

Exposure to Promote Healthy Eating

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Exposure to Promote Healthy Eating

Anita Jansen¹ · Ghislaine Schyns¹

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Abstract

Adopting a healthier lifestyle includes replacing long-standing unhealthy eating habits with new healthier ones and maintaining these newly acquired healthy eating habits. A permanent behavior change appears to be difficult to maintain, which may follow from some basic learning processes. In the last decades, a lot was learned about the learning mechanisms that promote relapse into old behaviours. Taking these learning processes into consideration, a new exposure intervention was developed to combat several forms of unhealthy eating. Exposure is a powerful strategy to change behaviours and cognitions. This theoretical article briefly discusses some fundamental learning processes that may be involved in unhealthy eating habits and shows how the exposure intervention can be applied to promote healthier eating and long-term behavioral change at all ages.

Keywords Overweight · Obesity · Craving · Unhealthy Eating · Exposure · Lifestyle

Introduction

‘Genes load the gun, the environment pulls the trigger’ (freely quoting Bray, 2004); this one-liner nicely summarizes the prevailing view that it is the interaction between a certain genetic vulnerability and the ‘obesogenic’ environment that stimulates overweight. The food industry aggressively markets cheap, refined, and easy to get calories that are tasty and rewarding for many people. These strongly wanted reinforcers straightforwardly provoke reward-driven or ‘hedonic’ eating, meaning that the eating is driven entirely by pleasure rather than physical hunger or energy deficits. Besides the wide availability of high-calorie fast food, physical activity is less necessary because of technological advances such as online shopping and meal ordering. So reasoned, obesity is a natural response to modern society of people with a certain genetic predisposition. However, the gene – environment view seems to ignore the psychology of eating, that is, the importance of cognitive and behavioral processes. Previously, we described some

cognitive-behavioral processes that may explain why some people easily overeat in certain situations while others do not (Jansen, Houben & Roefs, 2015). The current environment is especially obesogenic for people who show strong responses to food cues, are more sensitive to (immediate) rewards, have weaker executive skills, show impaired emotion regulation and dysfunctional thinking. These psychological processes easily sabotage healthy eating. Moreover, learning processes seem to be critical. Lifestyle changes involving healthier eating habits are recommended, but even when people know what to do, they may still fail to change because of fundamental learning processes. We will first discuss some learning processes that may operate in the maintenance of unhealthy eating habits; processes that make a permanent change to healthier eating difficult. Then, we will present an exposure intervention that may help promote healthier eating and long-term behavior changes.

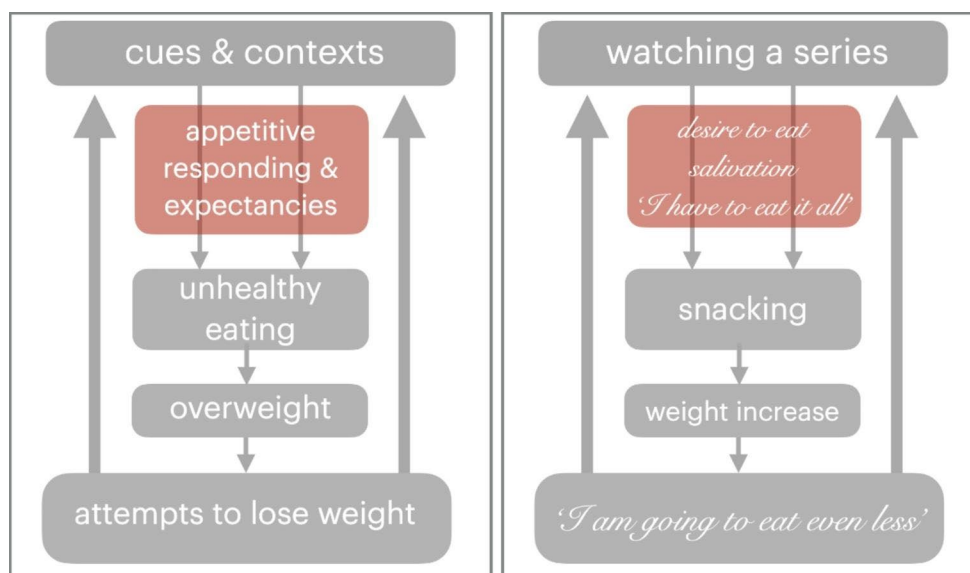
Learning Processes

Our maintenance model of unhealthy eating and overweight (Fig. 1) illustrates that a variety of cues and contexts, signalling the availability of desired foods, can trigger sabotaging expectancies and appetitive responding, both of which can promote eating rule violations and unhealthy

✉ Anita Jansen
a.jansen@maastrichtuniversity.nl

¹ Department of Clinical Psychological Science, Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, the Netherlands

Fig. 1 Maintenance model of overweight. On the right side using the words of a person with overweight



eating. The cues and contexts are very personal and vary between individuals. They may include, for example, mood swings, stress, boredom, happiness, social situations, physical contexts, or a specific time of the day. The appetitive responding to cues or contexts that signal the availability of tasty foods is called food cue reactivity (Jansen et al., 2016). Cue-induced food cravings, eating desires, attention biases, physiological responses such as salivary response or hormone release, but also the cue-induced eating expectations, all prepare for ingestion and reflect increased food cue reactivity. Stronger appetitive responding is robustly associated with eating more calories than physically needed, weight gain, higher body weights, and increased risk of relapse during weight loss and its maintenance (Boswell & Kober, 2016; Jansen et al., 2016). A major cause of increased reactivity to food related cues and contexts is appetitive conditioning (Boutelle & Bouton, 2015). When a cue or context becomes predictive of food intake, it will elicit mental representations of the food and its taste. When confronted with the cue or context, memories of the tasty food are activated and the desire to eat, as well as other appetitive responses, are triggered - even in the absence of hunger - and eating is encouraged. Associations between cues or contexts on the one hand and eating on the other, are particularly easily learned when it comes to the intake of rewarding palatable high-calorie foods. It is obvious to assume that a change of one's lifestyle is more feasible without excessive food cue reactivity. Reduced reactivity to palatable and tempting food cues, i.e., less appetitive responding, makes healthy and controlled eating a lot easier and therefore more feasible.

So it seems important to reduce one's reactivity to eating cues and contexts. Appetitive conditioning is a form of associative learning (also referred to as classical conditioning or respondent conditioning) in which an initially neutral

stimulus (cue, context) is associated with a biologically salient event (food intake). After the association is learned, the cue or context may elicit an appetitive response. To weaken or even eliminate the learned appetitive responding or cue reactivity, procedures such as extinction are available. Extinction learning is the process during which the cue is presented repeatedly without the biologically salient event, in this case food intake. As a result, reactivity to the cue decreases and a "safe" memory is formed.

Extinction learning reduces excessive food cue reactivity and unhealthy eating, but the reduction or extinction of food cue reactivity does not erase its original learning; it is not simply the unlearning, forgetting, replacement, or erasing of previously learned associations between cues and unhealthy eating (Bouton, 2014). Memories of previously learned associations last forever, it is important that they become less powerful and are not activated first. Extinction involves the learning of new associations: after systematically not reinforcing unhealthy eating cues and contexts, they begin to predict the absence of unhealthy eating. The original association still exists but has faded into the background a bit more. For example, when feeling happy and excited predicts unhealthy snacking, the cue signaling unhealthy snacking (feeling happy and excited) remains unreinforced during extinction, meaning that a happy and excited mood is evoked while snacks are not eaten. That way there is learning that feeling happy and excited need not be a predictor of snacking. But the old association of feeling happy and excited with snacking is not at all erased; the association still exists and is easily re-activated. This makes the cue becoming increasingly ambiguous: it signals two possible consequences, namely both the snacking and the absence of snacking. Thus, extinction refers to inhibiting the original cue - unhealthy eating associations and not to

the unlearning or erasing of these associations. The original association can be reactivated quite easily. If activated, appetitive responding returns and a relapse may occur.

Relapse

Inhibitory learning implies that the old and extant associations are quite easy to reactivate and thus remain a weakness for a long time to come. Spontaneous recovery, renewal, reinstatement, and rapid reacquisition after extinction demonstrate that a relapse can happen quickly (Bouton, 2014). With the passing of time after extinction, the original responding to the cue (food cue reactivity) can return which is called spontaneous recovery. Renewal refers to the return of food cue reactivity when confronted with the cue in a different context than the extinction context. For example, when the cue – unhealthy eating association is successfully extinguished in the practitioner’s room, confrontation with the cue at home might renew unhealthy food cravings. Contexts include physical environments but also interoceptive states, like hormonal states, hunger, and satiety. When unhealthy eating associations are extinguished during satiation, confrontation with the cue when hungry can renew the food cue reactivity. So after extinction, cues evoke different responses in different contexts; in some contexts, an extinguished cue evokes no desire to eat, while in others it may still evoke a desire to eat. Extinction, and therefore also the exposure intervention, is context dependent. Reinstatement may occur if you eat your favorite unhealthy food again after extinction: the eating can reinstate the responding to involved cues. Rapid reacquisition is the return of full-blown responding to the cue after a few cue – unhealthy eating pairings after extinction. Because the originally learned association persists even if a new association is learned, the risk of relapse always remains. This makes it necessary to apply extinction procedures that reduce or prevent the likelihood of complete relapse after extinction. The clinical analogy of extinction is exposure: new inhibitory associations can be made stronger by repeated exposures and the use of strategies that strengthen the consolidation and retrieval of the new memories.

Habituation vs. Expectancy Violation

During exposure, one is exposed to cues and contexts that signal food cravings and unhealthy eating, while the cues and contexts remain unreinforced, that is: the associated foods are not eaten. For example, one is exposed to the sight, smell and taste of tempting sweets or snacks, while being prevented from actual eating. Or one is exposed to

specific eating times and eating environments while being prevented from actual food intake. Data from a series of well-controlled studies show that food cue exposure is effective in the reduction of unhealthy eating (Schyns et al., 2016, 2018a, 2018b, 2020b). The so-called sabotaging expectancies are also triggered by the individual eating cues or contexts (Jansen et al., 2016a; Schyns et al., 2020a). Someone who smells good foods and thinks “I have to eat all of this” will eat more than someone who smells good foods and thinks “It smells delicious, but the food is not good for me, I take only one bite”. A person who feels bad and thinks “I don’t care anymore” will eat more than if they don’t think this. Who, after eating a bit of ‘forbidden foods’ thinks “it doesn’t matter now anyway, I might as well go on and eat it all” will eat more than someone who thinks “this was delicious but now I have to stop eating because it doesn’t fit in my diet”. Sabotaging expectancies can be considered a special case of food cue reactivity, which promotes unhealthy eating. Expectancies can be triggered by a variety of eating cues or contexts, that is, cues that indicate eating opportunities, and the automatism of thoughts implies that a person is far from always aware of the expectancies.

During exposure, one is exposed to cues and contexts that signal food cravings and unhealthy eating, while the cues and contexts remain unreinforced, that is: the associated foods are not eaten. For example, one is exposed to the sight, smell and taste of tempting sweets or snacks, while being prevented from actual eating. Or one is exposed to specific eating times and eating environments while being prevented from actual food intake. Data from a series of well-controlled studies show that food cue exposure is effective in the reduction of unhealthy eating (Schyns et al., 2016, 2018a, 2018b, 2020b). The so-called sabotaging expectancies are also triggered by the individual eating cues or contexts (Jansen et al., 2016a; Schyns et al., 2020a). Someone who smells good foods and thinks “I have to eat all of this” will eat more than someone who smells good foods and thinks “It smells delicious, but the food is not good for me, I take only one bite”. A person who feels bad and thinks “I don’t care anymore” will eat more than if they don’t think this. Who, after eating a bit of ‘forbidden foods’ thinks “it doesn’t matter now anyway, I might as well go on and eat it all” will eat more than someone who thinks “this was delicious but now I have to stop eating because it doesn’t fit in my diet”. Sabotaging expectancies can be considered a special case of food cue reactivity, which promotes unhealthy eating. Expectancies can be triggered by a variety of eating cues or contexts, that is, cues that indicate eating opportunities, and the automatism of thoughts implies that a person is far from always aware of the expectancies.

Exposure used to aim at the habituation of food cravings (Schyns et al., 2020a). It has however been demonstrated

Table 1 A list to help mapping out cues and contexts for unhealthy eating. The list includes common general categories of cues and contexts but is not exhaustive and should be adapted to individual circumstances

- **Foods:** Type, brand, quantity, what is your TOP-4 (foods frequently eaten while eating unhealthily)? Any drinks?
- **Place:** Where does the unhealthy eating usually take place, where can it happen, are there any specific locations?
- **Time:** When does it usually start, when does it occur, how long does it last?
- **Circumstances:** Are you alone or in company, after being together, when restricting, during a meal, instead of a meal or right after a meal, after weighing, and so on.
- **Thoughts:** What do you think before during and after the unhealthy eating; from the start of a desire to eat, to an uncontrollable urge, up to and including the actual unhealthy eating
- **Expectations:** What do you expect when you are in a difficult and potential unhealthy eating situation?
- **Feelings:** How do you feel before, during, and after the unhealthy eating? How well are you in control?
- **Physical signs:** Do you feel something special in your body?
- **Rituals or habits:** Do you have any special habits you perform before, during, or after you eat the unhealthy foods?

that habituation is not a good predictor of treatment outcome in anxiety studies, and it was argued that the violation of expectancies during exposure is more important for its effectiveness than the habituation of anxiety (Craske et al., 2014). Translated to unhealthy eating, expectancies like “If I am alone at home with a box of chocolate, I have to eat it all”, “If I take one bite, I will eat it all,” or “I cannot stop eating” should be violated during exposure. Expectancies are violated when being home alone without eating the whole box, when taking one bite without eating it all, or if eating is stopped midway. Indeed, Schyns et al. (2016) showed that within-session habituation of cue reactivity (craving and salivation) did not correlate with food intake after prolonged exposure, whereas a significant correlation was found between the violation of expectancies and intake: Participants whose unhealthy eating expectancies such as ‘If I have good food in front of me, I can’t resist eating it’ became weaker, ate significantly less of the food they were exposed to than participants whose expectancies were still strong. But Schyns et al. (2018b) showed that both an exposure intervention focusing on the habituation of eating desires and an exposure intervention focusing on the violation of eating expectancies are successful in the reduction of unhealthy food intake. Craving habituation and expectancy violation appeared to be highly correlated so it can be difficult to tell them apart. It was concluded that the targeting of expectancies during exposure works as good as the targeting of eating desires; both reduce expectancies, desires, and food intake (Schyns et al., 2018b). The exposure intervention is described in detail below.

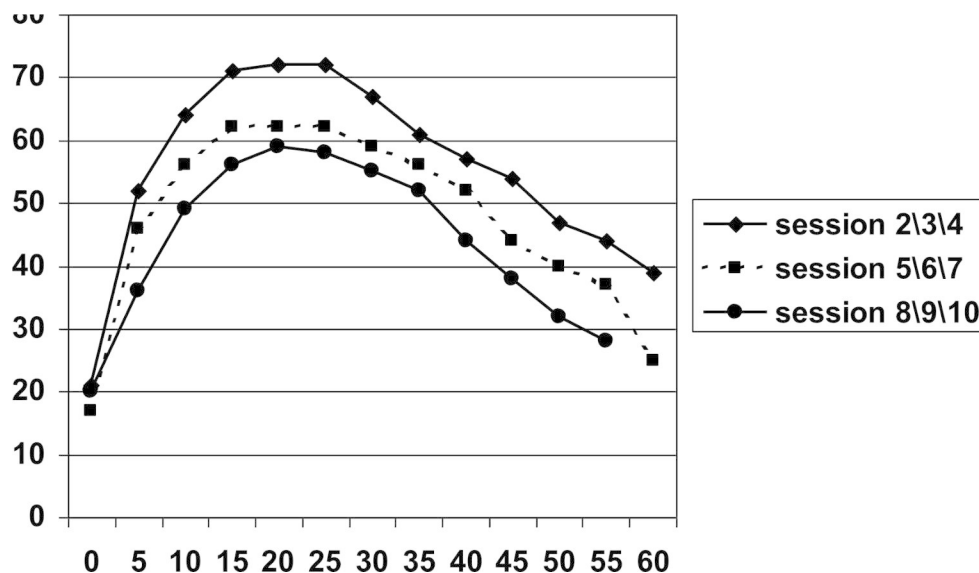
Exposure Preparations

Before the exposure can start, individual triggers of unhealthy eating must be identified. Triggers can be cues or contexts, you should try to identify all relevant cues and contexts that elicit undesired unhealthy eating episodes. Possible cues may include: the seeing, smelling, or tasting of palatable foods (ask for one’s favourite brands), being alone or lonely, specific times of day, specific locations, emotions, stress, social events, thoughts about one’s weight, body, or foods, eating rituals or habits, activities associated with uncontrolled or excessive eating, like watching series, and so on. To discover one’s individual cues and contexts, one may imagine making a movie of an undesired unhealthy eating moment. They are behind the camera; what do they see? See Table 1 for a list to help mapping out cues and contexts.

You also need to know what someone’s expectations are during food confrontation. People with overweight often say they are not thinking anything at all when confronted with cues or when eating unhealthily: “I am not thinking anything, I am just going to eat” or “I am really not thinking, I am just hungry”. Nevertheless, they may already have expressed many sabotaging thoughts and eating expectations unnoticed, such as “It’s unfair that I can’t eat something nice now” or “I’ve worked so hard, I’ve earned a treat”. They may not be aware of the thoughts which pass through the mind quickly or unnoticed, but these types of thoughts and expectations make it difficult to stay away from food. By helping the individual make explicit the thoughts and expectations that precede uncontrolled, hedonic, or unhealthily eating, the behaviour can be changed. Disinhibiting thoughts can be tracked in several ways, using techniques like analysing a situation, tracing ‘hot’ cognitions, or filling in a thought diary. If automatism is strong and the client insists that eating was completely mindless, for example, or that the realization of having eaten came only at the sight of empty packets, then imagining techniques may be helpful (see e.g., Solbrig et al. 2019).

Having gained a good understanding of the cues, contexts and expectations associated with unhealthy eating in this person, you explain the intervention. You can use the model (Fig. 1) and clarify how cues and contexts can trigger eating expectations, eating desires, salivation responses and/or other forms of appetitive responding, and end up in unhealthy eating. Explain the individual what inhibitory learning is and how exposure works. It should be clear that the exercises intend to learn new, inhibitory, associations and therefore a lot of practice is needed. Once you have a good idea of the predictors of unhealthy eating, and you explained the procedure, the exposure sessions can start.

Fig. 2 State food cravings during exposure. The X-axis shows the minutes of food exposure, and the Y-axis shows the mean level of craving measured on 0–100 mm Visual Analogue Scales during several sessions of exposure. Data from an unpublished pilot study (n = 14 patients with eating disorders) of the first author



Exposure Sessions

The exposure sessions may begin by seeing, smelling, touching, and tasting one's favourite unhealthy foods, without eating. The food is held close to the nose and smelled well, while it is stressed that the urge to eat should become as high as possible. The practitioner participates and models all the exposure exercises, so you both held the foods close to your nose and smell well. The foods may be broken into pieces, a lick or tiny bite may be taken, anything should be done to get and keep the eating desires as strong as possible. To monitor progress, the desire to eat is repeatedly indicated on a visual analogue scale (VAS). Of course, it is also possible to monitor feelings of control or other variables of interest during the exposure. Figure 2 shows an example of the course of food cravings during exposure sessions in patients with eating disorders.

The first exposure exercises focus on experiencing and tolerating food cravings and urges to eat without the actual eating in a reasonably safe setting; the treatment room. It will be learned that it is not necessary and inevitable to eat when faced with risky cues and that it is even possible to smell and taste palatable foods, and to experience a strong urge to eat, without giving in to those desires. During the exercises, the new inhibitory association 'food cues do not predict eating' is learned. The newly learned associations will become stronger the more often it is practiced. Pretty soon after the first exposure sessions, other cues can be introduced as well to approximate the original triggers of overeating as closely as possible.

Context

Studies show that the newly learned inhibitory associations ("the cue predicts that I will *not* eat") are strongly context dependent (Bouton, 2014). So, if cravings extinguish during exposure sessions in a treatment room, there is a good chance that the food cravings will return when one is in the original unhealthy eating context, like home (renewal). The treatment room became an important signal to activate inhibitory cognitions, but not the home context. The original context will still trigger strong cravings and the original behavior (i.e., unhealthy eating) or relapse. Therefore, practice sessions should not be limited to the treatment context; extinction should be done in many contexts that predict unhealthy eating. If necessary, a great diversity of unhealthy eating contexts with a great diversity of cues should be used. It is important to note that contexts are not restricted to physical places, like a specific room or shopping mall. They can also include specific times of the day or interoceptive contexts like physical states (hunger, satiety, tired, energetic), hormonal states, and so on. The proper context can for example be approached by doing the exposure at times and places where one is used to eating unhealthily, at varying degrees of deprivation and hunger. As many cues and contexts as possible should be used in the exposure sessions; they can be used in isolation but also in diverse combinations. An alternative is the use of retrieval cues, though, to our knowledge, there are no well-controlled data available on the effectiveness of retrieval cues after food cue exposure.

Predictability

Exposure sessions should not be very predictable: instead of always practising at the same time, they are preferably practised at varying times and days, with varying duration and under varying conditions. Make the sessions sometimes longer and sometimes shorter. Practice with many different cues and in many relevant contexts. Do not work according to a “from easy to difficult” hierarchy: alternate difficult and easy tasks and do them randomly. That’s when exposure works best because then learning will really be cue- or context-independent.

Repeat Exposure Frequently

The learning of new inhibitory pathways (the cue means no unhealthy eating) is fragile at the start of exposure therapy. During and after exposure therapy, the cue will become ambiguous and signal two possible outcomes: unhealthy eating or no unhealthy eating. The original association still exists and, if activated, the appetitive responding returns and a relapse might occur. As long as the original memory is strong and easily activated, relapses are likely. One way to strengthen the new cue - no unhealthy eating memory, and to make it stronger than original cue - unhealthy eating memory, is to do frequent exposures and to include exposure homework in treatment. Frequent exposures might also reduce the risk of spontaneous recovery. Further, repeating the exposures can strengthen the consolidation of new cue - no unhealthy eating memories learned during treatment (Schyns et al., 2016).

Mismatch

The sessions should be designed to maximise the expectation of unhealthy eating (see also the violation of beliefs paragraph). The stronger the mismatch between what is expected and what actually happens, the better the learning: someone who strongly expects the cue will inevitably lead to unhealthy eating, but is able to not eat during exposure, will better learn the new inhibitory association than someone who less strongly expects to eat unhealthily in the situation.

Avoidance

It is important to pay attention to attempts at avoidance. For example, one may argue that it is not necessary to bring the foods directly under the nose to smell them, which may be avoidance, perhaps because being afraid of an overwhelming urge to eat. In these cases, you must insist on smelling well, with the food against the nose. In general, talking too

much about perceived root causes can distract from what needs to be done: exposure.

Eat Unhealthy Favorite Foods Under Conditions That Do Not Cue Eating

One risk for relapse is reinstatement that may occur when confronted with unhealthy foods after extinction, e.g., when one eats favorite foods after extinction although cues or contexts are not present. The eating of favorite unhealthy foods could nevertheless reinstate one’s responding to cues. During the exposure intervention, the individual should practice eating some ‘favorite unhealthy foods’ when cues are not present (unpaired), for example eating them in contexts that would not quickly be associated with overeating. We propose to install moments of ‘alternative unhealthy eating’: eating small amounts of unhealthy foods under varying conditions that do not cue eating, for example at the gym.

Eat Unhealthy Favorite Foods Under Conditions That Do Cue Overeating

Another risk for relapse is the quick return of responding to the cue when a cue is paired again with unhealthy eating after extinction (= rapid reacquisition). When, after successful extinction, one eats unhealthy again when confronted with a cue or context that used to predict the unhealthy eating, relapse is possible. Occasionally reinforcing the cue during extinction slows reacquisition (relapse) (van den Akker et al., 2018). During exposure, the individual can practice eating a little favorite unhealthy foods when confronted with a cue. Disconfirmation of the belief that the “cue means unhealthy eating” at the same time could be helpful to prevent relapse (Schyns et al., 2016).

Violate ‘If Cue, Then Unhealthy Eating’ Beliefs

The disconfirmation of ‘If cue, then unhealthy eating’ beliefs is important for extinction. Strong, frequent, and repeated violation of those beliefs does strengthen the learning of cue - no unhealthy eating associations (Craske et al., 2014). The length of an exposure session can be determined by the time needed for unhealthy eating expectancies to be violated (instead of waiting for the eating desires to decrease) (Craske et al., 2014). For example, beliefs like “If I am alone at home with a box of chocolate, I will eat it all” or “If I eat one bite, I will eat it all” will be violated if the individual does not eat the entire box, or if only one bite is taken. “If I do not eat sweets when I travel home after work, I will pass out in the train” will be violated when travelling home by train succeeds without eating and without passing out. Violating such beliefs, which perpetuate unhealthy

eating, promotes effective exposure. Violation can be done by asking how big the chance is that the ‘If cue, then unhealthy eating’ belief will happen during the exposure, and how long it will take to occur. For instance, when one predicts that eating the entire box of chocolate will occur within 10 min, the belief will be disconfirmed after 10 min of exposure without unhealthy eating.

Homework

To strengthen the new cue – no unhealthy eating memory, daily homework exposure assignments should be done. Because the practitioner may be a ‘safety signal’, exposure exercises without the practitioner present can also be done during treatment sessions; the practitioner is in another room, for example, to reduce experienced safety.

Reflection on What Was Learned

New inhibitory associations are better stored in memory when the individual afterwards reflects about what was learned during the exposure. So, it is advised to ask before each session what they think will happen (expectations) and after the session you ask if it indeed happened (yes or no) and what exactly was learned (Craske et al., 2018). It is also helpful to engage in between-session mental rehearsal of what was learned during the exposure sessions (McGlade & Craske, 2021).

Conclusion

Genetic vulnerabilities within an obesogenic environment may load the weapon, but learning processes pull the trigger. Appetitive learning and food cue reactivity motivate unhealthy eating and weight gain, and they impede weight loss and its maintenance. Though appetitive responding is easily learned, the extinction of appetitive responding is challenging. Learned associations will always be in memory. New associations can be learned and made stronger than the original associations. We discussed these learning processes and ways to extinguish appetitive responding using exposure. Exposure interventions can reduce unhealthy eating and therefore contribute to lifestyle change.

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