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Cued overeating

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Chapter 92
Cued Overeating

Anita Jansen, Remco C. Havermans, and Chantal Nederkoorn

Abbreviations

WHO	World Health Organisation
CS	Conditioned stimulus (= cues)
US	Unconditioned stimulus
UR	Unconditioned response
CR	Conditioned response
CBT	Cognitive behaviour therapy

92.1 Introduction

Obesity, defined as an unhealthy amount of body fat, is a major health problem that is increasing dramatically worldwide; figures show a current overweight and obesity prevalence of more than 60% in the USA and UK, and comparable statistics are documented for many other countries in the world (Wadden et al. 2002). In 2005, it was estimated by the World Health Organisation (WHO) that at least 400 million adults were obese and 1.6 billion people of over the age of 15 were overweight (World Health Organisation 2009). WHO further predicts that by 2015, about 2.3 billion adults will be overweight and more than 700 million will be obese. WHO refers to these figures as the obesity epidemic.

The ultimate cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. The main reasons for the energy imbalance are a shift in diet towards increased intake of energy-dense foods that are high in fat and sugars and decreased physical activity. Highly palatable energy-dense foods are widely available and difficult to resist. However, not everybody grows obese, so some people are better able to handle the temptations of the current environment than others. Understanding how people handle temptations is necessary to develop prevention strategies or to strengthen interventions for obesity. Why are some people better able to resist the "toxic" environment than others?

A difference between normal eaters and overeaters might be related to the automatic responding of one's body to appetitive cues as a consequence of learning. Overeating is associated with increased

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cue reactivity, that is, increased appetitive responding to food cues (Jansen 1998; Jansen et al. 2003; Jansen et al. 2008). When overeaters are confronted with a diverse range of tasty food cues that are predictive of food intake – like the smell, taste, and sight of palatable high calorie foods – they show increased appetitive or cephalic phase responding, like salivation and the release of insulin, followed by increased food intake (Jansen 1998; Jansen et al. 2003; Wardle 1990; Woods 1991). Cephalic phase responses are responses that prepare for food intake: the greater the appetite, the more intense the response (Powley 1977). Signals that cause the cephalic phase response originate in the cerebral cortex, amygdala, and hypothalamus and are transmitted to the stomach. The cephalic phase or appetitive responding is believed to be experienced as an urge to eat, making it more difficult for people to refrain from eating. As a consequence, healthy eating in a "toxic" environment is much easier without than with these appetitive responses. Learning theory states that appetitive responses decrease and extinguish when exposure to foods remains *systematically* unreinforced, that is, when palatable high-calorie foods are seen or smelled but not eaten. In other words, being able to resist palatable high-fat food temptations and maintaining a regular and healthy diet even if exposed to the "toxic" environment, leads to a decrease and eventually extinction of the automatic urges to eat, which in turn makes it easier to refrain from eating high-fat foods for a longer period of time. In contrast, dieters who intermittently or always give in to the urge to eat, keep reinforcing the learned appetitive responding, ending up in increasingly stronger urges to eat the highly palatable foods (Jansen 1998). In the present chapter, it is argued and demonstrated that food cues might elicit almost reflex-like irresistible food cravings that could sabotage a healthy diet. It will also be shown that there are ways to decrease the abnormal food cue reactivity and overeating and it is suggested that cue exposure with response prevention should be used more often in the treatment of overeating.

92.2 Cue Elicited Eating

The intake of food activates physiological responses. A large number of studies show that the physiological responses brought about by food intake, e.g. insulin release, blood sugar increase, and salivation, can be brought under the control of any stimulus predictive of food intake, like odors, time of the day, eating-related situations, seeing, smelling, tasting, and even thinking of food (see for an overview Jansen 1998; Siegel 1972; Woods 1991). Any time food is ingested, there is an opportunity to associate the food with cues that are present at the time (Bouton et al. 2006; Havermans et al. 2007). The place where the food is eaten, the people with whom it is eaten, the food preparing rituals, the smell and taste of the foods – they may all become signals for eating and when this happens, classical conditioning occurs (see Fig. 92.1).

The conditioned responses (CRs) prepare the organism for food intake and contribute to the body's internal homeostatic regulation. Food intake may, in terms of classical conditioning, be considered an unconditioned stimulus (US), whereas its metabolic effects are unconditioned responses (URs). Cues that reliably signal food intake, such as the sight, smell, and taste of food, or even the context in which one eats, may start to act as conditioned stimuli (CSs) that easily trigger cue reactivity (CRs). In short, it is theorized that cues that are (nearly) always and almost exclusively present at the time of eating will, in the long run, acquire the ability to *predict* the eating and its effects. One might think of both proximal cues, e.g., the sight, smell, and taste of the food, intake rituals such as the preparation of food, and interoceptive cues (e.g., affective states or typical palatable food-related cognitions), but also distal cues like context cues (e.g., the room where usually is eaten, time of eating). From the very moment that these cues reliably signal food intake and classical conditioning occurs, the cues or conditioned stimuli (CS) acquire the ability to elicit special food intake related

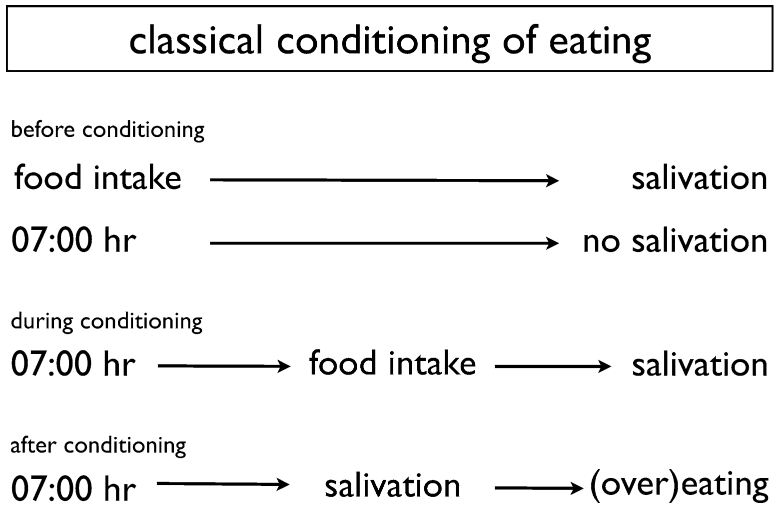

Fig. 92.1 The classical conditioning model of (over)eating. Any time food is ingested, the food intake is associated with the cues that are present at that time. For example, when breakfast is always eaten at 07:00, this time will be associated with food intake. At the moment 07:00 is a reliable predictor of food intake, the time alone elicits responses that prepare for intake, like salivation

responses in the organism, like insulin release, blood sugar decrease, and the subjective experience of food cravings or appetite. These responses are calledCRs or cue-reactivity. It is assumed that food cravings or appetite reflect the subjective experience of these learned responses (Jansen 1998).

The acquired responses (CRs) might have specific features. Deutsch (1974) showed that an initially neutral taste cue is able to elicit a glycometabolic effect in rats after pairing the taste with glucose administration in a classical conditioning paradigm; the rats learned that sugar would come and when they tasted the formerly neutral taste, they prepared for the glucose with a preparatory decline in blood sugar. In the same way, rats learned to respond with a decline in blood sugar to a placebo after they were repeatedly injected with glucose. Conditioned hypoglycemia was also demonstrated in dogs and humans after injections with intravenous glucose (Overduin and Jansen 1997; Overduin et al. 1997). Conversely, after repeated intravenous injections of insulin (which are usually followed by a decline in blood sugar level), rats learned to respond with a rise in blood sugar level to a placebo (Siegel 1972, 1983). Also eating behavior can be triggered by cues that were systematically associated with food consumption: rats that had already eaten till satiation were found to eat again when exposed to a tune that was previously associated with food consumption (Weingarten 1983). More recently, it was found that rats consumed significantly more (less palatable) chow when exposed to context cues that were earlier paired with the intake of highly palatable foods (Boggiano et al. 2009). Various context cues were used, e.g., different types of bedding or wallpaper. Boggiano et al. concluded that context-cues associated with palatable food intake might drive overeating in rats, even in sated rats and even when a less-preferred food (chow) was used in the test phase. The authors also report that the cue-conditioned overeating was quickly learned and appeared to be particularly strong when the taste of a palatable food was used to make cue-associations.

In humans, it has been found that the mere anticipation of food and sham feeding (i.e. the sight, smell, taste, chewing, or swallowing of food without it entering the gastrointestinal tract) as well as cognitive processes (such as the thought of food or even hypnotic suggestion of food) elicit responses which prepare the organism for the digestion of food, such as insulin release and salivary responses (Mattes 1997; Nederkoorn and Jansen 2002; Nederkoorn et al. 2000; Power and Schulkin 2008; Powley 1977; Rodin 1985).

In sum, it is well documented that exposure to food cues evokes cephalic phase responses. The cephalic phase responses gear up the body and serve the efficient use of nutrients. The classical conditioning model of food intake states that, after systematic association of cues (CS) and food intake (US), the cues will reliably signal the food intake effects. The moment the cues are good predictors of eating, they acquire the ability to elicit physiological responses that prepare for intake and are called cue reactivity. Appetite or craving is the subjective experience of cue reactivity. A main prediction flowing from this cued eating model is that the CRs or cue reactivity increase the likelihood of food intake and easily leads to overeating.

92.3 Cue Elicited Overeating

Imagine that you are in a wedding party: in that situation you will definitely eat more than when you are at home on a weekly day. Presumably, you will also eat more than you need to: you overeat. Overeating is quite normal; many people overeat once in a while, depending on the context or situation. But there are also people who do overeat on a regular basis, almost habitually. They will gain weight and might become overweight or obese. Some other people, mostly young females, are frequent binge eaters. Binge eating refers to the eating of an objectively large amount of food in a discrete period of time, while experiencing a loss of control over intake (APA 1994). Mostly, palatable high-calorie foods are eaten during a binge and the food usually is stuffed into the mouth. Binge eating occurs in the (sub)clinical eating disorders Bulimia Nervosa, Anorexia Nervosa, and Binge Eating Disorder (APA 1994), and it is also been found to occur in about 12% of a normal female population sample (Bruce and Agras 1992) as well as 15–50% of the obese participating in weight-control programs (Marcus et al. 1985). The obese usually do not compensate for the extra calories that they eat during a binge, whereas the underweight and normal weight binge eaters do compensate by e.g. self-induced vomiting, use of laxatives, exercising, and dieting.

The most frequently mentioned triggers of binge eating are negative emotions – like feeling depressed, hopeless, worried and dissatisfied – and appetitive cues that elicit craving – like the sight, smell, and taste of highly preferred foods (Jansen et al. 2008). Tasting or smelling palatable foods, being in a low mood, anxious or emotionally upset, thinking of eating; all these binge precursors could, hypothetically, be conditioned to the excessive intake of food. After systematic association of these cues with binge food intake, the cues reliably signal the food effects. The moment the cues are good predictors of intake, they will elicit physiological responses that are subjectively experienced as craving or appetite, which almost reflexively increase the likelihood of overeating.

This model hypothesizes that classically conditioned associations between cues that predict food intake and actual eating behavior are stronger in overweight than in normal-weight children since parents of overweight children more frequently prompt their children to empty their plate and overweight children show higher external eating styles, meaning that their intake is more often triggered by food cues like seeing or smelling food. Both increase the probability that a food cue is followed by food intake, which strengthens the bond between cues and intake and makes smell and taste more predictive of intake in overweight than in normal-weight children. In line with the model it was found that overweight and normal weight 8–12 year old children ate comparable amounts when they were not tempted by food cues (Jansen et al. 2003). However, when they were tempted by cues that signal eating, like the smell and taste of highly palatable foods, the overweight children overate. They ate more in response to food cues than without, whereas the normal weight children did the opposite: they ate less in response to food cues than without these cues. Cue reactivity (salivation) was related to food intake but only in the overweight children: they showed a highly significant correlation between

Table 92.1 Key points of cued overeating

1. The intake of food activates physiological responses
2. When food intake systematically is preceded by internal or external cues, classical conditioning occurs
3. During confrontation with the cue that predicts food intake, the body anticipates eating
4. Cues predictive of food intake are for example the smell, taste, and sight of palatable foods
5. These food cues bring about responses that prepare for intake, like salivation and the release of insulin
6. The anticipative appetitive responding increases appetite or the urge to eat
7. The anticipative appetitive responding increases intake

This table lists the key points of cued overeating including the required systematic association between cue and food intake that leads to a process of classical conditioning. Being confronted with a cue that predicts eating prepares the body for food intake by anticipative appetitive responding

caloric intake and salivary flow after food cue exposure ($r = 0.62$), whereas this relation was almost absent in the normal-weight group ($r = 0.05$).

The abovementioned study shows that overweight children eat normal amounts when tempting food cues are lacking. But when they are tempted by the taste or intense smell of palatable food, they fail to regulate their intake. This vulnerability to cued overeating in overweight children might follow from a learned association between the tempting cues and increased intake. The cue-elicited salivary response of the overweight sample was significantly related to their increased intake. Clearly, the cues elicited reactivity-related overeating in the overweight sample and not in the normal-weight sample, a finding that supports the idea that classically conditioned associations between cues that predict food intake (smell, taste) and actual eating behavior are stronger in overweight than in normal-weight children (Table 92.1).

92.4 The Role of Mood and Restraint

Risk factor models for eating disorders have put forward that negative mood states are key triggers of overeating in samples with eating disorders (Stice et al. 2008). In some recent studies, eating disorders were subtyped along dimensions of negative affect and these studies showed that increased negative affect signaled a stronger vulnerability to disinhibition (Stice et al. 2008). In our lab, we showed that a specific state-trait interaction facilitated overeating: the high negative affect overweight/obese subtype was more vulnerable to overeating in the presence of a disinhibiting cue (negative mood induction or food exposure) than the overweight/obese subtype that was low in negative affect (Jansen et al. 2008). The data show that individual differences might play a critical role in the way overweight/obese people handle the temptations of the current "toxic" environment: negative affect makes it more difficult for the overweight/obese to resist modern temptations (see Fig. 92.2).

Another trait that plays a role in the way people handle toxic temptations is restraint. Restrained eaters try to restrict their intake, mostly because they want to lose weight. But a substantial part of the restrained eaters usually alternates between restrained and overeating episodes: a very common eating pattern is that in the absence of tempting food cues, the so-called restrained eater succeeds in resisting highly palatable high calorie foods until a cued overeating episode announces itself. It should be noted that such an eating pattern facilitates classical conditioning: deprivation in the absence of cues and eating large amounts of high calorie palatable foods (strong USs) within a limited and specific range of cues (CSs) implies that the contingency between CS and US, and thus classical conditioning, will be strong (Bouton et al. 2006). Strong conditioning is reflected in strong CRs or cue reactivity including appetite or craving. Experimental studies indeed show that dieters overeat after exposure to cues that typically predict food intake, like tasting a priming dose (appetizer

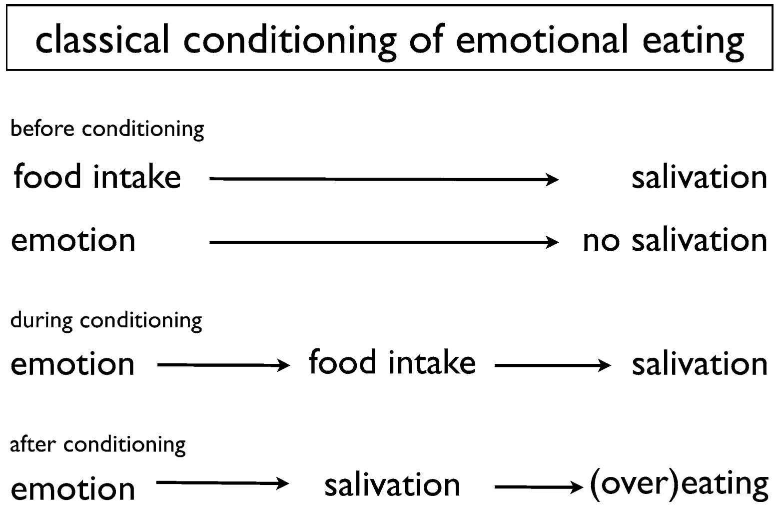

Fig. 92.2 The classical conditioning model of emotional eating. If snack foods are always eaten when emotionally upset, feeling upset will be associated with snack food intake. At the moment being emotionally upset is a reliable predictor of snack food intake, the emotion alone elicits responses that prepare for intake, like salivation

or preload; see for a classic experiment Herman and Mack 1975) and in other studies it was found that they overeat after mere exposure to the smell of binge food (e.g., Jansen and van den Hout 1991). The exposure to food cues (tasting, eating, or smelling the food) elicited a strong desire to eat in people that tend to alternate overeating and restrained eating.

92.5 Successful Dieting

Some dieters never overeat and they might be called successful dieters. Although it is not precisely clear how many people are successful in dieting, it is estimated that about 20% of the obese are capable of reducing to a normal weight and to maintain this reduced weight for at least a year (Wing and Phelan 2005). It is however not at all clear why some people are better able to stick to their diets for a long period of time in the context of a "toxic" environment than others. Successful dieters report to especially refrain from eating palatable high calorie fat foods; they say they are strict dieters who eat little fat and show little variety in their diets (Gorin et al. 2004; Raynor et al. 2005; Wing and Hill 2001). The classical conditioning model of cued overeating would predict that if exposure to tasty high fat foods remains unreinforced in successful dieters, this will lead to the extinction of cue reactivity (including craving) during confrontation with the cues. The extinguished cue reactivity makes it easier to maintain one's diet. In line with the cued overeating model, decreased salivary responding during exposure to palatable high fat food cues was found in postobese successful dieters, whereas unsuccessful obese dieters showed increased salivary responding during exposure to the same cues (Jansen et al. 2009). It was proposed that strict dieting extinguishes cue reactivity. In its turn, the extinction of cue reactivity will make dieting easier (see Fig. 92.3). Strict dieting is however quite difficult for many dieters, especially in the beginning of the dieting, and it might take much time before learned cue reactivity is extinguished. There are also dieters who do not expose themselves to high calorie foods but avoid them, for example because they only consume diet shakes for

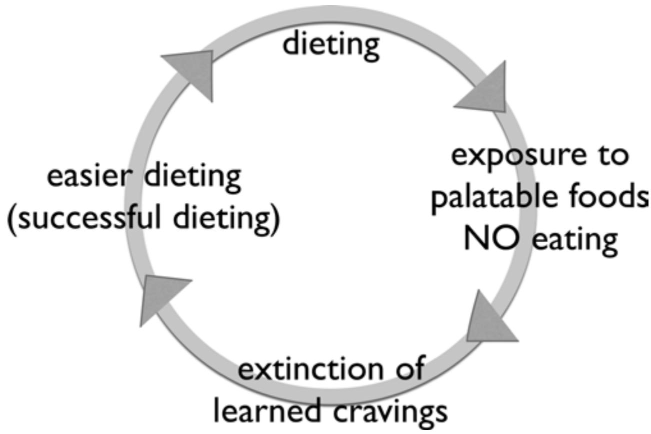

Fig. 92.3 The relation between the way of dieting, food cue exposure, food cue reactivity, and extinction or the success of dieting. If exposure to tasty high fat foods remains unreinforced this will lead to the extinction of cue reactivity and makes dieting easier

Fig. 92.4 The relation between the way of dieting, food cue exposure, food cue reactivity, and extinction or the success of dieting. If the dieter avoids the exposure to tasty high fat foods, this will not lead to an extinction of cue reactivity and sabotages dieting

periods of time. They are expected to remain cue reactive, which makes it more difficult for them to maintain the lost weight (see Fig. 92.4). It was further argued that the extinction of cue reactivity is necessary for successful dieting. Dieters that avoid highly palatable food cues, like the dieters that follow a specific shake-diet or another limited diet, do not enable their cue reactivity to extinguish. Likewise, in dieters who intermittently keep overeating high-calorie high-fat palatable foods, cue reactivity will not disappear because the CS is followed repeatedly by the US, which makes it difficult to learn that the CS does not predict the US anymore (see Fig. 92.5). For successful dieting and a reduction of overeating it seems necessary that dieters enter a vicious circle of strict dieting and decreased cue reactivity (see Fig. 92.3). Dieting appears to be difficult. Can we help overeaters to decrease cue reactivity, to facilitate dieting? (Table 92.2).

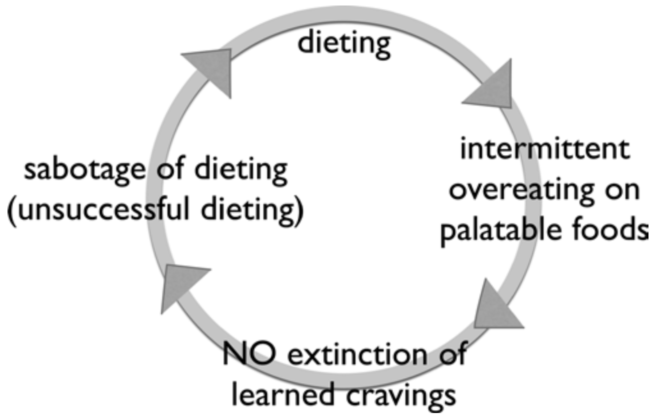

Fig. 92.5 The relation between the way of dieting, food cue exposure, food cue reactivity, and extinction or the success of dieting. If the dieter intermittently overeats on tasty high fat foods, this will not lead to an extinction of cue reactivity and sabotages dieting

Table 92.2 Key points of successful dieting

1.	When the body anticipates eating and prepares for consumption, appetite or the urge to eat is intense
2.	When the cues are not followed by eating, the anticipative appetitive responding decreases and appetite or the urge to eat as well
3.	After a series of nonreinforced exposures to the cues without eating, the cues do not predict eating anymore
4.	When cues do not predict eating anymore, they will stop eliciting preparatory responses
5.	Successful dieters confront themselves with the cues that predict food intake without eating
6.	The preparatory responses in successful dieters are extinguished making it easier to refrain from foods

This table lists the key points of successful dieting including the required extinction of the systematic association between cue and food intake. Being confronted with a cue without eating extinguishes the anticipative appetitive responding and makes dieting easier

92.6 The Reduction of Cue Reactivity

The classical conditioning model of overeating states that cue reactivity follows from probabilistic CS (cues)–US (overeating) contingencies. Cues will elicit craving as long as they are reliable predictors of food intake or, to put it differently, as long as the CSs are systematically reinforced by the US. The model predicts that craving will extinguish when the CS–US bond is broken. This bond will be broken by prolonged and repeatedly nonreinforced exposure to the cues that predict overeating (CS). Strict dieting in the current "toxic" environment is a form of continuous nonreinforced exposure to palatable food cues. However, many dieters try to avoid the palatable food cues in order to make it easier to keep their diets. The toxic environment is however everywhere, so they will never succeed in always avoiding palatable food cues. The link between cues that indicate that overeating is forthcoming and the actual overeating might be eliminated by cue exposure with response prevention. During cue exposure with response prevention the subject is exposed to the craving-eliciting highly palatable food cues and eating is prevented. Individually customized sets of highly palatable food cues are the best to use; the more likeness the cues have to the favorite foods, the better the reactivity is. This means for the exposure to food cues, that all of the cues and contexts that play a part in the overeating should be included in the most perfect exposure: the exposure takes place at the customary overeating spot and with the most favorite foods for overeating. Special attention must be paid to

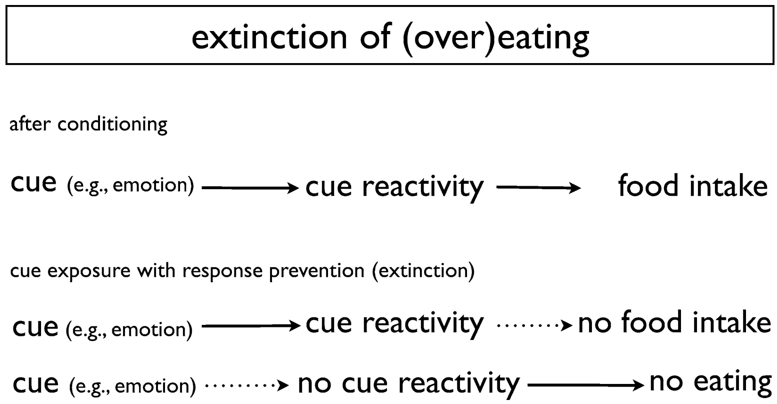

Fig. 92.6 The extinction of overeating through cue exposure with response prevention. The emotional eater is exposed to the emotion (e.g., by inducing emotions) and responds with cue reactivity including a strong desire to eat the foods (or craving). But the emotional eater is prevented from eating. After several sessions of exposure with response prevention, the emotion is no longer predictive of overeating. The cue reactivity including the desire for eating or craving is extinguished

moods and thoughts that accompany the overeating. For many overeaters, negative moods are important cues that elicit craving; inducing a negative mood might magnify the urge to eat. The goal of the exposure is to elicit a strong craving for the palatable high-calorie food. The overeater touches the food, feels around in it, grabs it, holds it to the nose and smells it – but never eats; the CS–US bond will be broken. Craving will increase until it is experienced as almost irresistible. But if the exposure lasts long enough, the craving for food will slowly die down despite all attempts to keep it as strong as possible; CRs (cue reactivity and craving) will extinguish (see Fig. 92.6).

Pilot studies show that cue exposure with response prevention elicits craving – the craving typically increases gradually until it is high, and then it extinguishes slowly in patients with bulimia nervosa (Jansen et al. 1989; Jansen et al. 1992; Toro et al. 2003; Martinez-Mallén et al. 2007). Extinction was found both within and between the exposure sessions (cue reactivity started lower each session). The exposure was not only highly effective in the reduction of cue reactivity and craving, also the binge frequency of the bulimia nervosa patients decreased significantly.

Another study was, however, less positive (Bulik et al. 1998; Carter and Bulik 1994). It was examined whether the effectiveness of short cognitive behavior therapy (CBT) could be increased through adding food cue exposure with response prevention. All bulimia nervosa patients were first treated with eight sessions of CBT, and then eight exposure sessions followed. The exposure did not improve the results of the short cognitive behavior therapy. However, CBT was already extremely effective; an 80% reduction of binge eating was reached and 40% of the sample was abstinent, i.e. did not binge eat anymore. These excellent results touch the sore spot; the cognitive behavior therapy reached a ceiling effect – the design of the study did not permit the exposures to be successful.

All in all, the positive findings from pilot studies suggest that cue exposure might be an effective treatment for binge eaters. Note, however, that although the data are promising, they were derived from pilot studies with small subject samples. The only large controlled clinical trial that was published is not positive about the contribution of cue exposure with response prevention to CBT in the treatment of binge eating. We pointed to several methodological shortcomings of that study. Further, as far as the authors know, the effects of cue exposure are yet only documented for bulimia nervosa patients. It remains to be seen whether nonbinging overeaters will also benefit from cue exposure with response prevention.

Apart from the extinction of cue reactivity that is strived for by the cue exposure to highly palatable food cues, the olfactory stimulation during the exposure to palatable food cues might have induced olfactory sensory-specific satiety. A short period of olfactory stimulation (i.e., smelling) produced decreased pleasantness of the smell of the food, which is called olfactory sensory-specific satiety (Rolls and Rolls 1997). Thus, smelling foods may induce satiety. It was suggested by Jansen et al. (2003) that overeaters and people that show a tendency to overeat are characterized by a slowing down of the sensory-specific decrease in neural activity. Indirect evidence for this idea is given in studies on the extinction of craving in binge eaters; binge eaters show increased craving after they started smelling binge foods (without eating it), and the highest of their craving is after about 20 min, after which craving gradually declines. In normal eaters the highest of craving is reached earlier and craving extinguishes more rapidly.

Relating these findings to the cue reactivity model, it might be hypothesized that tasting or intense smelling of palatable food works as a prime that elicits cue reactivity especially in overeaters who are used to eat after being confronted with these cues. Normal eaters show sensory-specific satiety responses to the highly palatable foods. Note that the priming cues will elicit reactivity as long as they are reliable predictors of intake. The model predicts that the cue reactivity will lead to overeating until the cue–intake bond is broken by prolonged and repeated nonreinforced exposure to the cues. During cue exposure, the participant is exposed to the cues (smell, taste) and prevented from intake, leading to reduced reactivity and craving (Jansen 1998). Cue exposure with response prevention might be a promising new treatment intervention for overeaters. It might help to reduce cue reactivity and craving more quickly compared to when one is merely strict dieting. Thus, the first blow is half the battle; a successful start of the diet that frees the body of its cue reactivity will make dieting easier and more successful.

92.7 Applications to Other Areas of Health and Disease

The learning model of excessive consumption was originally formulated for addictive behaviors; many studies showed that the craving and substance intake of addicts is cue-controlled. Cue exposure with response prevention seems to be a useful therapy for addictive behaviors as well (see e.g., Havermans et al. 2007). Cue-elicited overeating might also be present in some anorexia nervosa patients, suggesting that cue exposure with response prevention is indicated for anorexia nervosa as well. Therapists are however strongly advised against using cue exposure with response prevention in anorexia nervosa. A main characteristic of anorexia nervosa is the low body weight and cue-induced (over)eating might be a mean to consume at least some calories. As long as they are underweight, anorexia nervosa patients should not be treated with strategies that do decrease intake.

92.8 Conclusions

The present model of cued overeating states that cues that reliably signal highly palatable food intake, such as the sight, smell, and taste of highly palatable foods, or even the context in which the overeating takes place, may start to act as conditioned stimuli that trigger cue reactivity and craving. It is assumed that learned cue reactivity increases the probability of overeating. Numerous experiments demonstrated that overeaters specifically overeat after confrontation with cues that predict the intake of highly palatable foods.

It was further argued that the extinction of cue reactivity is necessary for successful dieting. Dieters that avoid highly palatable food cues, like the dieters that follow a specific shake-diet or another limited diet, do not enable their cue reactivity to extinguish. Likewise, dieters who intermittently keep eating high-calorie high-fat palatable foods will remain cue reactive. Only dieters who expose themselves to highly palatable food cues without eating them are expected to show the desired extinction of cue reactivity. This might however take a long time. The extinction of cue reactivity can be accelerated by cue exposure with response prevention. There have been a number of pilot studies suggesting that cue exposure with response prevention is an effective intervention to reduce binge eating. Whether cue exposure with response prevention is also suitable for overeaters and an effective intervention to reduce overeating remains to be studied.

Studies on the effectiveness of food cue exposure should be encouraged. Is cue exposure with response prevention beneficial to help people reaching the extinction sooner? Will dieting become easier and more successful when cue exposure with response prevention sessions are introduced quickly after or even before the start of the dieting? It would be highly relevant to find out how long it takes for learned cue reactivity to extinguish, in dieters who expose themselves to highly palatable high calorie foods without eating them and in dieters who do not expose themselves or to a lesser degree. The cued overeating model predicts that the first blow is half the battle. Experimental studies are needed to find out whether this is true.

Summary Points

- Obesity (partly) follows from overeating.
- Overeating follows from classically conditioned appetitive responding to food cues.
- The food cues elicit irresistible food cue reactivity including cravings that might sabotage a healthy diet.
- If overeating systematically follows negative emotions, the negative emotions will become cues for overeating.
- Cue exposure with response prevention decreases the abnormal food cue reactivity.
- Successful dieting requires the extinction of food cue reactivity.

Key Terms

Obesity: This refers to an unhealthy amount of body fat. Obesity usually is defined by a Body Mass Index (BMI = kg/m^2) of 30 or more.
Classical conditioning: It is a form of associative learning during which the organism learns that stimulus A predicts the occurrence of stimulus B, for example the smell of food (stimulus A) predicts eating (stimulus B).
Food cues: Cues that are predictive of food intake like the smell, taste, and sight of food, but also place, time, or emotions and thoughts if they are predictive of food intake.
Appetitive responding: Bodily responses that prepare for food intake, like salivation and insulin release, and the experience of appetite or urge to eat.
Cue reactivity: Increased appetitive responding to cues that predict food intake.
Extinction: The new learning that stimulus A does not predict stimulus B by presenting stimulus A without stimulus B.
Cue exposure with response prevention: A treatment procedure in which the cues that predict eating (e.g., the smell and taste of foods) are presented without the actual eating until the urge to eat is decreased. After several exposure sessions without eating it is learned that the cues do not predict food intake anymore and at that very moment they will not induce any appetitive preparatory responses and appetite anymore.
Successful dieting: The process by which dieters were successful in losing weight and in maintaining the weight loss.

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