



## ***Losing Weight, a Matter of Gender? Identification and Integration of Gender-Specific Psychological Factors in the Treatment of Obesity***

by Caroline van der Velde

### *Abstract*

*The prevalence of unhealthy overweight and obesity among women and men worldwide has tripled in recent decades and continues to rise steadily according to the World Health Organization. Obesity is associated with negative health and with negative psychosocial as well as social consequences. These negative consequences can be reduced by a multidisciplinary treatment approach (nutritional, exercise and behavioral therapy). However, long-term successful weight reduction is a challenge for women and men who have obesity. Previous empirical studies show that there are psychological factors that promote or impede successful weight loss (e.g. self-efficacy, self-control, coping strategies). For many of these psychological factors gender differences have been detected that have so far not been taken into account in the treatment of obesity. In order to do so effectively, digital health services (e.g. health apps) should be used that integrate weight-associated psychological aspects into weight loss and weight maintenance programs. The technical capabilities of digital services allow persons with obesity to adapt treatment individually to their own gender-specific needs. This is a promising approach to improve successful long-term weight loss for both women and men. This article reviews findings on gender-specific differences in psychosocial factors affecting obesity and obesity treatment. Furthermore, it introduces the app-based psychological intervention I-GENDO, which represents an approach combining digitalization and gender aspects in the treatment of obesity. Finally, it argues that the app can increase the effectiveness of conventional weight reduction programs.*

## Introduction

Excessive overweight is a prevalent topic in our current society that affects women and men equally. If one follows the media, however, one can get the impression that weight-related content, such as the most innovative dieting and weight loss strategies, only concerns girls and women. Indeed, research shows that women are more likely than men to diet for weight control (Kiefer et al., 2005: 199). They also participate in weight loss programs more often (Pagoto et al., 2012: 1237). The message seems obvious: Losing weight is a women's issue.

Yet, this conclusion cannot be maintained upon closer investigation, since the negative consequences of obesity apply to all persons regardless of sex and gender (World Health Organization, 2000: 39). Still, gender-specific needs with regard to excessive overweight have to be identified and must be integrated into the treatment of obesity. An integration of this dimension of weight loss can be realized best through digital health services such as smartphone applications (apps). Over the last few years, weight loss programs have been translated into digital formats that provide broad access to nutritional, exercise and behavioral advice through web pages or apps. Digitalization offers many advantages, e.g. the possibility for every user to individualize contents to their personal needs. Therefore, digitalized offers constitute a promising addition in gender-specific treatment of obesity.

In the following, I will present a literature review of gender-specific aspects affecting obesity and weight loss, focusing on gender differences in psychological factors that promote and impede weight management. Furthermore, I will describe the psychological smartphone app I-GENDO, which attempts to integrate the described gender-specific aspects in the treatment of obesity.

## Obesity

Obesity is defined “as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired” (World Health Organization, 2000: 6). Commonly, the Body Mass Index (BMI) is

used to classify weight categories in adults. It is determined by the quotient of a person's body weight and body height squared ( $\text{kg}/\text{m}^2$ ; World Health Organization, 2000: 8). The World Health Organization (WHO) defines the following cut-off points: BMI < 18.50 (underweight), BMI 18.50 – 24.99 (normal range), BMI > 25.00 (overweight) and BMI > 30.00 (obesity). Obesity is further subdivided by degree of severity, because treatment recommendations differ above a BMI of 35 (BMI 30.00 – 34.99: obesity class I, BMI 35.00 – 39.99: obesity class II and BMI > 40.00: obesity class III; World Health Organization, 2000: 9). Although the BMI is widely used due to its economic application and simplified comparability between age groups and people of all genders, it should be noted that it has a limited informative value. Calculations of the BMI do not take into account to what degree a person's body weight comes from muscle or fat. This is why physical build and proportions can influence the BMI range, which is important to consider when comparing data of women and men (World Health Organization, 2000: 8).

The prevalence of obesity in women and men worldwide has nearly tripled over the last thirty years. According to WHO, in 2016 more than 1.8 billion (39%) adults had overweight and of these over 650 million (13%) were affected by obesity (World Health Organization, 2020). Recent statistics from the German Robert Koch Institute, which include anthropometric measurements, show that more men (43.8%) than women (29.0%) have overweight. With regard to obesity, however, the prevalence in men (23.3%) and women (23.9%) is approximately equal. Results showed that prevalence trends in different age groups and socio-economic classes varied between genders (Mensink et al., 2013: 787-791). Further data from Germany confirm that there are no consistent gender differences in the overall obesity prevalence (Schienkiewitz et al., 2017: 22), but there is evidence that severity of obesity differs between men and women, with women more often having obesity class II and III than men (Mensink et al., 2013: 791).

The higher the obesity degree the higher the risk for secondary diseases that affect a person's quality of life and mortality such as cardiovascular diseases, impairments of the musculoskeletal system or type II diabetes (World Health Organization, 2000: 9). Besides these physical

comorbidities, excessive body weight is also associated with psychosocial aspects (World Health Organization, 2000: 55 - 56). Impaired psychological health can have a negative effect on nutritional and exercise behavior (e.g. lack of exercise, maladaptive eating behavior) and can prevent weight loss. Indeed, in comparison to persons with normal weight, persons with obesity have a higher prevalence of psychological disorders such as Major Depression and Anxiety Disorders (Hauner et al., 2014: 189). These disorders are likely to emerge or to be reinforced through negative stigmatization and weight-discrimination. Especially in Western nations, people with obesity have to deal with negative judgements and assumptions with regard to their appearance in education, health care, and employment settings, e.g., the attribution of negative characteristics such as laziness or incompetence, or physical barriers and social rejection because of weight (Friedman et al., 2005: 912; World Health Organization, 2000: 56). Research shows that persons affected by weight-based stigmatization internalize society's preconceptions (self-stigmatization), which translates into a low self-esteem, poor body image, pathological eating behavior, and general lack in psychological functioning (Puhl & Heuer, 2009: 954 - 955). This is why dealing with the psychological consequences of obesity needs to be addressed in therapy.

## **Treating Obesity**

Various national and international scientific societies label obesity as a chronic disease from a medical point of view (Hauner et al., 2014: 185; World Health Organization, 2000: 1). Therefore, the primary aim of therapy is long-term reduction of body weight, which improves the physical condition and mitigates obesity-related risk factors and diseases (Hauner et al., 2014: 197). Successful long-term weight reduction is defined as a minimum intentional weight loss of five (BMI 25 – 35) respectively ten (BMI > 35) percent of the initial weight for six to twelve months (Hauner et al., 2014: 197) which is maintained for at least one year (Wing & Hill, 2001: 326). Achieving these treatment goals can only be guaranteed if patients show a comprehensive change of behavior in various aspects affect-

ing obesity. Hence, amongst others, the German Obesity Society recommends a combination of nutritional, exercise, and behavioral treatment components as therapy of first choice. It is well known that the combination of these three aspects leads to a higher weight reduction than the use of a single treatment component (Hauner et al., 2014: 199).

Nutritional and exercise therapy is generally based on the goal of creating a consistent negative energy balance over a longer period of time through restricted nutritional behavior (reduction of fat consumption and/or carbohydrate) and increased physical activity (at least 150 minutes/week; Hauner et al., 2014: 202 - 204). Recommendations need to be adapted for each patient individually. Changes in eating and exercise habits are directly associated with weight-related outcomes. Importantly, though, the addition of behavioral therapy strategies can have an indirect impact on the individuals trying to lose weight by altering behavior that is associated with the development and maintenance of obesity. Proposed behavioral strategies are self-monitoring of behavior, practicing flexible self-control behavior, cognitive restructuring, goal setting, problem solving strategies, social skills training, social support enhancement, and relapse prevention (Hauner et al., 2014: 206).

Existing research suggests that the described conventional therapy should be the base for every weight reduction and weight stabilization. In addition to this, pharmacological treatment or bariatric surgery procedures (e.g. gastric bypass, sleeve gastrectomy) can be used if a severe form of obesity is present or when conservative therapy is not successful (Hauner et al., 2014: 211, 213). Still, the question arises how successful conservative weight loss attempts are, especially if the results are to be long-lasting. Existing interventions that focus on this therapy approach show promising results for initial, short-term weight loss success, that is, for the weight loss measured six months after the initiation of treatment (Jeffery et al., 2000: 7). After this period, a consistent temporal course was identified for the study participants across different interventional studies: “weight regain [...] begins and continues gradually until weight stabilizes somewhat below baseline levels” (Jeffery et al., 2000: 7). Observational data from Germany strengthen the impression that maintaining substantial weight loss remains a lifelong challenge. The risk of regaining

weight increases with the time that has passed since weight loss. In the respective population-based sample almost one-third (29.7%) of subjects with obesity ( $n = 223$ ) reached successful long-term weight loss (10% of initial weight) for one year, but only 11.7% achieved five-year weight loss maintenance (de Zwaan et al., 2008: 2539).

Whether men or women lose more weight in the course of weight loss programs cannot yet be answered. Some studies and literature reviews indicate that men lose relatively more weight than women (Stroebele-Benschop et al., 2013: 9; Tsai et al., 2016: 396; Williams et al., 2015: 181). These findings contrast both with the results of a systematic review of Robertson and colleagues (2016: 80), who did not find any differences in weight loss between genders, and with the data from population based studies, in which women with obesity reported more successful weight loss maintenance compared to men (de Zwaan et al., 2008: 2539). Despite the relative scarcity of available data on gender differences in weight loss and the inconsistent findings in the available studies, it is important to identify which factors influence a successful weight reduction.

## **Psychological Factors that Promote and Impede Weight Loss**

Even though the reasons for the limited long-term effect of obesity treatment have not been conclusively clarified, the analysis of cases in which individuals have successfully maintained their reduced weight provides important insights as to which factors promote and impede long-term weight loss. It has been shown that, above all, psychological and behavioral aspects have an impact on weight control in short- and long-term weight maintenance (e.g. Ahlgren et al., 2016; Elfhag & Rössner, 2005; Metzgar et al., 2015; Ohsiek & Williams, 2011). Building on these findings, Ohsiek and Williams (2011: 595-599) conducted a systematic review of studies on weight loss and weight control, including studies in which obesity was treated with behavioral modification interventions. They identified eight psychological factors which are associated with weight regain and hinder a successful weight loss maintenance:

- 1) unrealistic weight loss expectations,

- 2) the failure to achieve the initial weight loss goal,
- 3) a dichotomous thinking style (“all or nothing”),
- 4) emotional eating,
- 5) uncontrolled eating behavior,
- 6) the perceived cost of weight loss (e.g. time) compared to its benefits,
- 7) depression and
- 8) negative body image.

These findings are consistent with the psychological factors that were previously determined by Elfhag & Rössner, (2005: 76) who specified the following factors as promoting successful weight loss maintenance:

- 1) high self-efficacy,
- 2) enhanced self-monitoring,
- 3) less previous weight loss attempts,
- 4) access to adaptive coping strategies and
- 5) social support.

The impact of social support for long-term weight maintenance was also highlighted in qualitative studies with all-female populations (Ahlgren et al., 2016: 90; Metzgar et al., 2015: 601). Interestingly, social relationships to close family members and friends during weight management were either perceived as extremely helpful or extremely hindering by the women interviewed.

To summarize, various qualitative and quantitative studies of people who successfully lost weight and those who repeatedly regain weight suggest that success of obesity treatment can be significantly influenced by behavioral and psychological factors. Because these factors are linked to each other, the identified connecting themes (e.g. identifying and modifying dysfunctional emotion regulation, poor self-esteem and body image distress) should be included in weight loss programs to promote long-term weight loss maintenance.

## **Gender Differences in Psychological Factors Affecting Weight Control**

Due to genetic, biological, and socio-cultural influences, it can be assumed that women and men experience and manage obesity differently. It can also be assumed that they suffer from varying risk factors in particular when it comes to psychological distress. Indeed, gender differences have been demonstrated in several of the psychological factors associated with excessive weight (e.g. stigmatization, body dissatisfaction, body perception, depressive symptomatic, and motivation).

Studies show that women with obesity experience more weight-related stigmatization than men in occupational contexts (Giel et al., 2010: 38) and in health care settings (Giel et al., 2012: 8). Overall then, women with excessive overweight seem to be less socially accepted than men with obesity and are therefore sanctioned more severely (Giel et al., 2010: 38). With regard to psychological impairment, there is evidence that the association between a depressive mood and obesity is influenced by such factors as age and race, but also by gender. More precisely, the experience of depressive symptoms increases in women with increasing body weight, while this connection is not evident in men (Heo et al., 2006: 517 - 518).

In terms of body perception and body image, research suggests that weight related attitudes towards the body differ between men and women. Women with overweight are more often dissatisfied with their bodies than men with overweight (Schwartz & Brownell, 2004: 45). This difference may be explained by the fact that men with a BMI between 25 and 28, or in a study by Tsai and colleagues (2016: 391) with a BMI even up to 35 (obesity class II), tend to have a lower accurate weight perception and therefore have a less problematic perception of their bodies (Schwartz & Brownell, 2004: 46). This perception may be due to the internalized ideal male body type, which is heavier and stronger than the ideal female body type (Tsai et al., 2016: 395). The described gender differences in body perception are also reflected in the subjective weight loss goals that patients with overweight and obesity participating in behavioral weight loss programs set themselves. There is strong evidence that female partici-



pants are prone to set less realistic goals. In the study of Dutton and colleagues (2010), for example, women had a more unrealistic dream weight (the weight they would choose if they could weigh whatever they wanted) and happy weight (a weight they would not consider ideal but be happy with) expectation than men (Dutton et al., 2010: 76). Given the importance of realistic self-perception and goals for weight management, it must be assumed that gendered expectations surrounding ideal weight and weight loss influence the course and success of obesity treatment.

Gender differences also show in concrete eating and weight management behavior. Eating habits of women tend to be more strongly guided by emotions on the one hand and by restrictive diet recommendations on the other hand (Kiefer et al., 2005: 197). Both things can lead to uncontrolled eating behavior. Male and female patients with obesity describe different hierarchies of problematic food-related situations that they have to cope with. Alcoholic drinks, the desire for sweets and eating out present challenges for men, whereas women tend to have difficulties handling their desire for sweets, eating out, and sudden appetite (Kiefer et al., 2005: 196). Furthermore, gender-specific weight control mechanisms have been identified: “men are more likely to control their weight by means of exercise, women by means of dieting” (Kiefer et al., 2005: 199). Men tend to adopt a weight maintenance behavior that is based on active coping strategies. They opt for more exercising, for example, rather than giving up certain foods or avoiding certain social situations. They thus not only do something that constantly poses new challenges, they also engage in activities that increase their social contacts rather than reducing them.

Recently, the research group I work in conducted a qualitative study to investigate whether women and men report different psychological factors promoting or impeding long-term successful weight loss (van der Velde, Schroeder, Haun et al., 2019). For this purpose persons who had successfully lost weight (at least 5%) and kept that weight for six months (weight maintainers) as well as persons who had experienced various unsuccessful weight loss attempts (weight regainers) were asked in semi-structured focus groups about the barriers that impede long-term successful weight loss and the resources that enable it. We evaluated the

answers with qualitative content analysis in terms of gender and weight progression. Women in our study group reported more often than men that, in order to improve their own self-perception, they compared themselves with individuals who had even higher body weight. The more successful their weight reduction was, the more they paid attention to their own needs and the more mindful they became with regard to themselves (e.g. admitting breaks to themselves). Moreover, the majority of women interviewed used strategic avoidance behavior, which means that they were abstinent to specific food products. These restrictions were perceived as facilitating, because it gave them a sense of control. The male participants on the other hand did not follow such restricted eating guidelines. They preferred to compensate overeating with increased physical activity or by eating less instead of giving up some foods completely. In social situations, men experienced particular difficulties when alcohol consumption was socially desirable. In order to cope with such moments, they adopted a problem-focused behavior, such as designing social situations in such a way that alcohol consumption was not the focus. Interestingly, no meaningful gender-differences could be found in the group of weight regainers. Women and men in that group showed similar weight-related attitudes such as low self-efficacy and a pronounced dichotomous thinking style. Individuals for instance threw their entire weight loss plans overboard as soon as they ate something they had not planned and then experienced feelings of great failure that led to more unproductive behavior.

The current state of research indicates gender differences with regard to weight related behavior and weight loss programs. As stated before, men are much less likely to participate in weight loss programs than women. On average barely a third of participants in randomized controlled trials of behavioral weight loss interventions are men (Pagoto et al., 2012: 1236; Robertson et al.: 73, 2016; Tsai et al., 2016: 395). One reason for this low enrolment could be the aforementioned gender differences in weight-related perception and attitudes. Wolfe and Smith ( 2002: 121) have also dealt in their research with the question why so few men undertake serious weight loss attempts. They found that men were actually motivated to start weight loss programs because of obesity-related health risks

and a desire to improve their appearance, but they did not feel addressed by the traditional group-based treatment. Another study found that men did not relate to existing interventions because of the gendered associations of dieting and because the programs were predominantly attended by women (Morgan et al., 2011: 243).

Due to the small number of male participants in weight loss programs, it is difficult to draw definite conclusions about men's perceptions and experiences of obesity treatment. Studies indicate, however, that men who start a weight loss program are more likely than women to complete it successfully (Robertson et al., 2016: 80). It is thus important to examine under what circumstances men and women are willing to join weight loss programs, since there seem to be gendered preferences for style of delivery and content of intervention. Research results imply that men prefer weight loss programs in which individual support or tailored advice is provided, because this format creates a sense of greater personal control (Robertson et al., 2016: 81; Tsai et al., 2016: 397). Male-only interventions, studies show, lead to particularly successful weight loss reduction among the participants. Those interventions integrated treatment components that had been identified before in primarily qualitative investigations as appealing to a large proportion of men, such as simple and fact-based language with individual feedback, male-orientated humor, and sporting affiliation. This is why the intervention "Football Fans in Training", for example, took place in the stadium of the male participants' favorite football clubs (Hunt et al., 2014: 1218).

In order to develop gender-specific interventions that enable more successful long-term weight reduction it is necessary to consider the individual behavioral needs of female and male participants. Therefore, our team conducted a systematic review that aimed to identify gender-specific treatment components that focus especially on behavioral aspects in the treatment of obesity (van der Velde, Schröder et al., 2019: 161). We evaluated the effectiveness of behavioral weight loss strategies used in existing weight loss programs for female-only and male-only interventions. The results show that women in female-only interventions benefit from behavioral weight loss strategies that deal with negative feelings, cognitive restructuring, self-control capabilities, identification of individual barriers

and self-monitoring. In sum, women may benefit from traditional cognitive behavioral treatment components that address both the cognitive and emotional level of body weight issues and aim to create internal as well as external support structures. By contrast, the male participants benefited greatly from treatment components based on social and technical feedback, such as individualized feedback, social support and self-monitoring. It is important to note, though, that we only qualitatively summarized the effectiveness of each of these psychological components in either the female-only or the male-only programs, which is why we cannot conclude that the other gender would not benefit from the above-mentioned component as well. In order to assess the usefulness of these components for the respective other gender, the outcomes (e.g. weight loss) for women and men in intervention studies would have to be reported separately or an experimental study would have to be designed in which both women and men examine all strategies.

To conclude, women and men seem to differ in various factors influencing weight, weight loss, and weight maintenance. Therefore, a better insight into the perceived factors influencing psychological distress and behavior change in obesity treatment in all genders is required to give greater attention to these different expectations, motivators and barriers when designing interventions tailored to the individual needs of each participant.

## **Digital Health Interventions in Obesity Treatment**

The findings described so far indicate that behavioral therapy components are effective in the treatment of obesity and that the effectiveness of these behavioral therapy components could be further increased if the individual needs of patients were taken into account more systematically. Due to financial reasons, behavioral treatment is not commonly used in standard care outside of clinics (Thomas et al., 2019: 572). This is why different methods of delivery need to be developed to change this status quo and to make the treatment approach accessible to more people. With the rapid growth of digital communication, new digitally delivered programs such as counselling through email, text, or smartphone-apps are emerging.

These programs represent a promising addition to standard care in the management of obesity (Alamuddin & Wadden, 2016: 575-576).

In general, internet-based and more precisely smartphone-based interventions in psychosocial care offer the advantage of low-threshold access and an independence of time and place. Because of this accessibility and flexibility, persons that normally would not want to or could not join traditional treatment offers due to time constraints, geographical obstacles, or concerns of stigmatization are now given the chance to participate in digital health services (Ebert et al., 2016: 365). Beyond the greater range of participants that can be reached digitally, Kuhn and Amelung (2016: 103) provide evidence that treatment adherence is increased by using apps.

A number of existing smartphone-based interventions focus on weight loss and weight loss management. These differ in their theoretical basis (e.g. nutritional, physical or behavioral) and/or in the background of the developers behind them (e.g. healthcare professionals, commercial companies; Zhang et al., 2018: 265). In fact, the vast majority of these interventions only focus on transmitting information and are often lacking an evidence-driven basis (Zhang et al., 2018: 266). Consequently, the research group around Zhang (2018: 267) recommends a greater involvement of healthcare professionals in the conceptualization and design of health care applications for obesity treatment to improve the quality of these applications.

Although mobile health interventions differ from each other in many ways (e.g. settings or content; Khokhar et al., 2014: 7; Stephens & Allen, 2013: 326), findings of randomized controlled studies (RCTs) and meta-analyses suggest that the use of these methods in obesity treatment is effective to change weight-related outcomes. Fourteen studies that compared mobile phone interventions with control conditions were included in a systematic review and meta-analysis of Liu and colleagues (2015: 346). The evaluation of these studies showed that the app-based programs led to significant weight loss. These results support the findings of a previous systematic review, which stated that text messaging and mobile-based interventions in comparison to control groups increase physical activity and reduce weight in populations with overweight and obesity (Stephens &

Allen, 2013: 326). Another systematic review of RCTs revealed that beyond the influences cited, smartphone-based obesity interventions also change weight-associated behavioral determinants (e.g. sense of control, social comparison, goal setting) in a positive direction and thus have an indirect effect on weight loss (Lyzwinski, 2014: 376).

There are also studies that directly compare online interventions with standard in-person weight control treatment. For instance, Harvey-Berino and colleagues (2010: 125) investigated the effect of a six months internet-based behavioral intervention on weight loss in comparison to face-to-face (F2F) treatment and a mixed condition (internet + F2F-treatment). Besides nutritional and exercise goals, participants in all groups were training behavioral and self-management skills, such as stimulus control, goal setting, and relapse prevention. The researchers found that participants who received the traditional F2F communication lost more weight than persons in the internet-based group did. However, the majority of persons in the latter group also lost a significant amount of weight ( $\geq 5\%$  of initial weight). Interestingly, the combination of internet and F2F-treatment was not superior to the other two conditions in this study (Harvey-Berino et al., 2010: 126).

In a recent study, Thomas and colleagues (2019: 573) compared a smartphone-based behavioral obesity treatment with monthly weigh-ins with an intense group-based approach and a control condition. Both interventions lasted eighteen months and contained dietary education, exercise guidelines and offers to learn behavioral skills such as self-monitoring, stimulus control and problem solving. In contrast to the findings of Harvey-Berino and colleagues, the participants in all three conditions achieved a comparable clinically meaningful weight loss after six, 12 and 18 months respectively. Surprisingly, the control group also reached a meaningful weight loss, even though they only attended monthly weigh-ins lasting ten minutes and were instructed to self-monitor their eating and exercise behavior. Consequently, the authors conclude that a smartphone delivered behavioral obesity treatment with occasional in-person contact constitutes a cost effective and efficient method for the treatment of obesity (Thomas et al., 2019: 577)

In conclusion, research on digitally supported approaches shows that smartphone-based weight loss programs that focus on changing eating and exercise behavior by teaching behavioral and self-management skills lead to a clinical meaningful weight reduction. Recent findings indicate that long-term weight loss maintenance can be facilitated through digital tools in the delivery of treatment (Thomas et al., 2019). On the one hand, digital approaches make the treatment more cost effective and on the other hand, they increase the likelihood that the behavioral treatment approach reaches more people who would benefit from it (Alamuddin & Wadden, 2016: 576).

### **Tailoring Digital Services to Individuals' Needs**

Another advantage of digital based interventions—one that is not taken into account in the studies mentioned—is that it allows the adaptation of treatment content to users' specific needs, whether these needs are gender-based or not. A recent systematic review that evaluated the effectiveness of web-based behavioral interventions for weight loss and maintenance suggest that treatment of obesity delivered through digital services can be enhanced by tailoring content to each individual user (Sorgente et al., 2017: 13). Tailoring is here defined as “a process whereby the provision of information, advice and support is individualized to the user” (Ryan et al., 2019: 3). This process requires information about the individual needs and characteristics of each user, which can be gathered for example through questionnaire administration. The gathered information is then processed in two different ways. Either humans or computers choose the content most suitable for this person (e.g. intervention strategy, treatment recommendation) with the computer relying on algorithms or decision rules. The extent of tailoring moves on a continuum from personalized (e.g. inserting a person's name in a standard message) to heavily tailored content (e.g. customize content for each individual; Noar et al. 2011: 113 - 114). Ryan, Dockray and Linehan (2019) conducted a systematic review that investigated whether tailored internet-based interventions were more effective in producing weight loss in persons with overweight or obesity. They included six interventions, which were tailored according to factors

like age, weight goals, daily caloric intake, physical location and weight loss attempts. Analysis showed that four of these six tailored interventions produced greater weight loss than active or inactive controls and that in general, participants perceived this approach positively (Ryan et al., 2019: 19).

The studies to date support the assumption that tailored internet-based interventions in obesity treatment can enhance the effectiveness of behavioral weight loss programs. In previous interventions, tailoring has been based on different demographic, situational and cultural aspects, which are associated with experiencing, dealing and treatment of obesity (Ryan et al., 2019). Although gender differences have been identified in many obesity-related psychosocial factors (e.g. emotional eating, psychosocial burden, treatment preferences) these aspects have so far not been integrated into a smartphone-based tailored psychological intervention for overweight and obesity. An app developed by researchers at the University of Bamberg allows for this kind of tailoring.

### **Developing an Individualized Gender-Sensitive Smartphone-Based Intervention for Obesity**

In a recent pre-post study, a gender-tailored, online-based weight loss intervention was evaluated that focused on modifying depressive symptoms of men with overweight and obesity (Young & Morgan, 2018: 2). The self-guided intervention lasted three months and most content was tailored to appeal to men (e.g. male-specific pictures, frank and realistic communication). After the completion of the treatment, both the weight and the depressive symptoms of participants were reduced in comparison to baseline assessment. This study provides evidence that gender-tailored online-based interventions engage and improve the mental health of men with overweight and obesity in the short-term. A major limitation of this study is the pre-post design, which reduces the relevance of the study results. In addition, it is necessary to develop gender-sensitive interventions that take into account the needs of both men and women, rather than developing gender-specific interventions that exclude an entire group of participants.



For these reasons, our research group at the University of Bamberg (S. Steins-Loeber, Department of Clinical Psychology and Psychotherapy; J. Wolstein, Chair of Pathopsychology) in cooperation with researchers from the Ruhr-University Bochum (S. Herpertz, Department of Psychosomatic Medicine and Psychotherapy, LWL University Hospital) developed the smartphone-app I-GENDO, whose name stands for “individualized **gender**-sensitive smartphone-based add-on intervention for **obesity**” (van der Velde, Schroeder, Jongen et al., 2019). The I-GENDO project is funded by the Federal Ministry of Education and Research (BMBF; funding code: 01GL1719A/B). The intervention is supposed to modify weight-related behavior by training the following behavioral skills:

- 1) goal setting,
- 2) stress management,
- 3) dealing with the psychological consequences of obesity (e.g. stigmatization, low body image),
- 4) self-control behavior,
- 5) self-efficacy and motivation,
- 6) emotion regulation and
- 7) relapse prevention.

Each of the seven modules contains psychoeducational elements (e.g. how does stress affect my weight?) and specific behavioral skills that are trained throughout the course of a three-month program. Content in the app is delivered in form of videos, texts, and mini games. Every user is presented with all seven modules, but the intensity of each module varies according to the individual vulnerabilities. These individual vulnerabilities are determined based on a baseline assessment, which includes the Illness Perception Questionnaire-Revised (IPQ-R; Moss-Morris et al., 2002), a questionnaire that assesses cognitive and emotional subjective representations of a health condition (subjective illness representations, SIRs). These representations in turn are based on the Common-Sense Model of Self-Regulation (Leventhal et al., 1998) and display determinants of the management of chronic health conditions, which, as evidence shows, are associated with the psychological aspects of obesity (e.g.

Breland et al., 2012; Wang & Coups, 2010). If a user for example shows unfavorable emotional representations, low level of control, and high degree of psychological impairment, assessed by the IPQ-R, she or he will work intensively, three weeks per module with three sessions per week, on the associated modules (*emotion regulation, dealing with consequences, improving self-control*). By contrast, for this particular user the other modules *stress management* and *self-efficacy/motivation* will only be treated superficially in one session. All users must complete the modules *goal setting* and *relapse prevention* in the first and last week of the I-GENDO intervention. Through the customized content adaptations, the specific weak points of women and men will be addressed in particular.

While editing the modules users have to choose between two different module variants (A or B). These options contain the same fundamental information and follow the same treatment goal but are specifically designed to appeal to female (variant A) and male (variant B) cognitions and attitudes related to obesity treatment. The two variants differ in surface-structure and deep structure, meaning they contain either female-specific or male-specific research findings and prioritized style of communication. The gender-differences considered in this app are based on our own preliminary studies and previous evidence. For example, the female variant in the stress management module uses more everyday examples to convey information whereas the male variant is based on facts that are described in a more straightforward manner. When choosing a variant, the users do not know that conceptualization is based on gender-specific aspects. They only receive a detailed description of how the content will be presented and can then choose the variant that appeals to them more. What is new about the I-GENDO intervention, then, is that users can choose the gender-tailored content based on their individual needs and preferences. This approach is gender sensitive, while at the same time moving away from the idea of gender dichotomy and thus from the idea that individuals' preferences for a certain type of content must necessarily align with the typical preferences of their gender.

I-GENDO can be individualized at many other points in the app as well. Users can save the behavioral strategies from which they benefit the most in their personal *emergency kit* and they can choose a coach at the

beginning of the program that guides them through the app. The coach they pick is either a female or male physician or a female or male buddy-type character. Each type of coach uses a different style of communication and support (authoritarian and strict doctor vs. supportive and empathetic buddy).

As of December 2019, the I-GENDO app is being evaluated in a RCT, comparing an app-group, which uses the full version of the app with all the above-mentioned functions, with a waitlist-control group. The study participants use the app in their everyday life as an adjunction to their standard care. We expect that our I-GENDO intervention will lead to an improvement in weight-related behavior (e.g. eating, physical activity), cognitions (e.g. self-efficacy, self-control), motives and emotions. We assume that the effectiveness of weight loss interventions will be enhanced with regard to short-term weight loss and long-term weight maintenance by offering this individualized gender-sensitive app. Once the necessary data has been collected, we will also investigate gender differences in weight-related outcomes and obesity-related psychosocial aspects.

## **Conclusion**

Gender plays an important role in various aspects of obesity, and it can be assumed that these aspects also affect the effectiveness of treatment interventions. Existing behavioral weight loss programs based on group therapy models have been proven to be particularly appealing to women, neglecting the needs of men. To improve the long-term effectiveness of obesity treatment and to challenge the status quo in which losing weight is of matter of gender, interventions should be developed that suit the psychological needs and wants of both men and women. Digital health services (e.g. via smartphones) are particularly well suited for the implementation of these framework conditions, because content can be tailored to match the typical preferences of each gender, while also acknowledging individual preferences that go beyond these gender-typical preferences. For this reason, the gender-sensitive, individually tailored smartphone intervention I-GENDO was developed, which focusses on improving individual gender-specific psychological aspects. What remains to be examined is

whether, and if yes to what extent, the integration of these aspects enhances the effectiveness of weight loss interventions for obesity.

## Literature

- Ahlgren, C., Hammarström, A., Sandberg, S., Lindahl, B., Olsson, T., Larsson, C. & Fjellman-Wiklund, A. (2016). "Engagement in New Dietary Habits—Obese Women's Experiences from Participating in a 2-Year Diet Intervention." *International Journal of Behavioral Medicine* 23(1). 84–93. <https://doi.org/10.1007/s12529-015-9495-x>
- Alamuddin, N. & Wadden, T. A. (2016). "Behavioral Treatment of the Patient with Obesity." *Endocrinology and Metabolism Clinics of North America* 45(3), 565–580. <https://doi.org/10.1016/j.ecl.2016.04.008>
- Breland, J. Y., Fox, A. M., Horowitz, C. R. & Leventhal, H. (2012). "Applying a Common-Sense Approach to Fighting Obesity." *Journal of Obesity*. 1–8. <https://doi.org/10.1155/2012/710427>
- De Zwaan, M., Hilbert, A., Herpertz, S., Zipfel, S., Beutel, M., Gefeller, O. & Muehlhans, B. (2008). "Weight Loss Maintenance in a Population-based Sample of German Adults." *Obesity* 16(11). 2535–2540. <https://doi.org/10.1038/oby.2008.392>
- Dutton, G. R., Perri, M. G., Dancer-Brown, M., Goble, M. & van Vessum, N. (2010). "Weight loss goals of patients in a health maintenance organization." *Eating Behaviors* 11(2). 74–78. <https://doi.org/10.1016/j.eatbeh.2009.09.007>
- Ebert, D. D., Zarski, A.-C., Berking, M. & Baumeister, H. (2016). "Internet- und mobilbasierte Interventionen zur Prävention und Behandlung psychischer Störungen". In F. Fischer & A. Krämer (Hg.), *eHealth in Deutschland* (S. 363–381). Springer Vieweg, Berlin, Heidelberg. [https://doi.org/10.1007/978-3-662-49504-9\\_20](https://doi.org/10.1007/978-3-662-49504-9_20)
- Elfhag, K. & Rössner, S. (2005). "Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain." *Obesity Reviews* 6(1). 67–85. <https://doi.org/10.1111/j.1467-789X.2005.00170.x>
- Friedman, K. E., Reichmann, S. K., Costanzo, P. R., Zelli, A., Ashmore, J. A. & Musante, G. J. (2005). "Weight Stigmatization and Ideological Beliefs: Relation to Psychological Functioning in Obese Adults." *Obesity Research* 13(5). 907–916. <https://doi.org/10.1038/oby.2005.105>

- Giel, K. E., Thiel, A., Teufel, M., Mayer, J. & Zipfel, S. (2010). "Weight Bias in Work Settings – a Qualitative Review." *Obesity Facts* 3(1). 33–40. <https://doi.org/10.1159/000276992>
- Giel, K. E., Zipfel, S., Alizadeh, M., Schäffeler, N., Zahn, C., Wessel, D., Hesse, F. W., Thiel, S. & Thiel, A. (2012). "Stigmatization of obese individuals by human resource professionals: an experimental study." *BMC Public Health* 12(1). 1–9. <https://doi.org/10.1186/1471-2458-12-525>
- Harvey-Berino, J., West, D., Krukowski, R., Prewitt, E., VanBiervliet, A., Ashikaga, T. & Skelly, J. (2010). "Internet delivered behavioral obesity treatment." *Preventive Medicine* 51(2). 123–128. <https://doi.org/10.1016/j.ypmed.2010.04.018>
- Hauner, H., Moss, A., Berg, A., Bischoff, S. C., Colombo-Benkmann, M., Ellrott, T., Heintze, C., Kanthak, U., Kunze, D., Stefan, N., Teufel, M., M. Wabitsch & A. Wirth (2014). "Interdisziplinäre Leitlinie der Qualität S3 zur „Prävention und Therapie der Adipositas“." *Adipositas - Ursachen, Folgeerkrankungen, Therapie* 08(04). 179–221. <https://doi.org/10.1055/s-0037-1618857>
- Heo, M., Pietrobelli, A., Fontaine, K. R., Sirey, J. A. & Faith, M. S. (2006). "Depressive mood and obesity in US adults: comparison and moderation by sex, age, and race". *International Journal of Obesity* 30(3). 513–519. <https://doi.org/10.1038/sj.ijo.0803122>
- Hunt, K., Wyke, S., Gray, C. M., Anderson, A. S., Brady, A., Bunn, C., Donnan, P. T., Fenwick, E., Grieve, E., Leishman, J., Miller, E., Mutrie, N., Rauchhaus, P., White, A. & Treweek, S. (2014). "A gender-sensitised weight loss and healthy living programme for overweight and obese men delivered by Scottish Premier League football clubs (FFIT): a pragmatic randomised controlled trial." *The Lancet* 383(9924). 1211–1221. [https://doi.org/10.1016/S0140-6736\(13\)62420-4](https://doi.org/10.1016/S0140-6736(13)62420-4)
- Jeffery, R. W., Epstein, L. H., Wilson, G. T., Drenowski, A., Stunkard, A. J. & Wing, R. R. (2000). "Long-term maintenance of weight loss: Current status." *Health Psychology* 19(1, Suppl). 5–16. <https://doi.org/10.1037/0278-6133.19.suppl1.5>
- Khokhar, B., Jones, J., Ronksley, P. E., Armstrong, M. J., Caird, J. & Rabi, D. (2014). "Effectiveness of mobile electronic devices in weight loss

- among overweight and obese populations: a systematic review and meta-analysis." *BMC Obesity* 1(22). 1–13. <https://doi.org/10.1186/s40608-014-0022-4>
- Kiefer, I., Rathmanner, T. & Kunze, M. (2005). "Eating and dieting differences in men and women." *Journal of Men's Health and Gender* 2(2). 194–201. <https://doi.org/10.1016/j.jmhg.2005.04.010>
- Kuhn, B. & Amelung, V. (2016). "Gesundheits-Apps und besondere Herausforderungen. Chancen und Risiken von Gesundheits-Apps (CHARISMHA)." Medizinische Hochschule Hannover.
- Leventhal, H., Leventhal, E. A. & Contrada, R. J. (1998). "Self-regulation, health, and behavior: A perceptual-cognitive approach." *Psychology and Health* 13(4). 717–733. <https://doi.org/10.1080/08870449808407425>
- Liu, F., Kong, X., Cao, J., Chen, S., Li, C., Huang, J., Gu, D. & Kelly, T. N. (2015). "Mobile Phone Intervention and Weight Loss Among Overweight and Obese Adults: A Meta-Analysis of Randomized Controlled Trials." *American Journal of Epidemiology* 181(5). 337–348. <https://doi.org/10.1093/aje/kwu260>
- Lyzwinski, L. N. (2014). "A Systematic Review and Meta-Analysis of Mobile Devices and Weight Loss with an Intervention Content Analysis." *Journal of Personalized Medicine* 4(3). 311–385. <https://doi.org/10.3390/jpm4030311>
- Mensink, G.B.M., Schienkiewitz, A., Haftenberger, M., Lampert, T., Ziese, T. & Scheidt-Nave, C. (2013). "Übergewicht und Adipositas in Deutschland." *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz* 56(5-6). 786–794. <https://doi.org/10.1007/s00103-012-1656-3>
- Metzgar, C. J., Preston, A. G., Miller, D. L. & Nickols-Richardson, S. M. (2015). "Facilitators and barriers to weight loss and weight loss maintenance: a qualitative exploration." *Journal of Human Nutrition and Dietetics* 28(6). 593–603. <https://doi.org/10.1111/jhn.12273>
- Morgan, P. J., Warren, J. M., Lubans, D. R., Collins, C. E. & Callister, R. (2011). "Engaging men in weight loss: Experiences of men who participated in the male only SHED-IT pilot study." *Obesity Research & Clinical Practice* 5(3). e239-e248. <https://doi.org/10.1016/j.orcp.2011.03.002>

- Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L. & Buick, D. (2002). "The Revised Illness Perception Questionnaire (IPQ-R)." *Psychology and Health* 17(1). 1–16. <https://doi.org/10.1080/08870440290001494>
- Noar, S. M., Harrington, N. G., van Steen, S. K. & Aldrich, R. S. (2011). "Tailored Health Communication to Change Lifestyle Behaviors." *American Journal of Lifestyle Medicine*. <https://doi.org/10.1177/1559827610387255>
- Ohsiek, S. & Williams, M. (2011). "Psychological factors influencing weight loss maintenance: An integrative literature review." *Journal of the American Academy of Nurse Practitioners* 23(11). 592–601. <https://doi.org/10.1111/j.1745-7599.2011.00647.x>
- Pagoto, S. L., Schneider, K. L., Oleski, J. L., Luciani, J. M., Bodenlos, J. S. & Whited, M. C. (2012). "Male Inclusion in Randomized Controlled Trials of Lifestyle Weight Loss Interventions." *Obesity* 20(6). 1234–1239. <https://doi.org/10.1038/oby.2011.140>
- Puhl, R. M. & Heuer, C. A. (2009). "The Stigma of Obesity: A Review and Update." *Obesity* 17(5). 941–964. <https://doi.org/10.1038/oby.2008.636>
- Robertson, C., Avenell, A., Boachie, C., Stewart, F., Archibald, D., Douglas, F., Hoddinott, P., van Teijlingen, E. & Boyers, D. (2016). "Should weight loss and maintenance programmes be designed differently for men? A systematic review of long-term randomised controlled trials presenting data for men and women: The ROMEO project." *Obesity Research & Clinical Practice* 10(1). 70–84. <https://doi.org/10.1016/j.orcp.2015.04.005>
- Ryan, K., Dockray, S. & Linehan, C. (2019). "A systematic review of tailored eHealth interventions for weight loss." *Digital Health* 5. 1–23. <https://doi.org/10.1177/2055207619826685>
- Schienkiewitz, A., Mensink, G., Kuhnert, R. & Lange, C. (2017). "Overweight and obesity among adults in Germany." *Journal of Health Monitoring* 2(2). 20–27. <https://doi.org/10.17886/RKI-GBE-2017-038>
- Schwartz, M. B. & Brownell, K. D. (2004). "Obesity and body image." *Body Image* 1(1). 43–56. [https://doi.org/10.1016/s1740-1445\(03\)00007-x](https://doi.org/10.1016/s1740-1445(03)00007-x)



- Sorgente, A., Pietrabissa, G., Manzoni, G. M., Re, F., Simpson, S., Perona, S., Rossi, A., Cattivelli, R., Innamorati, M., Jackson, J. B. & Castelnovo, G. (2017). "Web-Based Interventions for Weight Loss or Weight Loss Maintenance in Overweight and Obese People: A Systematic Review of Systematic Reviews." *Journal of Medical Internet Research* 19(6). e229. <https://doi.org/10.2196/jmir.6972>
- Stephens, J. & Allen, J. (2013). "Mobile Phone Interventions to Increase Physical Activity and Reduce Weight: A Systematic Review." *The Journal of cardiovascular nursing* 28(4). 320–329. <https://doi.org/10.1097/JCN.0b013e318250a3e7>
- Stroebele-Benschop, N., Damms-Machado, A., Milan, F. M. P., Hilzendegen, C. & Bischoff, S. C. (2013). "Gender Differences in the Outcome of Obesity Treatments and Weight Loss Maintenance - A Systematic Review." *Journal of Obesity & Weight Loss Therapy* 3(4). <https://doi.org/10.4172/2165-7904.1000176>
- Thomas, J. G., Bond, D. S., Raynor, H. A., Papandonatos, G. D. & Wing, R. R. (2019). "Comparison of Smartphone-Based Behavioral Obesity Treatment With Gold Standard Group Treatment and Control: A Randomized Trial." *Obesity* 27(4). 572–580. <https://doi.org/10.1002/oby.22410>
- Tsai, S. A., Lv, N., Xiao, L. & Ma, J. (2016). "Gender Differences in Weight-Related Attitudes and Behaviors Among Overweight and Obese Adults in the United States." *American Journal of Men's Health* 10(5). 389–398. <https://doi.org/10.1177/1557988314567223>
- van der Velde, C., Schröder, S., Wolstein, J. & Steins-Löber, S. (2019). "Wirksamkeit von geschlechtsspezifischen Interventionskomponenten in der Behandlung von Personen mit Adipositas – eine systematische Übersichtsarbeit." *Adipositas - Ursachen, Folgeerkrankungen, Therapie* 13(03).
- van der Velde, C., Schroeder, S., Haun, M., Grillmeyer, C., Jongen, S., Herpertz, S., Steins-Löber, S. & Wolstein, J. (July 2019). "Gender in the treatment of obesity–Do Women and Men report different cognitive-behavioral factors that promote or impede long-term weight loss maintenance?" 9th World Congress of Behavioural and Cognitive

- Therapies, Berlin. [https://opus4.kobv.de/opus4-bamberg/files/55422/wcbct\\_van\\_der\\_veldese\\_a3b.pdf](https://opus4.kobv.de/opus4-bamberg/files/55422/wcbct_van_der_veldese_a3b.pdf)
- van der Velde, C., Schroeder, S., Jongen, S., Pape, M., Herpertz, S., Wolstein, J. & Steins-Löber, S. (July 2019). "I-GENDO – eine App-basierte gendersensible psychologische Intervention bei Übergewicht und Adipositas." DGVM-Kongress, 17, 2019, Würzburg, Würzburg. <https://fis.uni-bamberg.de/handle/uniba/47216>
- Wang, C. & Coups, E. J. (2010). "Causal beliefs about obesity and associated health behaviors: results from a population-based survey." *International Journal of Behavioral Nutrition and Physical Activity* 7(1). 1–7. <https://doi.org/10.1186/1479-5868-7-19>
- Williams, R. L., Wood, L. G., Collins, C. E. & Callister, R. (2015). "Effectiveness of weight loss interventions – is there a difference between men and women: a systematic review." *Obesity Reviews* 16(2). 171–186. <https://doi.org/10.1111/obr.12241>
- Wing, R. R. & Hill, J. O. (2001). "Successful weight loss maintenance." *Annual review of nutrition* 21(1). 323–341. <https://doi.org/10.1146/annurev.nutr.21.1.323>
- Wolfe, B. L. & Smith, J. E. (2002). "Different Strokes for Different Folks: Why Overweight Men Do Not Seek Weight Loss Treatment." *Eating Disorders* 10. 115–124.
- World Health Organization. (2000). "Obesity: Preventing and Managing the Global Epidemic." World Health Organization.
- World Health Organization. (2020, April 1). "Obesity and overweight." <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
- Young, M. D. & Morgan, P. J. (2018). "Effect of a Gender-Tailored eHealth Weight Loss Program on the Depressive Symptoms of Overweight and Obese Men: Pre-Post Study." *JMIR Mental Health* 5(1), e1. <https://doi.org/10.2196/mental.8920>
- Zhang, M., Loh, A. & Ho, R. (2018). "Web-Based and Smartphone Application-Based Psychological Interventions in Severe Obesity." In S. Cassin, R. Hawa & S. Sockalingam (Hg.), *Psychological Care in Severe Obesity: A Practical and Integrated Approach* (S. 264–271). Cambridge University Press.