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The complexity of self-regulating food intake in weight loss maintenance. A qualitative study among short- and long-term weight loss maintainers

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Abstract

Rationale

Whether self-regulation of food intake in weight loss maintenance (WLM) differs between being a short-term maintainer (having maintained without regaining less than 12 months) and a long-term maintainer (having maintained without regaining at least 12 months) is under-researched.

Objective

The aim of this study was to explore the self-regulatory strategies and self-efficacy beliefs applied by short- and long-term maintainers to the complex set of behaviours comprising food intake in WLM, and to obtain a better understanding of their challenges in the various food-intake processes in WLM.

Method

Individual interviews (14 female/4 male) were conducted with nine Danish short- and nine long-term weight loss maintainers. The Health Action Process Approach (HAPA) was applied post-hoc to organise data and support analyses, since it focuses on both the cognitions (e.g., self-efficacy, the nature of which differs depending on the phase of behaviour change) and self-regulatory strategies (e.g., action planning and coping planning) involved in behaviour change.

Results

Self-regulatory strategies and self-efficacy beliefs varied between the food-related behaviours and between short- and long-term maintainers. Consistent with the progression suggested by HAPA, with repeated use of action and coping planning, long-term maintainers had formed habitual routines, allowing more flexibility, but also providing stronger self-control in the behaviours related to WLM such as buying and storing food, and eating at social gatherings. The short-term maintainers often displayed a ‘weight loss mind-set’, focusing on the avoidance of certain behaviours, showed less self-regulatory flexibility, more detailed action planning, but their

interviews also inferred having ambitions for building strong WLM-habits, maintenance and recovery self-efficacy.

Conclusion

The contribution of this study is a more comprehensive view on food intake as an outcome of a set of complex behaviours, revealing insights into the differences in cognitions and strategies applied to the task of WLM, between short- and long-term maintainers.

Keywords: Denmark, Weight-loss maintenance, self-regulation, food intake, self-efficacy beliefs, qualitative

1 Introduction and background

The worldwide prevalence of obesity has more than doubled between 1980 and 2014, resulting in approximately 13 percent of the world's adult population being obese, and 39 percent being overweight (WHO, 2016). Being overweight increases the risk of cardiovascular disease (Field et al., 2001), type 2 diabetes (Stein & Colditz, 2004), and some types of cancer (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003). Weight loss (WL) resulting in a healthy range body mass index (BMI) (18.5-24.9 for adults) is desirable, as is the long-term maintenance of such weight loss. Successful long-term weight loss maintenance (WLM) has been defined as losing at least 10 percent of initial body weight and keeping it off for at least six months (Elfhag & Rössner, 2005) or one year (Wing & Hill, 2001). After weight loss, there is a considerable risk of regaining weight (e.g., Anastasiou, Karfopoulou, & Yannakoulia, 2015; Elfhag & Rössner, 2005; Jeffery et al., 2000; Reyes et al., 2012). Over-strict dietary regimes during WL (Wing & Hill, 2001) and difficulties breaking unhealthy habits (Cleo, Isenring, Thomas, & Glasziou, 2017) have been associated with unsuccessful WLM. In addition, a recent review of qualitative studies on WLM explains that the behavioural changes needed to maintain weight loss creates a psychological 'tension' due to the need to override existing habits (Greaves, Poltawski, Garside, & Briscoe, 2017). This study's investigation of various food-related behaviours in WLM is a way of exploring this tension and try to understand whether this tension gets somewhat resolved as the duration of WLM increases.

The focus of this study was on the self-regulatory behavioural strategies related to food intake in WLM, since food intake is one of the two main factors (together with physical activity) having an impact on WL and WLM (e.g., Franz et al., 2007; Teixeira et al., 2015). In this study, food intake was considered as a personal food system (Sobal & Bisogni, 2009), where food intake is an outcome of a complex set of food-related behaviours, such as planning, shopping, storing and cooking food, and dealing with impulses, cues, and social norms in different situations.

To understand long-term WLM, it is relevant to explore self-regulatory strategies used in food intake. By contrasting self-regulatory strategies and self-efficacy beliefs between long-term weight loss maintainers (maintained a weight loss for at least 12 months) and short-term maintainers (maintained a weight loss less than 12, but more than two, months), the aim of this study was to obtain a better understanding of short- and long-term maintainers' challenges in the various food-intake processes in WLM.

1.1 Previous studies on food intake self-regulation in WLM

Self-regulation has been defined as an individual's ability to exercise self-control and purposively override a short-term goal (e.g., pleasure) to act consistently with a long-term one (e.g., weight control), and furthermore, the ability to employ effective self-regulatory strategies (e.g., self-monitoring) to evaluate the success in attaining the goal (Carver & Scheier, 1998). Previous studies on self-regulation of food intake have positively associated WLM with frequent self-monitoring of body weight and food intake, regular physical activity, eating a low-fat diet, and in general being able to self-regulate behaviour (Burke, Swigart, Turk, Derro, & Ewing, 2009; Chambers & Swanson, 2012; Elfhag & Rössner, 2005; Hindle & Carpenter, 2011; Karfopoulou, Mouliou, Koutras, & Yannakoulia, 2013; Wing & Hill, 2001). However, these studies seem to merely define food intake as lower energy intake, rather than the outcome of a set of complex, interactive behaviours related to food intake that are embedded in people's daily routines and social activities. In addition, previous qualitative studies among weight loss maintainers have focused on successful maintainers compared to those who relapse in the behaviours needed for successful WLM (Byrne, Cooper, & Fairburn, 2003) or to those who regain (Chambers & Swanson, 2012; Christensen et al., 2017; Reyes et al., 2012). Hence, this study contributes with insights into WLM. Focusing on

differences between short- and long-term maintainers has the potential to further existing understanding.

1.2 Conceptual framework for analysis

With the aim of this study in mind, The Health Action Process Approach (HAPA) was found most useful for post-hoc organisation of the collected data and supporting the analysis. Other models, such as The General Model of Preventive and Interventive Self-Control (Hofmann & Kotabe, 2012), Integrating Components of Self-Control (Kotabe & Hofmann, 2015) and The Situational Strategies for Self-Control (Duckworth, Gendler, & Gross, 2016), were also considered, but rejected due to the narrower focus on self-control.

HAPA distinguishes between a pre-intentional motivation phase, where pre-action self-efficacy, risk perception, and outcome expectancies influence behavioural intentions, and a post-intentional volitional phase, where actions are planned, controlled, and maintained, considering the individual's perceived barriers and resources (Schwarzer, 2008). Planning is a prospective self-regulatory strategy where mental simulations link concrete responses to future situations. Planning can be further categorised as action planning and coping planning, where action planning refers to the process whereby goal-directed behaviours are linked to certain environmental cues (e.g., Gollwitzer, 1993) specifying when, where, and how to act. Coping planning refers to the mental simulation of overcoming anticipated barriers (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Different self-efficacy beliefs are required to master the various tasks in the different phases successfully (Schwarzer, 2008). Maintenance self-efficacy refers to the perceived capability to maintain a newly adopted behaviour, develop routines, and cope with unexpected barriers in the maintenance phase (Luszczynska & Schwarzer, 2003), while recovery self-efficacy is the perceived

capability to deal with lapses. Individuals high in maintenance self-efficacy respond to difficulties with more effort, persistence and confidence to overcome hurdles (Sniehotta et al., 2005), and if experiencing setbacks, individuals high in recovery self-efficacy manage to control the damage and get back on track relatively quickly (Schwarzer, 2008). Although not a self-regulatory theory per se, HAPA provides a framework for understanding both the motivation processes that lead to a behavioural intention (about WLM) and the post-intentional volition processes that lead to the actual health behaviour (the self-regulatory strategies).

2 Method

2.1 Sampling and participants

Individual semi-structured interviews were carried out with 18 adults (14 females, four males) in Denmark between August and December 2015. Since both short- and long-term maintainers should take part in the study, several purposeful sampling strategies were used to recruit participants: Physical advertisements were put up in supermarkets, libraries, and other public places allowing this sort of advertisement (five were recruited). Online adverts were posted in closed Facebook groups on weight loss and weight loss maintenance (three were recruited). The first author also contacted three general practitioners across Denmark, who pointed eligible patients' attention to the study (three participants). Snowball sampling was also applied by asking participants whether they knew of others fulfilling the criteria who would be interested in participating (seven were recruited).

Eligibility criteria included being 18 years or more, a BMI before weight loss above 25 kg/m^2, a clinically significant weight loss (> 10%) with no more than 2 kg regain (taking into account normal weight fluctuations) and a stable weight for at least two months. Potential participants were

asked to fill in a short pre-interview screening questionnaire at home covering age, height, current weight (in order to compute BMI), lowest and highest adult weight, duration of last WL attempt and amount lost and length of maintenance period. Eight out of 26 potential participants did not meet the eligibility criteria (five had not lost 10%, one had an initial BMI lower than 25 kg/m^2 and two had regained more than 2kg (5 and 7kg, respectively) during the WLM period), which resulted in 18 participants taking part in the study. Table 1 provides the background characteristics for the participants.

---Please insert Table 1 here----

Nine short-term maintainers (mean age = 39.8y, SD = 19.9) and nine long-term maintainers (mean age = 43.2y, SD = 12.7) participated in the study. Their self-reported pre-weight loss BMIs were between 26.6 and 66.8 kg/m^2 (mean = 38.7 kg/m^2, SD = 11.7 kg/m^2 for short-term maintainers and mean = 31.9 kg/m^2, SD = 3.2 kg/m^2 for long-term maintainers. They reported to have lost between 10 and 41.7 % of their bodyweight (with means of 21.3% for short-term maintainers and 25.8% for long-term maintainers). In addition, they reported to have maintained their weight for periods ranging from 2 to 33 months. Five of the short-term maintainers expressed that WLM was a consequence of reaching a WL plateau and that they maybe at some point would like to achieve even more WL.

2.2 Procedure

Interviews took place during the day, early evening, and on weekends and were conducted in person (15) or by phone (three). All interviews were audio recorded and conducted by an experienced

interviewer (SP). The study was conducted in accordance with the Helsinki Declaration and no formal ethical approval was required according to the Danish National Committee on Health Research Ethics in Central Denmark Region. At the beginning of the interview, participants were informed about their right to leave the study at any time. Participants gave informed consent and were told that the study was about their experiences with WLM. At the end of the interview, participants were debriefed and were given the opportunity to ask questions about the study. They received a gift certificate of DKK 200 (approx. 27 €) for their time and effort.

The interviews followed an interview guide focusing on four themes related to food behaviours in WLM: Planning, shopping, cooking/preparation, and eating. For instance, participants were asked about their meals and snacks during a typical day, what determined when they ate and with whom, and how they went about planning and shopping for food. They were also asked about their food preparation practices and how their family was involved in the various steps. An overarching fifth theme was the perceived barriers and resources useful for WLM (see interview guide in appendix). The 18 interviews lasted between 52 and 84 minutes. The interviews were transcribed verbatim (in Danish) by the first author and four student assistants. A transcription guide based on the recommendations of Silverman (2001) was developed to ensure consistency and transparency. This was, as recommended by Fade and Swift (2011), checked across transcriptions as well as between all audio recordings and transcriptions by the first author.

2.3 Data analysis

The coding process began with reading the transcriptions thoroughly several times to become familiar with the data. Initial codes were based on the five themes related to food intake as outlined in the interview guide: planning, shopping/storing, preparing/cooking, eating, and general barriers

and resources in WLM. Then post-hoc coding was applied based on HAPA, focusing on both the cognitions (i.e., self-efficacy beliefs involved in the various processes of regulating food-intake for WLM) and volitional processes (i.e., self-regulatory strategies) involved in WLM. Hence, the model helped to organise the data and supported the analysis. Thematic analysis, which can add to the description and exploration of a phenomenon (Flick, 2006), was also applied to identify additional themes. Codes were compared for short- and long-term weight loss maintainers, themes identified and relations between the themes were discussed between two coders to reach consensus. Finally, the differences between short- and long-term maintainers were highlighted. The analysis was conducted using NVivo (version 11, QSR International, 2015).

3 Results

3.1 Planning

The majority of participants reported that planning was a key part of their WLM efforts when it came to food intake. This involved action planning, such as deciding in advance what they were going to eat, when, and where. This helped them ensure a calorie intake that would not jeopardise their overall WLM efforts. Although many participants described how they consciously planned their meals for the day or the week, it was also common for them to rely on beneficial habits and routines developed during WL. For example, participants tended to eat a similar breakfast and lunch every day, which no longer required the same extent of planning. Hence, over time, constant self-regulation had turned into habits. Those who engaged in planning specific meals, writing down their plans and displaying them (e.g., on the fridge) saw this as a helpful strategy. If participants felt their WLM efforts slide, their planning became stricter: *"If I feel my good habits* are slipping, I *plan my food intake for the next couple of days"* (female, 36 years, 24 months WLM). The mentioned types of action planning helped participants to feel in control, and especially short-term

maintainers were explicit about the need for action planning, while long-term maintainers to a greater extent relied on habitual behaviour.

Participants also described instances of coping planning helping them manage any unforeseen circumstances – either situations or urges – that might otherwise have jeopardized their WLM. Especially long-term maintainers mentioned the habit of keeping snacks such as carrots, fruit, and nuts ready and available to quench their temptation for more energy-dense foods: *"Now I always* have peeled and cut *carrots in water in the fridge. If I want a snack, I always go there first"* (female, 61 years, 24 months of WLM). Some even had a 'planned lapse' – for instance at weekends before returning to their usual eating routine during the week. One participant reported: *"I have a small ritual, a Saturday ritual. I* must have a pizza during the weekend, because I love pizza. I know it is inappropriate to eat pizza every day, so I have to get a pizza once a week and I want cris*ps as well. And you can't have that without soft drinks. Sunday, I am back on track"* (male, 31 years, 12 months of WLM). Since he had lost 31kg in one year and maintained this WL for a year while practicing this ritual, his self-efficacy beliefs about getting back on track were strong and an integrated part of his maintenance efforts.

3.2 Shopping and storing

Linked to planning, shopping played an important role in WLM for both short- and long-term maintainers. Many participants stated that they prepared a grocery list with the necessary items to sustain their WLM. Sticking to a grocery list allowed participants to resist putting, for instance, high-energy dense snacks in their basket: *"*My *grocery list is what I use when I shop (….) it keeps me from looking at all the offers"* (male, 63 years, 4 months WLM). Others – mostly long-term maintainers – did not use a written grocery list, but had a general idea about what to buy in order to

stick to their weight management plan. Linked to the development of healthy habits resulting from more rigid restriction and planning in WL, several participants had reached the stage where, rather than planning specific individual meals, their planning occurred more so in relation to shopping. That is, even without a meal-by-meal plan, the fact that they only purchased and stored healthy ingredients meant that they were still able to stick to a WLM-enhancing eating pattern: "Well, I buy huge, huge amounts *of vegetables (…) it is more improvisation (…) and I always make sure to* stock *almonds, lentils and beans in my cupboards"* (female, 44 years, 24 months WLM).

Activities related to shopping and storing also included elements of coping planning. Following the logic of *"You cannot eat what you don't buy"* (female, 44 years, 24 months WLM), several participants said that availability at home (including limiting the availability of unhealthy foods) was key in managing impulses, if and when they arose. Hence, on entering a shop, some participants, who characterised themselves as low in impulse control with particular foods (both short- and long-term maintainers), committed themselves not to buy or look at tempting products. Especially short-term maintainers explained that leaving the supermarket without any high energy-dense food items made them feel good about their self-control – hence, the experience had strengthened their maintenance self-efficacy beliefs. Some participants – both short- and long-term maintainers – limited their exposure to unwanted items by scheduling their grocery shopping to once or twice a week, only. It saved them time, but also made them avoid temptations. Most of the long-term maintainers did not use complete avoidance as a coping strategy, but reminded themselves explicitly about the consequences of buying energy-dense foods. When faced with a good offer on their favourite energy-dense snack, some said they would buy the snack, but also immediately planned how to store and ration it.

3.3 Preparation and cooking

After shopping and storing food, preparing and cooking it naturally followed. Here, participants described several strategies to support their WLM. This did not seem to depend on where they were in the WLM phase, but more on their cooking skills (which some participants described as almost non-existent and some as very good) and their responsibility for cooking in the household. Food preparation strategies were often thought of as supportive or, for some, even solutions to good WLM (and a direct consequence of WLM-focused shopping strategies) rather than challenges to be overcome.

Cooking and preparing food also involved elements of action planning. Some participants often cooked a double portion of wholesome food to make it easier to maintain their WL: one portion was eaten the same day, and the other was kept in the fridge for consumption later in the week, or stored in the freezer: *"It's a lot of work, but we have* it structured*, and overall it saves time"* (female, 46 years, 6 months WLM). Others pointed out that this strategy also served as a way of coping with the likelihood of more WLM-compromising food choices in a busy schedule knowing they had a wholesome ready-to-eat meal at home.

Participants confident in their cooking skills stated they were able to improvise meals using different ingredients. Others tried out new ingredients or prepared well-known ingredients in a new way. This creativity was, for some (both short- and long-term maintainers), very rewarding and strengthened their maintenance self-efficacy. Some even enjoyed making everyday foods from scratch such as tomato ketchup, hummus, or rye bread – hence, the enjoyment of the behaviour itself became a motive for maintenance. Even though it could be tiresome, a number of participants expressed how they liked the slow process of peeling potatoes or carrots, and perceived cooking as a kind of mindfulness exercise, in which they actively paid attention to the smell, appearance, and taste of the ingredients – all perceived as supportive of WLM, especially among long-term

maintainers. A long-term maintainer gave an example: “Cooking used to be something that I wanted to be done with as quickly as possible. Now, I actually enjoy it. It is fun trying out new foods or techniques – it is like a break for me” (female, 54 years, 18 months WLM).

Some participants with self-perceived limited cooking skills described how their partner was a better cook, therefore leaving most of the cooking to her/him: *“My girlfriend is very creative with soups (….) so* my diet is more varied than ever since I left h*ome”* (male, 31 years, 12 months WLM). Even though they had strong self-efficacy beliefs about the outcome (WLM), they exercised no personal control, but relied on their partner’s understanding of nutritional issues relevant for WLM support.

3.4 Eating

In eating, control over portion sizes was a crucial action planning element for both short- and long-term maintainers. Some participants described how they had replaced their usual dinner bowls and plates with smaller ones, thereby cueing them to eat smaller portions. Since this had become habitual, it kept them from thinking consciously about self-regulation. Others reminded themselves only to have one serving or dished out their food in the kitchen, thereby avoiding pots and pans on the dinner table from which they could easily serve a second helping.

Especially short-term maintainers memorised the number of calories in certain portions or types of food and thought about that while eating: *“If I know this meal contains 400 calories, if I eat one* portion, then I *know I am okay”* (male, 27 years, 2 months WLM). This ‘WL-mind-set’ was closely related to the trade-off thinking displayed by several participants such as this long-term maintainer, who often asked herself: “Is this food really worth eating considering how many calories it contains?” (female, 53 years, 12 months WLM). Some exercised flexible restraint when restricting

other meals or increased physical activity in order to maintain an overall reasonable energy balance. One short-term maintainer gave an example: *"I can fancy a burger or a big pizza (...)* but I manage *to catch myself and say: 'No, you really don't want to do that because you know how much time you* need to *spend losing it again'"* (male, 27 years, 2 months of WLM). Hence, using this 'trade-off strategy' and thinking of 'counteractions' actually acted as a deterrent for the WLM compromising option. This was especially true for short-term maintainers.

'Mindful eating' was a term familiar to some participants (e.g., a female participant (54 years, 18 months WLM) who had attended a course in mindfulness in relation to stress reduction at work), who used this as an element of action planning. In order to constrain eating, they tried to focus on the texture, taste, and smell of the food while eating. By doing this in most eating situations, they focused on what they actually ate and feelings of satiety and hunger. Some tried to overrule hunger signals by distracting themselves with, for instance, taking a walk, emptying the dishwasher, or listening to the radio. Others ate a small snack (e.g., 5 almonds), or started preparing dinner and allowed themselves to nibble on some of the vegetables. Some participants had practiced paying attention to cues for satiety and hunger. One participant concluded: *"I have* learned that I w*on't die from feeling hungry. You learn it is okay to feel hunger in your stomach and that you don't have to give in to the hunger controlled by your brain"* (female, 53 years, 12 months WLM). After having eaten smaller portions during WL and WLM, over-eating was experienced as unpleasant and something to avoid. However, some acknowledged that their sense of hunger was distorted – even in WLM: *"Even now, after keeping my weight for so long, I can still binge eat (...) I don't think I* feel satie*ty like others do, I can just keep on eating"* (female, 36 years, 24 months WLM). Hence, she had a need for ongoing, active self-regulation despite having maintained for 2 years.

Flexibility in eating patterns was also an important element in participants' WLM efforts. Participants were – to varying degrees – aware of the need to integrate more flexibility into their

weight management plans in WLM. The short-term weight loss maintainers showed less flexibility: *"I don't dare go down that* road *again, I stick to what I know works"*, said a 46-year-old female, who had maintained her weight for six months. Long-term weight loss maintainers displayed more flexibility and a general example involved adhering to a quite strict eating regime, but leaving room for social gatherings or unforeseen circumstances.

3.5 Barriers and resources for WLM

This last theme presents the overall barriers and resources in WLM as viewed by the participants. Here, social norms were amongst both short- and long-term maintainers perceived as having a high impact on food intake and one of the biggest barriers to WLM. One example of social norms impacting WLM efforts negatively was declining cake at social gatherings: *"I try to find a way to* live a good life, and it *doesn't make it* easier if people constantly try to keep an eye on how much *cake I eat"* (female, 53 years, 12 months WLM). Trying to turn down offerings was common for participants and some coped with the situation by eating a smaller piece of cake than what was offered. Others tried to bring their own replacement, but it often made them feel isolated and exposed.

Participants living with family members (partner/spouse/children) described how the family's attitudes impacted their WLM efforts. Some participants had experienced family members not appreciating their cooking efforts and criticising the results. One long-term maintainer stated: *"I* have experimented with cauliflower pizza, but my children and husband did not like it – so I have *refrained from making it again"* (female, 33 years, 16 months WLM). Other participants had managed to change the whole family's view on certain foods or dishes: *"Now we always use* Philadelphia Light [spread cheese] instead of cream in our food and nobody can taste the

difference" (female, 49 years, 2 months WLM). Hence, family members' opinions served as barriers for some and as WLM support for others.

Some participants bought special ingredients or prepared special dishes for themselves, while serving the rest of the family what they perceived to be 'normal food'. One participant explained: *"I* prepare a meal with meat, rice and vegetables for my family, but I only eat the meat and the *vegetables (...)* of course, our children were curious about this, so we discussed how my husband is very tall and very, very skinny and that he can eat a lot and still be slim and healthy, while I cannot *eat as much, because my body is different (...) and then we* said to them that they are like their father, so they need not worry so much about they *eat"* (female, 36 years, 24 months WLM). Hence, since she planned this strategy for her WLM, and the family accepted her explanations, she was able to use this strategy long term, thereby building higher self-efficacy beliefs about maintenance.

However, there were also examples of several participants not prioritising their own WLM needs. One example was a divorced participant, whose son stayed with her every other week, stated: *"He* is a fussy eater, he has a hard time eating vegetables, so the meals I prepare when he is here, are not all that healthy. That is my big challenge – *I live far healthier, when he is not here"* (female, 44 years, 24 months WLM). Hence, every other week, when her son was staying at her house, WLM-compromising foods were bought and consumed – both in order to avoid conflicts with her son, but also to give herself a break from the constant self-regulation of WLM. After practicing this for almost two years, she considered her recovery self-efficacy as quite good: "I know what to do when he stays *with his father. I quickly get back in the saddle"* (female, 44 years, 24 months WLM). Other barriers were cues in the participants' environment (such as boredom, stress at work, TV commercials) triggering habitual or automatic processes making WLM harder. One mentioned experiencing a great urge to go to the nearest store in the middle of the night to buy chocolate:

"After a tough week at work, I give in, because otherwise I know I will eat a lot of other rubbish, and will still not be satisfied before I get that special chocolate. So, I have learned to go directly for *what I want, also if it entails driving far to get it"* (female, 33 years, 16 months WLM). Also, participants recognised that they were much better at coping with lapses and changing behaviour compared to earlier in their lives: *"Now, if I have a day that ends with a bad food choice, I am* quicker to get back in the saddle – it does not last for several days *or weeks, as earlier"* (female, 36 years, 24 months WLM). Especially long-term maintainers mentioned having strong recovery self-efficacy beliefs.

Internalised norms about eating and not wasting food were also considered as a WLM barrier. A participant described her inner dialogue about leaving half of her main course while dining at a restaurant: *"Well, normally you would think, 'oh, I have paid for this and then* I *have to eat it' (...)* And yes, I have paid for it, but what is it that I am paying for? I pay for the food, but when I am full I would rather leave some *than pay by being fat"* (female, 35 years, 3 months WLM). Being a short-term maintainer, she was very aware of her internalised norms and reflected on them in a social setting.

Self-control was viewed as a desirable resource for managing WLM. Participants described how they perceived self-control as a mechanism that could be practiced and reinforced: *"In the* beginning there were days where I lapsed, but when I think about it, I am much better now at a*voiding these situations or days (....) I think my self*-control *has improved"* (female, 44 years, 24 months WLM). This was especially true for long-term maintainers, but also short-term maintainers expressed ambitions of improving self-control. Some described different coping planning strategies, such as bringing their own snack to the cinema, or avoiding buffets, since they had little trust in their self-control in such places. One participant coped with the rather strict degree of self-control in WLM by allowing herself regular treats: *"I eat dark chocolate every day"* (female, 24 years, 18

months WLM). Even though it was only a small piece, she found it helpful in exerting self-control at other times. When feeling a desire to snack, some enjoyed the experience of finding new or alternative food products in the store, which could help them enjoy a snack without compromising their WLM efforts: by replacing peanuts with roasted almonds or by eating chocolate with a higher cocoa content. However, sometimes the consistent self-control backfired, and some described how they longed for their favourite foods, but because they did not buy them (in order not to eat them), the desire was so strong that sometimes they had to give in. Finding the right balance between allowing themselves to live and still maintain weight was perceived as important – and this was expressed by almost all participants.

3.6 Summary of results

The expressed self-regulatory efforts and self-efficacy beliefs in various food intake related behaviours were similar across short- and long-term maintainers, but the emphasis was different. These similarities and differences are highlighted in Table 2, which provides an overview over the presented results. These similarities and differences are discussed in the next section. As mentioned in the data analysis section, thematic coding also revealed a number of additional themes, which were not mentioned in the analysis above as they were not directly concerned with WLM and food intake. These themes were different aspects related to physical activity, such as planning and motivation, and personal issues, such as divorce, bullying and illness, which in some cases resulted in a weight gain and later on an aspiration to lose and maintain weight.

----Please insert Table 2 here ----

4 Discussion

The aim of this study was to explore the self-regulatory strategies and self-efficacy beliefs applied by short- and long-term maintainers to the complex set of behaviours comprising food intake in WLM, and to obtain a better understanding of the challenges involved in the various food-intake processes in WLM. The HAPA was used, post-hoc, to organise and support the analysis of the data. Results showed a considerable overlap in self-regulatory strategies between short- and long-term maintainers when it came to eating, dealing with barriers, and utilising resources helpful for WLM. Group differences were more noticeable as regards planning, shopping/storing, and preparing/cooking behaviours. Here, action planning seemed to be more important for short-term maintainers trying to build stronger maintenance self-efficacy, while a greater degree of improvisation and flexibility among long-term maintainers supported their strong maintenance self-efficacy. This was mainly related to their success with building WLM-supportive habits. Long-term maintainers also described enjoyment with some of the WLM-supportive behaviours (e.g., cooking healthy meals and mindful eating), which suggests that these individuals in WLM had developed more autonomous forms of motivation (Deci & Ryan, 1985). In contrast, short-term maintainers displayed to a greater extent a 'WL mind-set' focusing on "inadmissible" behaviours and less self-regulatory flexibility. However, short-term maintainers also had a strong self-efficacy in terms of continuing maintenance. Hence, self-regulatory flexibility and better coping strategies seemed to develop with time in WLM.

The study clearly demonstrated that different self-regulatory skills were at play when regulating WLM behaviour: planning actions, planning coping, maintaining, lapse recovery, dealing with barriers and building maintenance and recovery self-efficacy. Results indicated that long-term maintainers showed a wider range of self-regulatory strategies than short-term maintainers.

The broader view on food intake as an outcome of various food-related behaviours provided a good understanding of how different self-regulatory strategies were applied across separate behaviours. Although the strategies could be categorised into planning, coping and recovery strategies, each interviewee had found their own set of strategies that could be used depending on the type of behaviour (e.g. shopping, cooking or eating). Insight was also gained into how maintenance self-efficacy could be enhanced, but also shattered, thereby possibly influencing the success of long-term WLM. The view on food intake, as more than simply eating, underlined that there is no 'one-size-fits-all' solution to WLM. Indeed, there was considerable heterogeneity in participants' self-regulatory food intake strategies – also between groups (as highlighted in Table 2). To some extent this resembles the results of a study comparing a sample's weight control practices over time in WL and in WLM: only 8 out of 36 practices were the same in WL and WLM (Sciamanna et al., 2011). This suggests that different self-regulatory strategies apply depending on the progress of a maintainer in the process of WLM. As the first 1-2 years after WL are crucial for maintenance success (Anastasiou et al., 2015), this study provides detailed insights into this period of time. The diverse sample of this study is an additional benefit, since it provides richer details than more narrow samples with students (Alsawy & Mansell, 2013; Kitsantas, 2000) or university employees (Reilly, 2015).

Trustworthiness of this qualitative study, as recommended by Lincoln and Guba (1986), was ensured by cross-checking the participants' self-reported data from the screening questionnaire with the interview responses and by having two researchers discussing the coding and analysed themes. Also, by including a thorough description of the recruitment of participants, the characterisation of participants, the context of the interviews and the data analysis method, the aspiration was to provide a 'thick description' (Lincoln & Guba, 1986) in order to ensure credibility and transferability.

4.1. Limitations

A number of limitations should be mentioned: First of all, the short-term maintainers were on average still obese after WL, while the long-term maintainers were normal weight. They also had a considerably higher initial BMI compared to the long-term maintainers. This might indicate that for the short-term maintainers WL was still ongoing thereby questioning their status as 'true' maintainers. Also, both the short- and long-term maintainers had achieved very significant weight losses (21.3 % and 25.8 %, respectively) compared to what was found in other studies (e.g., Elfhag & Rössner, 2005; Wing & Hill, 2001). Hence, participants with these above-average WL results might experience WLM as easier or more positively than people with average WL results thereby limiting the generalisability of the findings. Even though the identified strategies and self-efficacy beliefs had similarities and differences between short- and long-term maintainers, future studies are suggested to investigate the generalisability of the identified strategies for instance by means of quantitative methods.

Moreover, the sample of long-term maintainers was predominantly middle-aged women, very successful at losing weight. The overrepresentation of women might bear on women having more experience with dieting and being more willing to talk about this subject. Hence, the results could be biased towards females' version of WLM. A previous study on men's thoughts on dieting found that men perceived women dieting as doing so for cosmetic reasons, whereas men preferred to think of themselves as dieting for "legitimate" reasons such as health (De Souza & Ciclitira, 2005). Hence, there might be greater differences between men's and women's views of WLM than presented here – however, future studies with a declared aim of exploring gender differences in WLM should look into this.

This study did not aim to identify trends in self-regulation and self-efficacy beliefs related to, for instance, age, initial weight, size of weight loss or even structural stigma (which has been associated with reduced capacity to self-regulate (Richman & Lattanner, 2014)). Future studies should look into this, since detailed information about successful self-regulatory efforts in various segments would be useful for treating obesity and ensuring WLM.

Finally, the post-hoc use of theory (instead of having for instance designed a theory-based interview schedule apriori) is also a potential limitation. However, the purpose of this study was not to test a specific theory through qualitative means. Other models, such as the Situational Strategies for Self-Control (Duckworth et al., 2016), The General Model of Preventive and Interventive Self-Control (Hofmann & Kotabe, 2012) or Integrating Components of Self-Control (Kotabe & Hofmann, 2015), could equally have been used to support the analysis, which may have changed the interpretation. However, since not enough is known about the processes involved in WLM, choosing a theory from the outset might have limited the breadth of responses obtained.

4.2. Conclusions

This study highlighted the differences between short- and long-term weight loss maintainers' self-regulatory strategies and self-efficacy beliefs in food intake. Overlap between the two groups was found in terms of eating, dealing with barriers and utilising resources helpful for WLM, while the differences included self-regulatory strategies in planning, shopping/storing, and preparing/cooking behaviours, where detailed action planning was more important for short-term maintainers.

The contribution of this study is a more comprehensive view on food intake as an outcome of a set of complex food-related behaviours revealing insights into the differences between short- and long-term maintainers and indicating how weight loss might be maintained. Including the food-related behaviours preceding food intake and including the context of eating has implications for all weight

loss maintainers and professionals working with WLM, who should reflect on the food intake as the outcome of their own personal food systems (Sobal & Bisogni, 2009) including not merely eating but also food acquisition and preparation when sustaining WL. Our results indicate that each weight loss maintainer has to find and adopt their own combinations of self-regulatory strategies that, while supporting WLM, do also fit with their food-related life situation.

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Table 1: Background characteristics of short-term and long-term maintainers

	Short-term maintainers (2-12 months)	Long-term maintainers (> 12 months)
N	9	9
Gender, male/female	3/6	1/8
Age, mean (SD)	39.8 (19.9)	43.2 (12.7)
Initial BMI, mean (SD)	38.7 (11.7)	31.9 (3.2)
Current BMI, mean (SD)	30.2 (6.9)	24.5 (2.1)
% Body weight lost, mean	21.3	25.8
Duration of recent weight loss in months, mean (SD)	8.0 (3.2)	20.8 (10.0)
Duration of current weight loss maintenance in months, mean (SD)	4.9 (2.7)	17.8 (5.2)

Table 2: Comparison of short and long-term maintainers

	Short-term maintainers (2-12 months)	Long-term maintainers (> 12 months)
Planning	• Need for action planning	• Some degree of action planning, but rely more on good habits
Shopping/ storing	• Grocery lists • Meal-to-meal planning • Self-restriction through non-availability	• Improvisation while shopping without jeopardising WLM • More flexible acquisition of food items – do not avoid certain foods completely • Rationing of food items

	• Not buying certain foods strengthens maintenance self-efficacy beliefs	• Strong maintenance self-efficacy beliefs
Preparing/ cooking	• Experimenting with new ingredients, trying to build new habits • Thinking ahead by preparing large batches	• More improvisation with ingredients – strengthened maintenance self-efficacy • Ensuring supportive food preparation strategies • Mindful aspects of preparing food
Eating	• Cues to control portion sizes • Flexible restraint • Eating same type of meals - habit formation • 'Trade-off' strategy • Experience with 'getting back on track' builds recovery self-efficacy beliefs	• Cues to control portion sizes • Flexible restraint • Eating same type of meals – habit formation • Strong recovery self-efficacy beliefs
Barriers and resources	• Social norms are barriers • Help from social context helps build maintenance self-efficacy • Building self-control as a resource	• Social norms are barriers • Social acceptance helps build maintenance self-efficacy • Self-control is a resource • Stronger recovery self-efficacy beliefs, since lapses were dealt with more efficiently