Understanding and treating obesity in daily life

Valorisation

RELEVANCE

Obesity (Body Mass Index; BMI > 25kg/m^2) is considered a pandemic (Swinburn et al., 2011), as its worldwide prevalence is now at over 37% of the population (Ng et al., 2014). This is problematic, as obesity has a negative impact on physiological and psychological health. In addition, obesity is associated with social stigma (Puhl & Heuer, 2010). Obesity-related conditions, such as type-2 diabetes and cardiovascular disease (Dixon, 2010) are a significant healthcare burden. The US obesity-related annual medical healthcare costs is about 20.6%, at 209.7 billion (Cawley & Meyerhoefer, 2012).

These detrimental effects make obesity an undesired state, and as a result many obese people resort to dieting. A Dutch study found that more people (around 63%) are currently dieting than there are obese people in the Dutch population (De Ridder, Adriaanse, Evers, & Verhoeven, 2014), which implies that many people are concerned about what they eat. However, the majority of dieting attempts are unsuccessful in the long run, and weight loss interventions in general do not result in effective, sustained weight loss (e.g., Franz et al., 2007). In fact, obesity is sometimes considered a chronic condition (Bray, 2004; Rippe, Crossley, & Ringer, 1998). It is, however, clear that, given the detrimental effects of obesity on health and the economy, research on effective obesity interventions and antecedents and consequences of (over)eating behavior should continue (Brownell, 2010).

The studies conducted in the present thesis primarily contribute to the fields of eating behavior research and research on effectiveness of obesity interventions. The first goal of the present thesis was to investigate cognitive behavior therapy (CBT)-related aspects of eating behavior in people's daily lives. CBT is a prominent treatment with application to many different psychological disorders (e.g., Beck, 2005). For obesity, so far, some trials have shown that CBT might lead to moderate long term weight loss maintenance (Stahre & Hällström, 2005; Stahre, Tärnell, Håkanson, & Hällström, 2007; Werrij et al., 2009).

A central component of CBT is the identification and evaluation of dysfunctional cognitions, and the influence these cognitions have on the occurrence of (negative) emotions (Beck, 2011). However, not much is known about the kinds of eating-related cognitions people have, and about whether cognitions of overweight and healthy-weight people differ. The results presented in Chapter 2 illustrated that cognitions and emotions right before eating may not be effective targets for obesity interventions, as most cognitions were not dysfunctional, and instead were about food desire and taste. In addition, there were hardly any differences between overweight and healthy-weight participants, and negative emotions occurred just as often prior to eating events than to non-eating moments.

The second, and central goal of the thesis, was to investigate possibilities for improving obesity treatment, by designing and testing a CBT-based weight loss treatment (Think Slim) that relied entirely on mobile technology and the internet, provided in addition to a regular calorie restrictive diet, with no therapist involvement. Proving treatment this way has sev-

eral advantages that are of general relevance. First, it is possible to provide (psychological) obesity treatment without active, in-person consultation with an expert throughout the treatment, which is relatively cost-efficient (Agras, Taylor, Feldman, Losch, & Burnett, 1990). This treatment can be tailored to individually relevant moments (e.g., moments of dietary weakness). Second, the barrier to starting with treatment is lowered, as there is no longer a need to physically visit clinics. Lastly, another economic advantage is that treatment provision can be indefinite, so there is no longer a need to prepare a client to apply the learned therapeutic techniques independently. This is especially relevant for obesity, as it is sometimes considered a chronic condition (Bray, 2004; Fujioka, 2002). The app, as a therapeutic tool, will always be available, and treatment sessions can be reviewed at any time.

The Think Slim treatment was more effective at reducing belief in dysfunctional cognitions, and emotional / external eating than a diet-only control condition. However, both conditions lost similar (modest) weight. So, there is still need for future research on CBT for obesity and / or on treatment of obesity in daily life before a general recommendation can be provided. Such future research should focus on disentangling what aspects of treatment could be improved. For example, the duration of the Think Slim treatment was relatively short (6 weeks). It is possible that differences between the Think Slim treatment and the diet-only control only become apparent after a longer treatment period. Also, as compliance with the Think Slim treatment reduced greatly over time, it is essential that methods for avoiding this reduction in compliance are investigated. For CBT itself, it is important to investigate cognitions not only when about to eat, but also at different relevant moments (e.g., in the supermarket). Most importantly, however, as the emphasis for effective weight loss treatment is on the follow-up period results (i.e., weight loss maintenance), it is still possible that participants in the Think Slim treatment will be able to maintain their weight loss, whereas participants in the control condition will regain the lost weight. So, it is important to wait until the follow-up results of the Think Slim trial are available, before any firm conclusions can be drawn.

RELEVANCE TO SPECIFIC TARGET GROUPS

Aside of general relevance, the findings of the present thesis are relevant to three target groups. (1) Overweight population: Both studies in the present thesis included relatively large and heterogeneous samples of overweight (and, for the first study, healthy-weight) participants. Included participants varied widely in terms of age, socioeconomic status, education level, and BMI. So, the presented findings can be generalized to the entire (Dutch) overweight/obese population. (2) Healthcare professionals: Although there was no therapist contact in either of the presented studies, investigating eating behavior in daily life is relevant to clinical settings. By mixing therapist contact with reliance on smartphone

and/or internet tools, face-to-face therapy can be enhanced. This so-called blended therapy (e.g., van der Vaart et al., 2014), has the advantages of being able to obtain insights into clients' eating behavior promptly in daily life (e.g., by having clients conduct EMA). However, therapeutic sessions and intervention can be provided in a face-to-face manner. This also provides new opportunities for obesity intervention research, as not much is known about blended therapy for obesity that makes use of EMA. (3) Health insurance companies: A previous review of obesity interventions concluded that including obesity treatment in the standard healthcare package could not be recommended, as the effectiveness of such treatment was not established (Mann et al., 2007). Since then, there has not been much improvement in terms of effectiveness (Brownell, 2010) So, in this case, the cost of treatment would not outweigh the outcome benefits on health. However, by conducting treatment via a smartphone app and the internet, treatment costs are reduced (once a treatment platform is developed), which makes this form of treatment provision especially interesting as an alternative to traditional face-to-face therapy.

TRANSLATION INTO INNOVATIVE ACTIVITIES AND PRODUCTS

There are two distinct directions of development that are relevant in this respect. First, in the RCT presented in Chapter 5, computational algorithms were used to construct 'eating profiles' for each participant (See: Spanakis, Boh, Weiss & Roefs, 2016). Such profiles relied on knowledge of participants' previous (over)eating behavior to estimate when they were at risk for new (over)eating events. So, the app continuously tailored to individually relevant moments. Briefly, to be able to predict risk factors for overeating, a novel computational algorithm was developed, which relied on decision tree modeling to cluster overweight participants into separate groups, based on how similar they were in terms of antecedents of overeating behavior. Treatment was then provided in the form of a warning and CBT-based feedback message. This algorithm can be applied to future research that uses EMA data to estimate what combinations of states of variables may lead to undesirable behavior, and can help prevent overeating altogether.

Secondly, the Think Slim app could be expanded by incorporating sensor technology. Increasingly often, different sorts of sensors are included in mobile devices. Using such sensors has the benefit of reducing the self-report aspect of EMA (relying on people to make judgments about their own behavior, thoughts, and emotions), and instead using objective measures of physiological states and geographical locations. In addition, people will spend less time completing the EMA questionnaire (as less self-report questions will need to be included). Sensors that are useful for eating behavior could be related to external factors (e.g., GPS or accelerometry), or internal states (e.g., by measuring heart rate). Some of these sensor technologies are more thoroughly investigated than others. In general, it is essential

that the predictive quality of a sensor is not impeded by noisy measurements (e.g., making sure that a certain signal is relevant to an overeating event). For example, although automatic (unobtrusive) facial recognition of emotions might be interesting, as it is a potentially objective measure of emotions, it is currently not reliable enough to be implemented in clinical settings, with one study reporting accurate recognition in 55 to 76% of cases (Asselbergs, Ruwaard, Ejdys, Schrader, Sijbrandij, & Riper, 2016). However, on the other hand, GPS and accelerometry are already very accurate, and fairly easy to implement, as most mobile devices can track physical locations (e.g., using Google Maps) and can count steps / physical exertion. GPS and accelerometry have already been successfully applied with high accuracy in several devices and mobile systems (e.g., Doherty, Lemieux & Canally, 2014; Gaggioli et al., 2011).

A separate development that resulted from the work conducted in the present thesis is fostering and enhancing inter-faculty and inter-university knowledge exchange and cooperation, and increasing contact between universities and companies. To develop the Think Slim app, extensive collaboration occurred between the Maastricht University Faculty of Psychology and Neuroscience, and the Faculty of Humanities and Sciences (specifically the Department of Data Science & Knowledge Engineering). This has resulted in open and future-oriented scientific collaborations.

IMPLEMENTATION

The Maastricht University Instrumentation department is currently in the process of expanding the functionality of the Think Slim app to suit more general research needs. This update of the Think Slim app will allow researchers to script their own research designs (e.g., what sorts of EMA questions to ask, and how to score the questions). A major advantage of having such an app available within the university is that future EMA research projects do not have to rely on, and invest in, commercially available alternatives. Also, support staff is available immediately to fix any technical issues that may arise during development and during a study. One potential risk that can be identified in relation to EMA app development is that smartphone usage might decline when different forms of technology become popular.