work was nervous and exhausting. She would rather stay at home, eat some delicious chocolate and watch her favorite TV show. What activity (staying at home versus going out for a jog) will be an accurate self-regulatory strategy used by the women in this particular situation? If she decides to go for a jog will she demonstrate the willpower? Or maybe the genuine willpower will be to break the previous decision, sabotaging internal imperative and immerse into pleasure of the moment?

Let us consider another dilemma in the subject of self-management area. Based on the previous example, the women who want to lose weight issue an order to herself to grab for an apple when she feels like eating a snack. But at the kitchen table, besides fruits there is also a plate with donuts. Her internal voice (let us call it “angel”) says: eat an apple, you decided to shift into a healthy lifestyle! But at the same time, another voice (“devil”) demands: eat a donut! You like it better! The truth is that indeed she likes sweets more than fruits, but at the same time after eating too much junk food she feels bad, both physically and emotionally.

How can it be explained that one tells him or herself “eat an apple” but his or her own hand grabs for a donut? To understand this phenomenon, two modes of self-management should be distinguished [15].

3.2.2. Self-regulation and self-control: democratic and autocratic self-management modes

Kuhl distinguished two modes of self-management: self-regulation and self-control [14, 15]. Self-regulation is a mode, which is dedicated to support self-maintenance and can be metaphorically portrayed as a democratic leadership aimed to sustain or increase one’s well-being (positive emotionality). The self-control mode, on the other hand, supports goal-maintenance activities and can be paralleled to mild or even strict dictatorship. The role of this mode is to inhibit potentially uncooperative processes like feelings, values or preferences in order to protect and conserve the intention from any distracters. When the subject decides to reduce body weight following the serious health condition, the necessity to change the menu most probably arouses negative emotions and is not perceived as democratically assigned (even though patients rationally agree that this is a proper decision). A good solution in this situation is to gradually incorporate this goal to the patient’s personal goals network, so it could be seen as a great chance for development, getting respect from others or to avoid adverse health effects. However, prior to this positive introjection, the effective dietary change discounting self-control mode seems to be very unlikely. Thus, Kuhl and Fuhrmann [35] mark some advantages of using this mode, especially when realizing difficult and effortful tasks. Nevertheless, the long-term and rigid employment of self-control drains psychophysical resources and can lead to negative consequences [38].

3.2.3. State and action orientation

Based on the vast empirical data [15, 33], Kuhl assumes the existence of relatively stable individual dispositions in affect regulation: state or action orientation. The action-oriented subjects facing demand-related stress are able to elicit positive affect and to neutralize negative affect when confronted with threat-related stress [15]. They also manifest higher self-motivation when challenged by difficult task and imply self-relaxation while threatened to risks or failures. On the contrary, state-oriented persons expose low ability to generate positive affect when faced with challenge, and at the same time, they show inability to effectively initiate the goal-related behavior. That is why they expose tendency for procrastination, experience passive rumination over the goal, engage in counterintentional behaviors and are oppressed by the task-irrelevant intrusions.

3.3. The ability to delay of gratification: self-control in inhibiting impulses and temptations

An effective self-management strongly depends on the temporal perspective. What is good for me here and now (e.g. eating a donut) is no longer good for my distant goal (losing weight). On the other hand, what is good for my distant goal (e.g. reduce BMI), not necessarily is good for me at the moment (go outside to the frosty air to jog). This problem is widely known in the literature as a delay of gratification paradigm or marshmallow dilemma [39–42]. In the series of experiments, Mischel and his colleagues [40, 43, 44] showed that:

1. Under 4 years of age, children are generally unable to wait any time for the delayed gratification.
2. Above this age, children start to vary—some of the young subjects can wait until experimenter goes back to the room to receive bigger treat and some cannot do it even when gets older.
3. The number of seconds the child waits in the situation of being exposed with temptation (e.g. cookie or marshmallow) strongly predicts his or her results in the Scholastic Aptitude Test (SAT) and social-cognitive, personal and interpersonal skills many years later.

How to explain those effects? Mischel distinguished two types of control: stimulus-control and self-control [42]. The first type refers to the power (control) which is executed by tempting object present in one's perceptual field. The second type is a control operated by self over the stimuli. This type of control provides one with the ability to resist the temptation as so not to consume it. The effectiveness of delay of gratification or resisting the temptation relays, according to the Mischel's concept, on the interaction between *hot* and *cool* systems [45]. The hot system is a "go" system, which directs emotional, quick, simple and significant for survival information. It regulates fight or flight reactions. The system is ready to operate from the very early childhood and enables the child to communicate with outside world. The most probable neural substratum for hot system is amygdala [46, 47]. Amygdala is a small, almond-shaped structure in the brain, which reacts to the situations perceived by the subject as threatening [46]. The effect of amygdala's activation is physiological arousal, which fosters automatic, survival reactions. However, there is also a second system of behavior regulation—the "cool" system. This one is cognitive, slow, thoughtful and elaborative and outputs rational, deliberative and rational behaviors. The neural origins of the cool system are being attributed to hippocampal and frontal lobe processing [45]. Those neural structures are responsible for metacognitive processing, memory, problem-solving and knowledge organization. The effective self-control while being exposed with temptation depends on the maturity of the brain (especially hippocampus and frontal lobe, which ripen quite late in the ontogeny) and stress level (high emotional activation attenuate or even turn off the cool system). Mischel and his colleagues mark also the role of mental representation of the temptation (gratification) [42] in the successful delay. For example, in the study by Mischel and Baker [43], children who were hinted with a cool, informational representation of temptation were able to wait for a reward (snack) 13 minutes in average, while those who

were cued with a hot instruction could delay only for 5 minutes. Concluding the findings by Mischel [40], it can be pointed out that the significant role in delay of gratification (self-control) is played by attentional control, namely the way in which the temptation is mentally represented. Mentally portrayed as “white, puffy cloud” or “yummy and chewy” marshmallow is objectively still the same treat but subjectively its appealing strength is much different.

4. Mental simulations and implementation intentions as beneficial techniques of self-control enhancement

Since effective goal pursuit requires engagement not only in motivational but also, or even primarily, in volitional phase, significant question arises: Are there any techniques which can increase one’s self-control? In this section, we review two basic techniques, which are proved to be especially beneficial in enhancing successful goal achievement, mental simulations and implementation intentions.

4.1. Mental simulation

Mental simulations can be defined as cognitive activities, which constitute an imitative representation of event or series of events [48]. There are three basic forms of mental simulations: outcome simulations (representing the result of performance), process simulations (portraying the following steps of action to be taken in order to achieve the goal), and ruminations (negative images of setback or adversity) [49]. Three primary psychological mechanisms are responsible for beneficial effects of process mental simulations on goal attainment: effective emotional regulation (e.g. reduction of stress), plan for action formulation and activation of problem-solving behaviors. On the other hand, positive outcome simulations are maladaptive because, though they imply positive affect (pleasure derived from the mental image of success), they veil effective planning and problem-solving activities. Ruminations, however, also hinder effective goal pursuit. Ruminative thoughts glue one’s attention to negative aspects of the reality and distract from potential planning and problem-solving activities [49–52].

The effectiveness of process-focused simulations was displayed in areas such as problem-solving [53], examination performance [49], planning fallacy reduction [49], quitting smoking [54] running on time skills [55] and finally weight loss [52].

Mental contrasting developed by Oettingen [56] is a kind of cognitive procedure, similar to mental simulations but slightly different in the form. The subject is mentally contrasting when he/she is actively processing the discrepancy between the presence and the desired future [50]. Based on this cognitive process, the subject starts to perceive the reality as an obstacle to reach a desired goal [57]. If the subject exposes high expectations of realizing the future, then the actual behavior (performance) is highly probable. On the contrary, if the expectations are low, mental contrasting is supposed to inhibit the performance, since it depicts the necessity of effortful goal attainment requiring personal or other resources that the subject thinks he/she is lacking.

4.2. Implementation intentions

Implementation intentions serve as a form of self-instructions, which anchor intentions in concrete time, place and circumstances of action [20, 58]. They are formulated as implications: “Whenever situation x arises, I will initiate the goal-directed response y !” Gollwitzer, author of implementation intentions concept, assumes [8] that this special form of planning delegates the control of goal-directed responses to anticipated situational cues, which, in the situation they appear, elicit these responses automatically (so-called cue-to-action [6]).

Meta-analysis of 94 studies conducted by Gollwitzer and Sheeran [59] showed that implementation intentions facilitated effective goal attainment with medium-to-large effect of $d = 0.65$. Implementation intentions showed protective role in the process of performance initiation, in guarding ongoing action from distractors and threats, shielding disengagement implied by temporary failures and preserving resources for future goal attainment [59]. The effectiveness of implementation intentions was proved in many studies (for the review: [8, 59]). Among others, it was demonstrated that this form of planning enhanced breast self-examination during the next month [60], vitamins intake [61], recovery of patients prior to joint replacement surgery [62] or regular exercise activity [7]. Also effectiveness in dieting behaviors has been attributed to applying implementation intentions [63].

4.3. Mental simulations and implementation intentions in weight loss and weight-related behaviors: the research review

Since neural substrates of self-control (“cool system”) are being attributed to hippocampus and the frontal lobe [42, 45, 64], it seems to be obvious that effortful and effective self-control assumes brain’s health. Researchers who scrutinize determinants of the brain’s health and longevity propose SEEDS model referring to following five scientifically verified factors, which strongly contribute to subjective and objective well-being [65]: social support (S), exercise (E), education (long-life, E), diet (D) and sleep (S). Although all five health factors (SEEDS) stay in two-way relation with effective self-control (reciprocal relation) in this section, we focus on weight loss and weight maintenance implied by two factors: appropriate diet and physical activity. Those two factors showed to be absolutely crucial to sustain health, including mental and neurological conditions (e.g. [66–68]).

If it is already obvious that appropriate diet and exercise (thus in turn, adequate weight) are crucial to regain or maintain health (also brain’s health) and, at the same time, volitional processes are indispensable for effective goal achievement (e.g. to losing or maintaining weight), it is time to present specific studies devoted to this relation. Studies exposing the use of mental simulations and implementation intentions in weight loss, diet change and exercise will be disclosed later.

4.3.1. Mental simulations in weight loss process

In our research project, two experimental studies were conducted [52]. We tested the influence of various mental simulations on the effectiveness in weight loss process.

In study 1, we expected that participants who imagined the structure of the weight loss relevant performance would reduce more weight than those imagining only the result of activity, either positive (success) or negative (failure). We also tested an influence of mixed type of simulation: negative outcome followed by process. This condition was implemented based on the assumption that fear caused by the image of failure would motivate and energize subjects to avoid the adverse result. At the same time, plan of action triggered by the process simulation following the negative outcome was supposed to strengthen the volitional resources of participants. This assumption reflected the Leventhal et al.'s results of studies referring to fear-arousing communications and their influence on peoples' behavior [69, 70].

In study 1, 40 female students from universities in Warsaw were participated (19–27 years old, $M = 23$). The criterion to join the research was the desire to lose weight and signing informed consent to take part in the 5-week program. Subjects were randomly allocated to one of four conditions: positive outcome simulation, process simulation, mixed simulations (process followed by negative outcome simulations) and control (no simulations). Participant from all groups received written instructions portraying the content of respective simulation. Instructions in positive outcome group referred to the very final stage of losing weight. Participants were supposed to imagine themselves as being slimmer, wearing smaller size clothes, walking on the beach in the bikini and receiving many compliments regarding their new, better look. Subjects in the process simulation group, instead, were instructed to imagine quite another content. Their task was to imagine themselves in the specific actions imprinted in the weight loss process. In detail, the scenario of simulations illustrated step-by-step activities, which should be implemented to reduce body weight like buying low-fat and low-calorie foods, avoid junk food, preparing diet meals and exercising. In the mixed simulations condition, participants were first instructed to imagine that they gained even more weight. Just after that suggestion, the process simulation was provided. The content of the scenario was directly copied from the one adopted in the former group. The control group did not receive any instructions and was supposed to lose weight in their typical form or just as they wished.

Subjects from all experimental groups agreed to use this mental training for 5–10 minutes everyday in 5-week period. Additionally, there was a direct contact (via telephone or e-mail) between experimenter and subjects during the time of experiment, and once a week, there were meetings to measure the effects of weight reduction process.

The results showed that participants from mixed group (process followed by negative outcome simulation) and process simulation group lost significantly more weight than those from the positive outcome simulation and control group. At the same time, there was no significant difference between mixed and process simulations group (see **Figure 1**).

In study 2, we tested five scenarios of mental simulations. The experiment was targeted to verify the effectiveness of two additional treatments: sole negative outcome simulations and mixed simulations of process following positive outcome simulations. Although the dependent variable in the study 2 – weight loss was the same as in study 1, the procedure was quite different. First, the study was conducted via internet. An information about the study was located at its website and included a statue of participation. About 274 female subjects were entered into the study and signed informed consent, while 106 (aged 19–45, $M = 29$) out of

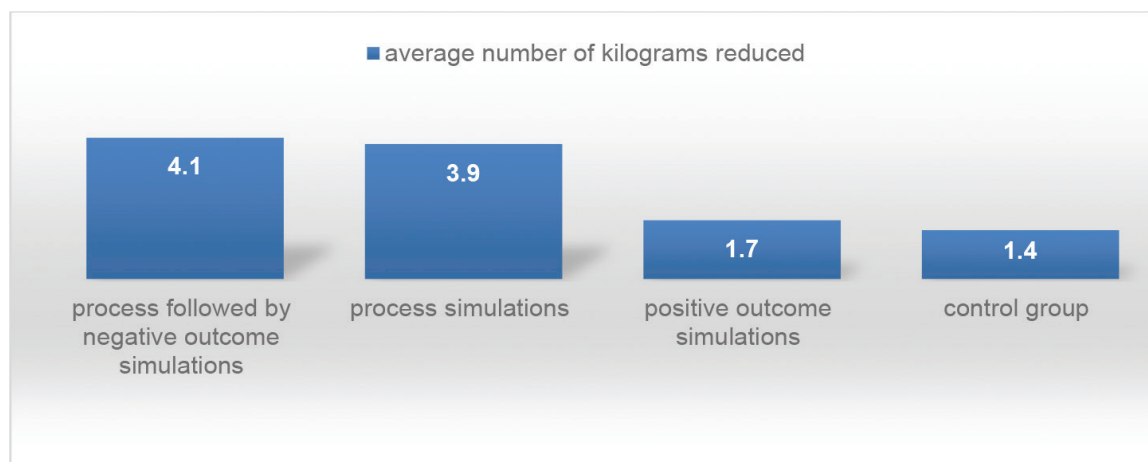


Figure 1. Average number of kilograms reduced within groups.

initial number logged into the study at least twice so their results were included in the statistical analysis. Second, besides the effectiveness of the simulations on the weight loss process, we also implemented other dependent variables which were persistent. This variable was measured by the number of logins to the study website. Each person who decided to enroll 5-week weight loss program was randomly assigned to one of six conditions: five simulation groups or control group. The scenarios for positive outcome, process and process followed by negative outcome simulations were directly taken from the previous study. The instruction for negative outcome simulation group was served by the first part of the instruction used in the process followed by negative outcome condition (without the process part). In the process followed by positive outcome simulation, subjects were supposed to imagine first the positive result of weight loss (being slimmer) and then the process of activities which would enable them to reach this desired goal. All subjects were asked to log into the system as frequently as they can and write down their weight at that moment. The number of logins was a measure of persistence. We assumed that each time the subject needs to declare her weight, and she has to overcome a discomfort implied by this moment of sensitive data verification.

The results showed that the most persistent were subjects assigned to the process followed by positive outcome simulation group, who logged into the website significantly more often than subjects from the negative outcome and control groups (see **Figure 2**).

In terms of weight loss effects, the results from the first study were quite replicated. Participants from the process followed by negative outcome simulation group lost significantly more weight than subjects from the negative outcome and control groups. There was also a trend ($p < 0.08$) showing that participants from the process followed by negative outcome group were more effective in weight loss than those from the positive outcome group. Also subjects from the process simulation group achieved significantly better result than those from the negative outcome and control groups. Additionally, those participants who simulated first the positive outcome and then process of reaching the favorable effect (process followed by positive outcome group) performed better than negative outcome and control subjects (trend $p < 0.07$). The summary of results concerning number of kilograms reduced within groups is presented in **Figure 3**.

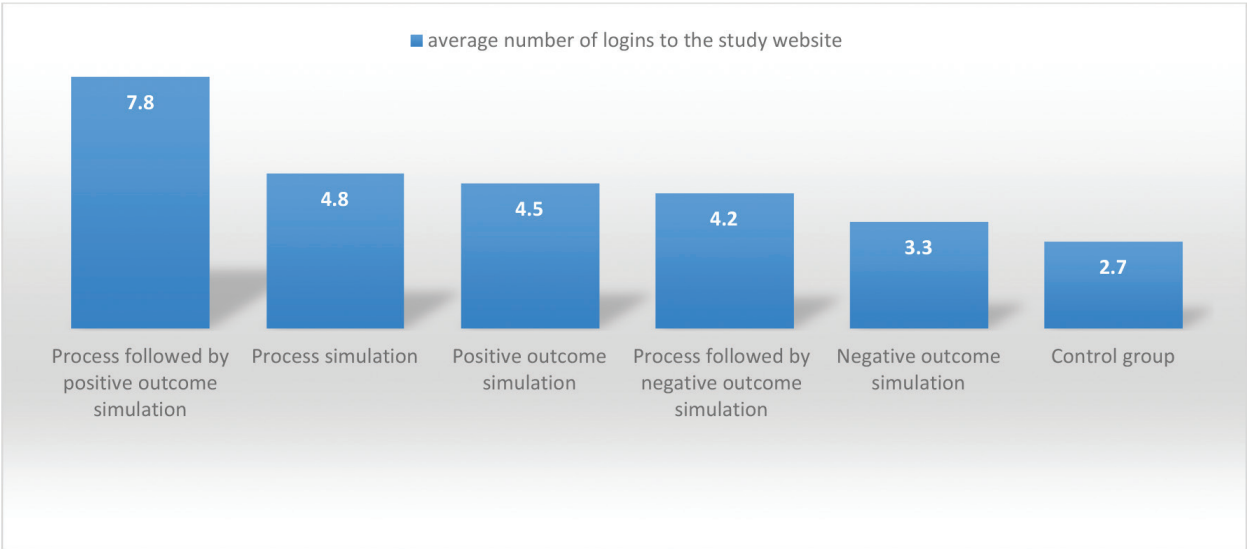


Figure 2. Average number of logins into the website within groups.

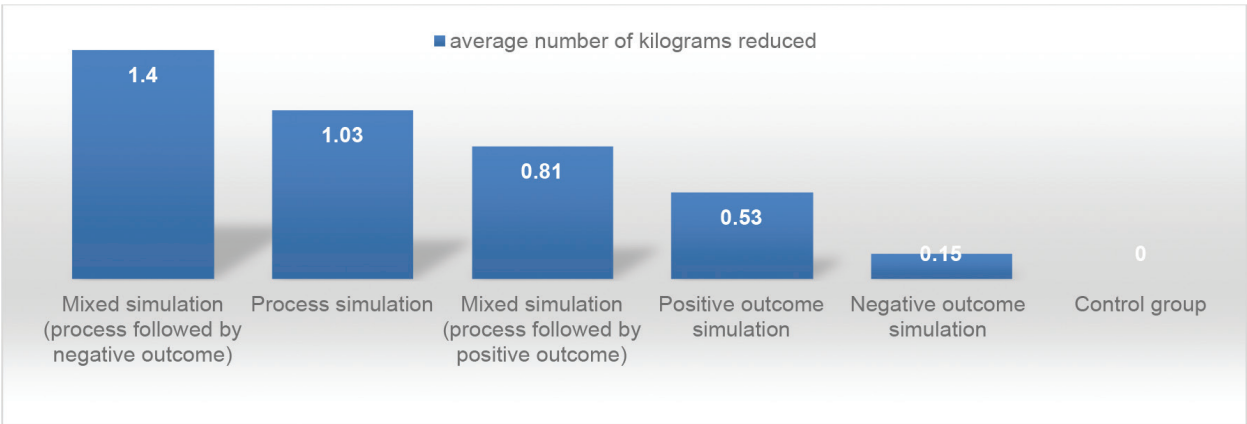


Figure 3. Average number of kilograms reduced within groups.

Based on the results above, it can be concluded that imagining the process of performance increases both effectiveness and persistence in intention enactment. Studies also showed that combination of simulations (process and outcome) can be a beneficial technique of self-control enhancement. Additionally, we noted the effect that cannot be dissembled but was observed as a kind of artifact of implied methodologies. This effect refers to the fact that participants in study 1 achieved generally greater results of weight loss comparing to participants in study 2. The main difference between methodologies used in both studies was that in study 1 there were personal, relatively frequent meetings of subjects with experimenter, while in the study 2, the contact between participants and experimenter was only via internet (except the meetings at the beginning and at the end of the study when the subjects were weighted). Most probably face-to-face meetings function as a form of the “social mirror” activating self-consciousness, which induce the need to meet the personal standards [71].

4.3.2. *The role of implementation intentions and mental contrasting in dietary behaviors*

Healthy diet means not only reduction in calories intake but also consumption of appropriate foods like vegetables and fruits [1]. Thus, it becomes extremely important to find the way of persuading people to change their dietary behaviors.

In the study conducted by Stadler et al. [63], training combining implementation intentions and mental contrasting was adopted. In this study, 255 females aged 30–55 were participated. At the beginning of the study, all participants had a meeting with experimenter who in 2-hour session presented significant health-related benefits of increasing the intake of fruits and vegetables (information intervention). Then, participants were divided into two groups: experimental (information & mental contrasting & implementation intentions) and control (information). In the experimental condition, subjects were asked to write down their biggest wish due to the diet which should have been challenging but feasible (e.g. I want to eat more fruit and vegetables). Then subjects were supposed to state the benefits of this positive change (e.g. I will increase my well-being) and anticipate the obstacles standing in the way to enact this desired future (e.g. There is a lack of vegetable and fruits at my workplace). This procedure of comparing the positive, desired future with negative aspects of reality (obstacles to be overcome) is named mental contrasting. As a next step, participants were instructed to prepare three implementation intentions regarding this prospective change: (1) Where and when will obstacles occur and what can I do to cope with it? (2) Where, when and how can I predict and prevent those obstacles not to occur? (3) Where, when and under what circumstances there will be a suitable moment to perform goal-directed behaviors? Fruits and vegetables intake was measured by servings (handfuls) of cut raw, frozen, cooked or canned fruits or vegetables or one glass of fruit or vegetable juice (with 100% fruit or vegetable content). Subjects noted the number of consumed portions in the daily diary reports form. The study lasted for 24 months.

The results showed that in both groups participants increased the number of consumed fruit and vegetable portions (especially at the beginning of the study). However, in the control group who received informative training only, after visible growth especially in the first month following the session, at the end of 24-month program, participants resumed to the initial level of fruit and vegetable consumption. In the experimental group, who besides information intervention received also volitional training (mental contrasting and implementation intentions), the number of consumed portions was not only higher than in control group but also very stable in time.

Two issues deriving from this experiment are additionally worthy to highlight. First, subjects from control group showed accelerated tendency to increase fruits and vegetables intake at the beginning of the study. In means that indeed, this commonly used motivational technique—persuasion can be effective to prompt individuals to start the activity. In terms of time persistence, however, mere information referring to benefits of diet change proved to be insufficient. The second issue is a number of consumed fruit and vegetable portions. At the end of the study in control group, the number of weekly consumed portions was about three portions per day. In the experimental group, although it was higher (about four portions per day), but still below recommended intake [1].

The effective weight management requires one more dietary behavior—abandonment of unhealthy snacking. Indeed, the weight increase is an adverse condition, but still, this is not the only reason why to resign from chips, chocolate bars or cookies. Although our brain depends on its main fuel—glucose, both too low and too high glycemic index cause many health problems [65].

In two studies conducted by Adriaanse et al. [72], mental contrasting and implementation intentions were used to foster the subjects in the process of declining the number of consumed unhealthy snacks. Female students who wanted to change their dietary habits were participated in the study. They were divided into two groups: experimental with mental contrasting and implementation intentions and control. In the first group, participants were asked to close their eyes and imagine the positive future (decrease in unhealthy snacking) and then obstacles standing in the way to reach this desired goal. The subjects assigned to the control group, however, were only informed that one of the possible ways to cut down unhealthy snacking is to replace them with healthier substitutes (e.g. chocolate bar with orange). In the next 7 days, all participants noted in their diaries how many and what kind of snacks they consumed everyday. As a measure of unhealthy snacking, not only the number of snacks was accounted but also their caloric value. The results showed that after 7 days participants from the experimental condition assimilated significantly less calories from unhealthy snacking comparing to subjects from the control group. The average number of calories from unhealthy snacking in the mental contrasting and implementation intentions group was 1745 for the week period. In the control condition, the weekly value was much higher (2870 calories).

The goal of the study 2 [72] was to determine the primacy of the two volitional techniques. The question was: What is more effective, mental contrasting or implementation intentions, or maybe the synergic effect of combining both techniques? The subjects were divided into three groups: with the use of implementation intentions, with the use of mental contrasting and mixed with the use of both techniques. The results of the study disclosed that the technique combining implementation intentions and mental contrasting provided with significantly better effect than each of the techniques itself. Nonetheless, there were no significant differences in efficiency of the two techniques used separately.

4.3.3. The role of implementation intentions and mental contrasting in regular exercise

Lack of regular exercise is being attributed to many mental and physical health problems [65, 66]. On the other hand, regular physical activity predicts well-being and longevity (Anders Hansen, *The Real Happy Pill: Power Up Your Brain by Moving Your Body*, 2017).

In the study conducted by Milne et al. [7], implementation intentions were used to increase the regular exercising among 248 university students. They were divided into three groups: motivational training, motivational plus volitional training and no intervention groups. At the beginning of the study, subjects assigned to the two experimental conditions were provided with the leaflets informing about the health threats implied in the lack of regular exercise and also about the benefits that can be gained following the regular physical activity. This procedure served as a motivational support, supposed to awake the desire to change current habits and formulate an intention to attain the desired goal (to exercise regularly). Besides the informative support, subjects from the second experimental condition (combined motivational and volitional support) were asked to generate implementation intentions of when and

where they were going to exercise in the following week. Participants from the control group did not receive any treatment—they were only asked to engage in regular physical activity in following weeks of research program. In the first week of study, there were no differences between groups in terms of number of workouts. Nonetheless, after second week of the study, significant effects started to appear. Subjects from the second experimental group (combined training) exercised more frequently than those from the first experimental (motivational training) and control groups. Interestingly, there were no differences between the first experimental and control groups. This result proves again that intention induced by awareness of adverse consequences of not changing the behavior and favorable effects following the change is not enough to actually enact this intention.

Sheeran et al. conducted the study with low-SES, middle age, overweight fishermen from North England [73]. The goal of the experiment was to help them to form positive habit of regular physical exercise. About 467 males in their middle ages ($M = 54$ y. o.) were participated in the study. At first, participants were asked about their attitude toward regular activity, and then they were randomly assigned to one of the two groups: experimental (mental contrasting) and control. The subjects from the experimental condition were invited to imagine the gains that regular activity could supply. Most participants considered such results as weight loss or better health. Then, the subjects were instructed to think about major obstacles that stand in the way to reach the desired goal. The main problems foreseen by the participants were lack of time and lack of company during the trainings. In the control condition, no instructions were used to induce favorable change but only the actual level of physical activity was monitored. The measurement of exercise level was conducted three times: at the beginning of the study, after a month and after 7 months of treatment. At the beginning of the study, there were no differences between participants in their activity (or rather inactivity, because most of them denoted that they exercised rarely or not at all). Nonetheless, just after 1 month of joining research program, observable differences started to appear. Subjects from the experimental condition exercised more than those in control group. After 7 months, however, the difference between groups became even greater. Indeed, participants who imagined the benefits of regular physical activity prior to considering the obstacles standing in the way to reach this goal exercised more regularly than those who did not mentally contrast the desired future with unfavorable reality full of obstacles. Subjects from the control condition stayed as inactive as they were at the beginning of the research program.

5. Individual differences in self-control of weight loss process

Most of the studies exploring the individual differences in effective intention enactment, especially in the health-related area, refer to the self-efficacy construct [74, 75]. Proposed by Bandura [76], concept of self-efficacy assumes that a sense of personal control over behavior facilitates effective goal attainment. For example, in the study with diabetes patients motivated to increase their exercise level, the results showed that people lacking self-efficacy benefit from planning strategies significantly less than those who exert high self-efficacy [75]. There are also some other attempts to appoint the dispositional factors influencing effective intention enactment. In the study of 43 dieters, Big Five personality factors were measured to verify the relation between conscientiousness as personality trait and effectiveness of weight

loss [77]¹. The results showed that after 8 weeks of research program women who manifested high level of conscientiousness lost average 1.43 kg more than those who revealed low level of this personality factor.

5.1. The role of *processuality* as type of *mental simulativeness* in effective weight loss

Not only, however, self-efficacy and conscientiousness seem to influence humans' ability to struggle with goals. Since different types of mental simulations lead to diverse effects in intention enactment, the personal, individual tendency to imagine either outcome of action or the process of reaching it should result in varied achievements. To test this hypothesis, Jarczewska-Gerc [78] constructed the Questionnaire of Goals dedicated to measure the individual difference in the way people imagine the goals and the process of attainment, called *mental simulativeness*. This construct can be defined as an individual tendency to imaginatively think about the goals either in the structural or outcome mode. The analysis based on the representative for Polish population sample (1005 of Poles) showed that the questionnaire accounts for two factors: the structural factor (processuality: focusing on outcome versus process of action) and the affective factor (the valance of emotions which accompany the action: positive versus negative). This two factor construction of questionnaire enables to distinguish four types of mental simulativeness:

1. "Persistent" —People who manifest high processuality when set their goals and experience predominantly positive emotions while achieving them. Subjects representing this type easily set plans for their actions and imagine step-by-step activities which are imprinted in successful performance. Once analyzed, they do not dwell on past failures but effectively move on. They are characterized by rather positive affectivity. Objectively, they are very effective and persistent in actions.
2. "Defensive pessimists" —Subjects who display high processuality, though at the same time they tend to fall into ruminations. They imagine the structure of performance but not so much to gain the goal but rather to avoid the failure. Prior to prevent potential adversity, they imagine the obstacles standing in the way to attain the goal. They experience more often negative affect and tend to ruminate over past misfortunes. Objectively, they usually succeed in their actions but the cost of performance is very high, sometimes exceeds the gains.
3. "Depressives" —Persons who reveal low processuality and high ruminations. They focus their attention on the outcomes of performance—especially negative ones—failures. Subjects representing this type rarely set or plan to attain their goals since they settle on defeats and ruminate over them.
4. "Wishful optimists" —People who display low processuality but still experience mostly positive affects (at least, for a time). Persons representing this type fall into positive

¹The study was conducted within MA seminar supervised by Ewa Jarczewska-Gerc at SWPS University of Social Sciences and Humanities in Warsaw, Poland.

fantasies (conf. [79]); they daydream about eligible outcomes but do not think much about how to enter the action and actually reach the goal. Objectively, most of times they loudly speak about their desires and resolutions but rarely enact them later on.

In the study of dieters, those who represented “persistent” type of mental simulativeness showed the highest weight loss comparing to other types after 5 weeks of research program [80]. Also research with bariatric patients confirms the relation between simulativeness and effectiveness in action [81]². In the longitudinal study with 38 obese subjects (with BMI 34–60) who decided to undergo bariatric surgery, the effects of the operation were measured after a following year. The results showed significant correlation between individual tendency to processuality and weight loss in the group of female patients ($r = 0.62$, $p < 0.05$).

5.2. The role of motivational (internal versus external) and volitional dispositions in weight loss

In our latest applied studies with dieters, conducted in 2017 [82], we intended to identify main factors, which drive people to go on a diet and then to assess the influence of those factors on the actual diet effectiveness. The subjects were recruited from the dietary internet portal DietaOxy, which provides with prescriptions and dietary supplements.

In the first step of our research program, we designed the questionnaire to measure types of motivation for weight loss, called the *Motivation for Weight Loss Questionnaire*. The construction of this questionnaire was based on the general assumption that to enter the diet and persist in its enactment depend much on the motivational factors (What drives us? Why are we doing this?), volitional factors, i.e. the ability to delay of gratification (resist a temptation) [42] and ability to affect regulation [33].

In this research program, 853 subjects were participated (aged 16–81, $M = 37$), women in majority ($N = 816$ females aged 16–68, $M = 36$). The factor analysis of the results from the *Motivation for Weight Loss Questionnaire* revealed six factors related to weight loss process: three motivational and three volitional.

Within motivational factors, the following factors were distinguished: (1) *internal motivation*, (2) *positive external motivation* and (3) *negative external motivation*. *Internal motivation* factor refers to the global and long-term desire to change lifestyle including dietary behaviors. Persons receiving high results on this factor decided to go on diet because they want to maintain or regain health. Diet is not a temporary whim for them, they tend to internalize behaviors attempted to lose weight. They consider overweight and obesity as adverse health conditions. *Positive external motivation* is a factor strictly related to the positive outcomes expected following the diet. Persons who receive high results on this factor motivate themselves by focusing on benefits, especially appearance related, derived from the weight loss. They also have high need for positive appraisal from relatives and significant others (especially from the partner). The last motivational factor—*negative external motivation* operates when the subject perceives

²The study was conducted within MA seminar supervised by Ewa Jarczewska-Gerc at SWPS University of Social Sciences and Humanities in Warsaw, Poland.

own decision about dieting as a kind of punishment for sins. The necessity to change everyday menu makes them quite nervous, because they did not internalize the reasons for dieting. This happens because most people rebel against the behaviors which they thought planned but still do not accept. People scoring high on this factor look forward to finish the diet and go back to the previous, unhealthy habits.

Within volitional factors, the following factors were distinguished: (1) *the ability to delay of gratification* and two different affect regulation strategies, i.e. (2) *task-oriented* and (3) *avoidance-substitutional* strategy. Subjects who score high on the *ability to delay of gratification* factor declare that they can resign from the temporary pleasure in order to achieve greater and more valuable goal in a while. For them, the necessity to employ the diet and abandon previous bad habits constitutes a natural path to attain the desired goal. The *task-oriented strategy* factor means facing the challenge, planning the action and avoiding eating unhealthy food as a coping behavior. In turn, the *avoidance-substitutional strategy* factor is a tendency to mentally and/or physically escape from the difficulties and effort, focusing on the stimuli and activities unrelated with ongoing action. The subject scoring high on this factor when exposed to a stressful condition tends to attenuate negative affect by bingeing on tasty foods, alcohol or excessive shopping.

The cluster analysis based on this six factors solution revealed three types of dieters, which we operatively named: "Masters of self-control," "Motivated" and "Waiting for a miracle."

"Masters of control" (N = 223) exactly know why they decided to go on diet; they want to permanently change the lifestyle to gain or regain health, well-being and happiness. They are internally motivated, thus external rewards or gratifications (like attractive "bikini look") are not so important for them. They can easily delay of gratification and generate plans and strategies of goal implementation. They can both initiate advantage behaviors and inhibit adverse activities. While faced with difficulties, they most usually use task-oriented strategies of coping. They rarely obey to impulses when stressed or anxious.

"Motivated" (N = 296) are also effective in their pursuance of weight loss. They are motivated and their willpower is high, but at the same time they are driven by diverse motives. Being healthy and happy are much of their desire, but besides that they yearn for external attention and appreciation. They daydream about the positive results of losing weight, like attractive, thin figure, being praised by relatives and strangers. In stressful situations, they chose task-oriented strategies at first, but sometimes they also fall into substitutive or avoidance behaviors.

"Waiting for a miracle" was the most represented type in the study sample (N = 334). The subjects representing this type are motivated externally and their motives are in majority negative. They experience many various problems while enacting their intentions, because they have problems with delay of gratification and planning. They perceive dieting as a punishment and look forward for a diet to terminate. They daydream about an attractive appearance but without restrictions. Most usually they use avoidance-substitutional strategies of coping when faced with stress.

Figure 4 shows the average results on respective factors dependently to the type of dieter (1–7 scales were used, where 1 means *this statement does not suit me at all* and 7 means *this statement totally suits me*).

The last step of analysis was aimed to verify the differences in actual weight loss between subjects representing particular types of dieters (measured by declarations of subjects provided in the internet). The analysis (one-way ANOVA) indeed revealed the main effect of the type of dieters ($F(2, 755) = 15.5, p < 0.001$) showing that subjects who were qualified to “Masters of self-control” and “Motivated” lost significantly more weight than those representing “Waiting for the miracle” group. The results are presented in **Figure 5**. The differences are a, b–c, $p < 0.001$.

The results of the study enabled to distinguish three different types of dieters and denote their effectiveness in weight loss process. As we assumed, people differ in terms of the drivers which steer them to go on a diet and later determine efficiency in implementing their weight loss-related intentions. The results comply with the theoretical assumptions, which formed the basis for our expectations. People differ in both: the source of the dietary motives (external versus internal) and volitional ability to realize these motives in factual action. Those differences, as it was confirmed in the statistical analysis, influence the effectiveness in goal attainment, also in weight loss area. It should also be remarked that the majority of our sample were females, thus the conclusions can be only attributed to this group of subjects. In further studies, we intend to account for more male participants and verify the legitimacy to include them to respective types of dieters. Furthermore, in following steps, we plan to generate appropriate feedbacks for subjects representing particular types to help them effectively pursue their dietary goals. Especially, we will focus on the “Waiting for a miracle” type, which occurred to be the least effective while dieting.

6. Concluding remarks

In this chapter, we presented theories and research concerning the problem of self-control in weight-related behaviors. We intended to demonstrate what the self-control is, what are its manifestations and how successes and failures of self-control can be explained. We depicted techniques which can increase self-control: mental simulations, mental contrasting and implementation intentions. We indicated benefits of those techniques but also marked the threats which are imprinted in inappropriate forms of using them (e.g. adverse effects of outcome mental simulations). Additionally, we presented data, especially from our studies revealing the role of individual differences in effective weight loss.

Our review of selected theories and empirical data presented in this chapter enables to formulate following global conclusions and remarks:

1. However, self-control, as a significant factor in effective intention enactment (including weight loss intention), requires effort, the mechanisms rooted at its core are diverse and go beyond ego strength thesis comprehended as restricted and depletable self-regulatory, energetic resource.
2. The effort necessary for effective intention enactment depends on the modes of self-management, what precisely means the degree to which the regulation standard (goal, intention) is integrated with the self. There are two self-management modes: democratic

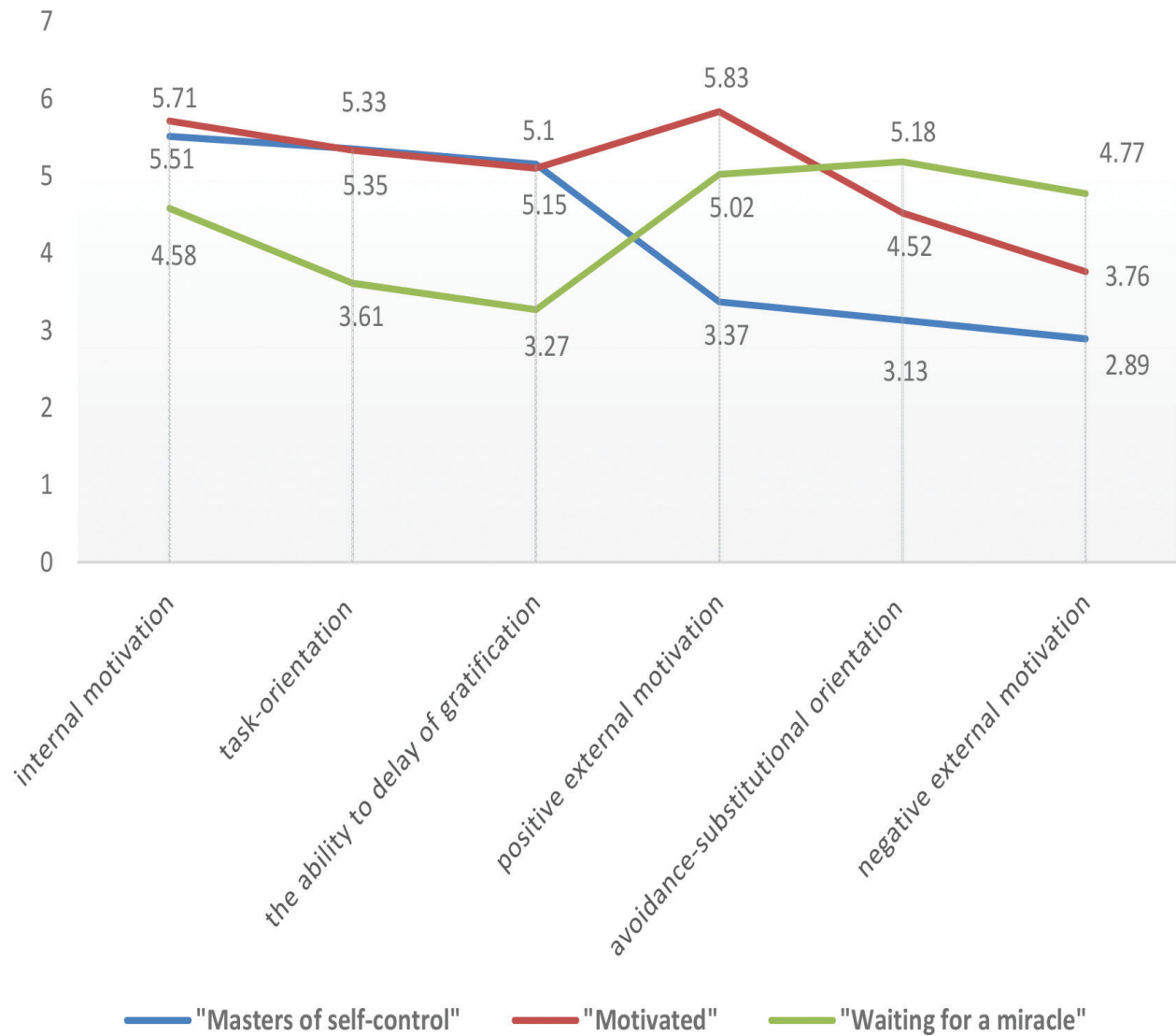


Figure 4. The average results on respective factors dependently to the type of dieter.

and autocratic. First one—democratic mode (named by Kuhl self-regulation)—enables performance consistent with the self (goal/intention is integrated with the system representing own needs, value preferences and autobiographical memory) and allows for the self-system’s integration. Autocratic mode in turn (named by Kuhl self-control) excludes the influence on the performance of significant aspects of the self like feelings, needs or values. The person in the self-control mode implements the intentions which are not integrated with the self at all or are integrated in small extent.

- 3. Affect regulation (the ability to activate positive and/or neutralize negative affect) plays a significant role in effective intension enactment.
- 4. Alike mental simulations, mental contrasting and implementation intentions are beneficial techniques of self-control enhancement.

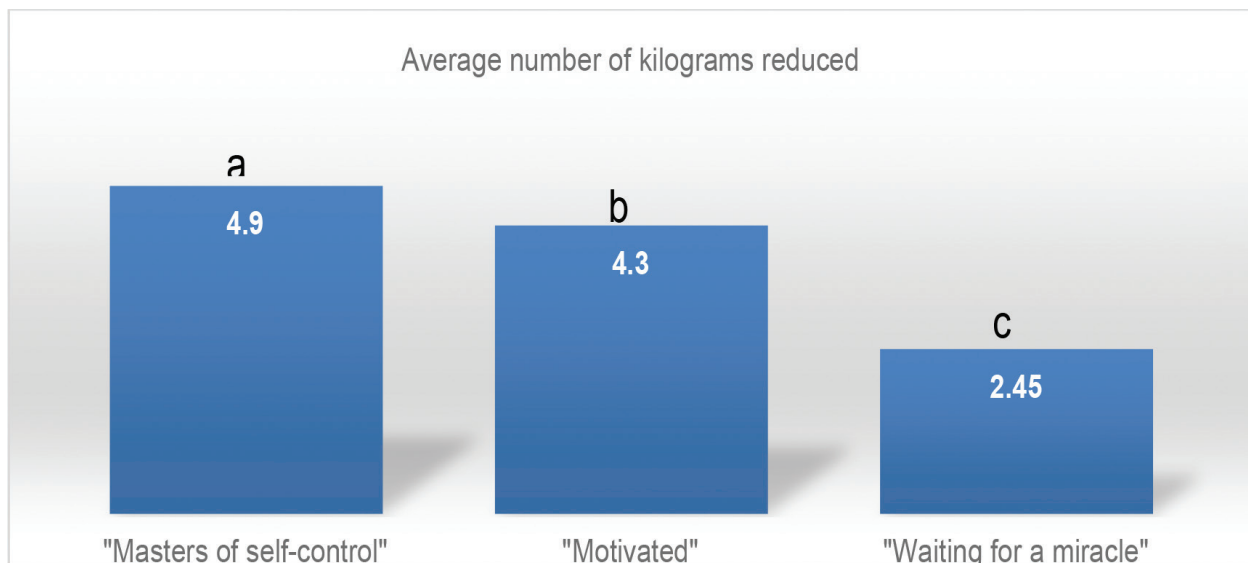


Figure 5. The average weight loss (in kilograms) dependently to the type of dieters.

5. Research results prove as far that in weight-related behaviors, the technique combining implementation intentions and mental contrasting is more beneficial (provided with significantly better effect) than each of the techniques itself.
6. The results of our studies referring to the influence of various mental simulations on the effectiveness in weight loss process evidenced that imagining the process of performance increases both effectiveness and persistence in intention enactment. Our studies also showed that combination of simulations (process and outcome simulations) can be the most beneficial technique of self-control enhancement.
7. There are individual differences in the way people imagine the goals and the process of their attainment. An individual tendency to imaginatively think about the goals either in the structural or outcome mode is called mental simulativeness. The results of our studies presented that the subjects representing so-called persistent type of mental simulativeness, who are characterized by the high processuality (i.e. strong tendency to imagine the process of goal attainment) accompanied with experiencing positive emotions while achieving the goal—showed the highest weight loss after 5 weeks of dietary program.
8. In the search for main factors which drive people to go on a diet and individual differences in this domain, we entered the research program which takes into account motivational factors (internal versus external motivation), volitional factors (the ability to delay of gratification) and affect regulation strategies as well (task-oriented and avoidance-substitutional strategy). The data gathered as far evidenced that type of dieters, which we operatively named "Waiting for a miracle," is the most represented type in the study of Polish sample. The subjects representing this type are motivated externally and their motives are in majority negative. They have problems with delay of gratification and planning. They perceive dieting as a punishment and look forward for a diet to terminate. Most usually they use avoidance-substitutional strategies of coping when faced with stress.

Hopefully, the theoretical and empirical review presented in this chapter was at least in some part exhaustive and contributed to better understanding of processes, which are involved in humans' attempts to struggling with goal. Further studies should focus on possible sources (e.g. energetic, neural, etc.) of interindividual differences in self-control abilities and suggest the ways in which psychological interventions could compensate unequal chances for success in health-related behavioral change. Additionally, virtual reality seems to be an interesting area of further explorations. Currently, in Poland, there are conducted studies which are dedicated to examine the possibility of using virtual reality in the phobias area (the results have not been published yet since the studies are still carried on). Research concerning implementation of virtual reality could open a new path to scrutinize mechanisms of will power and later on inspire practitioners to create diverse and complex interventions dedicated to everyday struggles with self-control problems.

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