

## FOOD CRAVING: AN OVERVIEW

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**F**ood craving can be defined as an intense desire to consume a particular food that is difficult to resist (1). This specificity differentiates food craving from feelings of hunger: a craving for a specific food can be typically only satisfied by consumption of that food, while hunger can be alleviated by consumption of any type of food. Moreover, food cravings can occur in the absence of hunger, that is, food deprivation is not a necessary condition for the occurrence. In a study by Pelchat & Schaefer (2000), for example, participants were instructed to adhere to a monotonous diet (vanilla-flavored, nutritionally-complete drinks) for five days. In young adults, the number of food

cravings were markedly increased during that period, indicating that sensory monotony without nutritional deprivation is sufficient to stimulate food cravings (2).

Just because hunger is not a prerequisite for experiencing food craving does not mean, however, that hunger and food craving do not co-occur. In fact, it is likely that in many instances hunger easily turns into food craving: just imagine when you are feeling very hungry and you are then exposed to the smell of your favorite food – this will most likely induce craving for that exact same food. Nevertheless, even when hunger

and craving co-occur, it still seems that they can be differentiated with regard to their physiological and behavioral

correlates. In a recent study by Meule & Hormes (2015), participants underwent a chocolate exposure, during which current craving for chocolate increased. Unexpectedly, participants also reported an increase in current hunger. While this may be due to physiological reasons (chocolate exposure may induce a general preparatory response for food ingestion, thereby increasing feelings of hunger) or to methodological issues (it may be difficult for participants to differentiate between feelings of hunger and craving), several dissociations were found:

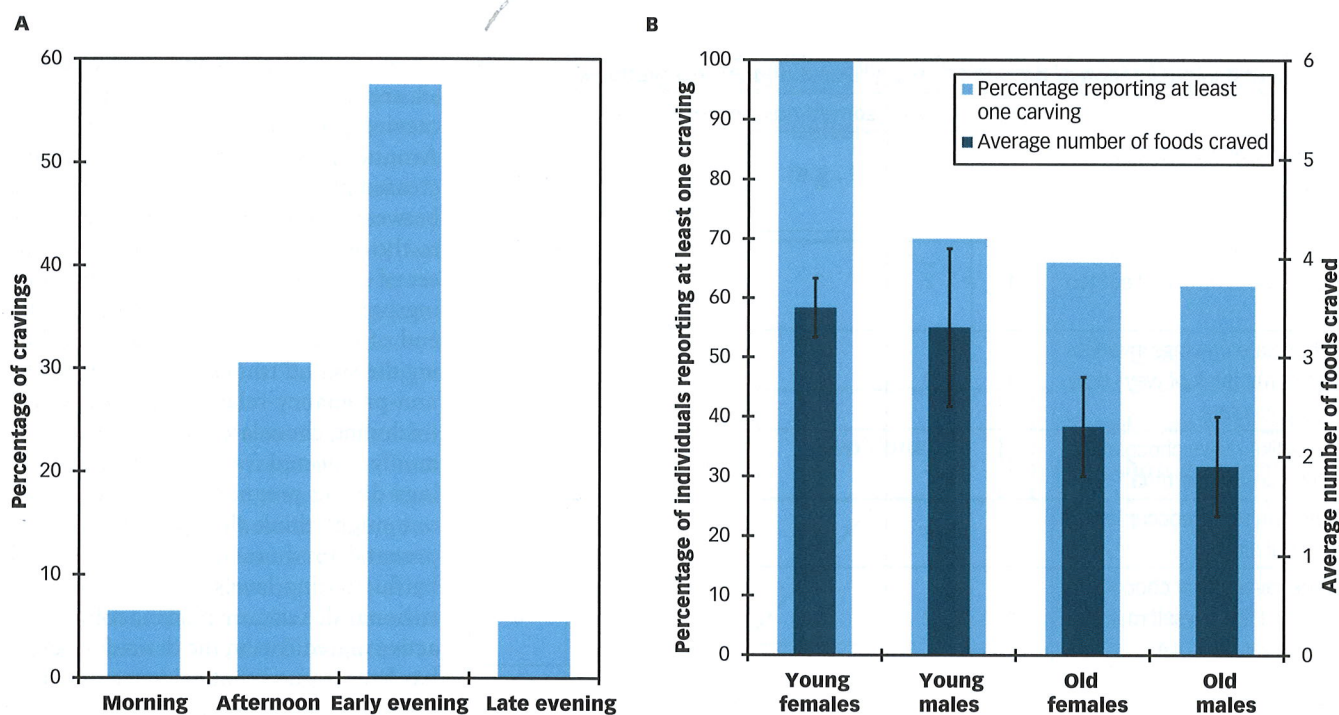
- Longer food deprivation (hours since the last meal before the testing) was associated with higher current hunger, but not with current chocolate craving.
- Salivary flow was increased during chocolate exposure and this increase was associated with increases in current chocolate craving, but not with increases in current hunger.
- Higher chocolate consumption in the laboratory was associated with higher current chocolate craving, but not with current hunger.

To conclude, it appears that even when hunger and craving arise simultaneously, they can still be differentiated under certain circumstances as food deprivation predicts current hunger, but not current food craving, and current food craving, but not hunger, predicts food cue-elicited physiological responses and subsequent food intake (3).

### *Cultural aspects* In

the English language, craving refers to an intense desire to consume a substance, which can be an alcoholic beverage, tobacco, another drug as well as a food or a non-alcoholic beverage (4). Although the concept of food craving exists in most cultures, it appears that the term *craving* does actually not lexicalize in most languages other than English, that is, there is rarely a truly equivalent translation of the term. While individu-





**Figure 1.** (A) Percentage of cravings as a function of time of day. Cravings tended to occur in the afternoon and early evening. (B) Percentage of individuals reporting at least one craving in the past year and the average number of foods craved in the past year in young (18–35 years) and elderly (>65 years) adults as a function of gender. Young adults were more likely than elderly adults and females were more likely than males to report at least one craving. Young adults also reported higher total numbers of craved foods than elderly adults. Data from Pelchat (1997).

als outside of English-speaking countries may well experience what native English speakers would designate as a craving, it appears that there is often not a specific word for this experience (4).

Craved foods usually have high energy density brought about by a combination of high sugar and fat content. In North America, the most commonly craved food is chocolate (5, 6). Other frequently craved foods include pizza, salty snacks, ice cream, other sweets and desserts, and meat and chicken (6). Studies from European countries are rare, but the types of craved foods are most likely very similar to North America. In a study from Germany, for example, participants reported that chocolate was the food that they had most difficulties with controlling its consumption (7). However, it appears that there are indeed some cultural differences, even within Europe. In a study by Rodríguez and colleagues (2007), British women reported more frequent chocolate cravings than Spanish women (8). In other studies, gender differences were found in American participants such that chocolate was the most frequently craved food in women and savory foods were

the most frequently craved foods in men. This gender difference was absent in Spanish participants as chocolate was the most often craved food in both genders (9, 10).

Other evidence for cultural differences comes from Arab and Asian countries. For example, it has been reported that savory rather than sweet foods were much more likely to be identified as craved foods in Egyptian adults (11). In Japan, it has been reported that rice is the most frequently craved food (but note that chocolate still was the second most frequently craved food)(12, 13). In one of these studies, the authors also assessed how often participants tried to restrict the intake of certain foods. Scores on craving for and restriction of foods were highly, positively correlated with each other, indicating that craved foods do usually represent restricted foods as well. Restriction scores for rice, however, were moderate, suggesting that the mechanisms of craving for a staple food may differ from other foods (13).

**Body weight, age and gender** Food cravings are common phenomena that are experienced by most individuals

and they usually occur in the afternoon and in the early evening (Fig. 1A). More than 80% of young adults report ever having experienced a craving for a specific food (14). Thus, experiencing food cravings is not abnormal. However, very frequent and intense food cravings are indeed associated with pathological eating behavior such as binge eating (15). Likewise, more frequent food cravings are associated with lower perceived self-regulatory success in dieting (16). Although more frequent food cravings also relate to higher body weight, this relationship appears to be rather small (17). Thus, it seems that frequent food cravings do not necessarily result in indulgence of foods and subsequent weight gain, but there are moderating factors that may attenuate the relationship between this desire and body weight (e.g., flexible eating control or physical activity).

The frequency of food cravings declines with age (Fig. 1B). These age-related changes may be the result of a reduction in sensory function (particularly in the gustatory and olfactory modality) and, thus, a general decline in appetite and other motivated behaviors. Yet, further



Chocolate version of the Food Cravings Questionnaire-Trait-reduced						
	never	rarely	sometimes	often	usually	always
1. When I crave chocolate, I know I won't be able to stop eating once I start.	1	2	3	4	5	6
2. If I have a chocolate craving, I often lose control and eat too much.	1	2	3	4	5	6
3. Chocolate cravings invariably make me think of ways how to get chocolate.	1	2	3	4	5	6
4. I feel like I have chocolate on my mind all the time.	1	2	3	4	5	6
5. I find myself preoccupied with chocolate.	1	2	3	4	5	6
6. Whenever I have chocolate cravings, I find myself making plans to eat chocolate.	1	2	3	4	5	6
7. I crave chocolate when I feel bored, angry, or sad.	1	2	3	4	5	6
8. I have no will power to resist my chocolate crave.	1	2	3	4	5	6
9. Once I start eating chocolate, I have trouble stopping.	1	2	3	4	5	6
10. I can't stop thinking about chocolate no matter how hard I try.	1	2	3	4	5	6
11. If I give in to a chocolate craving, all control is lost.	1	2	3	4	5	6
12. Whenever I have a chocolate craving, I keep on thinking about eating chocolate until I actually eat it.	1	2	3	4	5	6
13. If I am craving chocolate, thoughts of eating it consume me.	1	2	3	4	5	6
14. My emotions often make me want to eat chocolate.	1	2	3	4	5	6
15. It is hard for me to resist the temptation to eat chocolate that is in my reach.	1	2	3	4	5	6

Table 1 Notes. Individuals are instructed to indicate how frequently each comment is true for them in general. Sum scores of more than 50 can be considered high values, because they lie above one standard deviation from usual mean values of about 35 (Meule & Hormes, 2015).

studies are needed to rule out other confounding factors such as age-related response biases, for example, differences in social or cognitive function. Not only that elderly adults report less frequent food cravings, they are also more likely to report that they can resist food cravings or that they can substitute some-

thing else for the craved food. Taken together, it seems likely that food cravings become less frequent and less compelling in elderly individuals (18).

Women are more likely to experience food craving than men (Fig. 1B). One consideration why this gender difference exists may be, that it could be due to

hormonal differences and, indeed, women are more likely to experience food craving premenstrually and prenatally. Around 30% of women report an increased likelihood of chocolate cravings between approximately four days prior to the onset and four days after the onset of menses (19). Food cravings during pregnancy typically emerge by the end of the first trimester and peak during the second trimester (20). Similar to non-pregnancy-related cravings, sweets (including chocolate) are the most commonly reported foods involved in cravings during pregnancy (20). Although one might think that premenstrual or prenatal food cravings may be caused by fluctuating levels of hormones, nutritional deficits, or pharmacologically active ingredients in the desired foods, it has been argued that evidence for these potential factors is weak (14, 20). Instead, premenstrual and prenatal food cravings may be driven by cultural and psychosocial factors (Fig. 2). These factors would also explain why there is only a small decrease in the prevalence of chocolate cravings in post-menopausal women (21) and why many women show excess gestational weight gain, that is, weight gain during pregnancy over and above the weight of the fetus, placenta, and amniotic fluid (20).

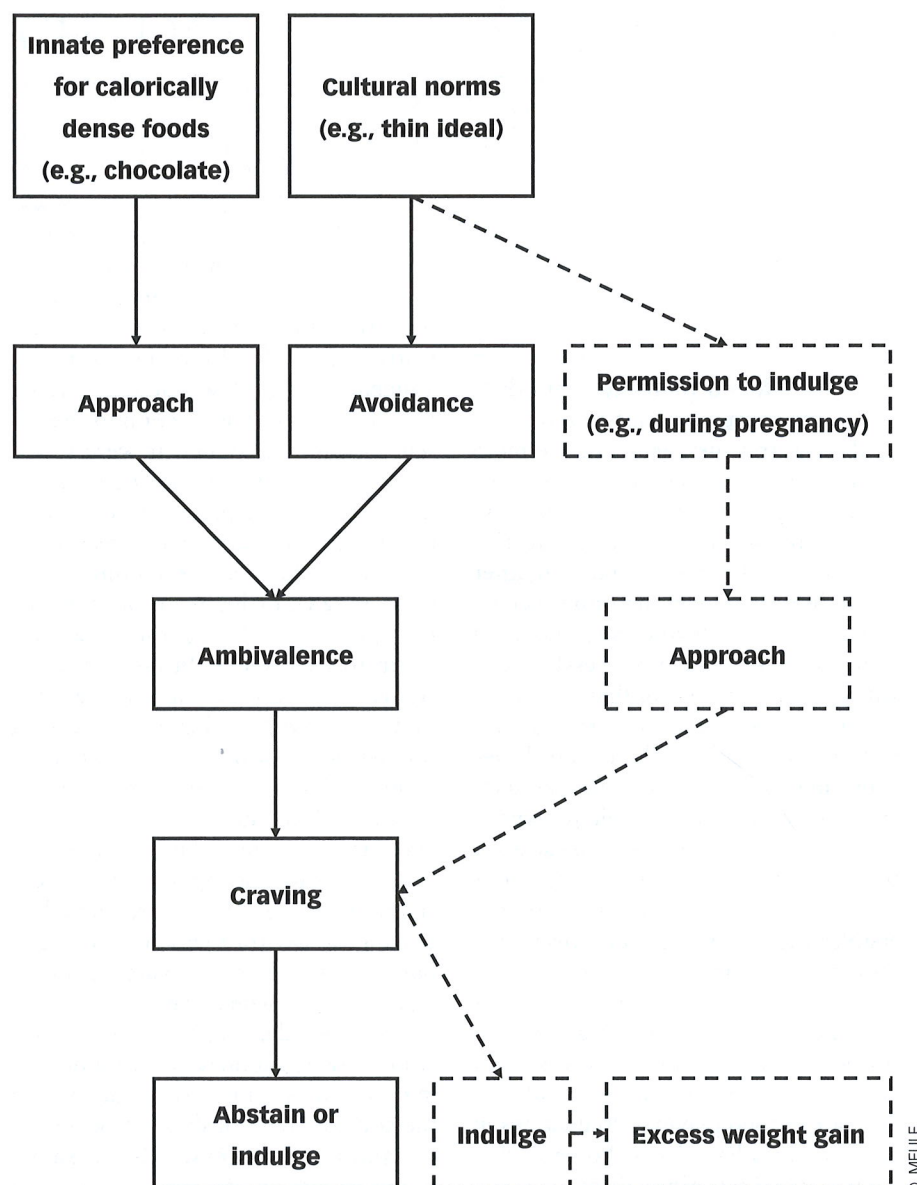
**Assessment of food craving** As food craving is, by definition, a subjective, psychological experience, the most straightforward approach to measure it is self-report. Although several psychophysiological or behavioral variables have been found to correlate with subjectively reported craving (e.g., heart rate, blood pressure, salivation, attention allocation, consumption)(22–25), they usually lack specificity and reliability for indicating craving (26). Self-report questionnaires for the assessment of momentary food craving include the *Craving Experience Questionnaire* (CEQ) (27) and the *Food Cravings Questionnaire-State* (FCQ-S)(28). The CEQ contains ten items and measures current craving *intensity* (e.g., “How much do you want it?”), *imagery* (e.g., “How vividly do you imagine its taste?”), and *intrusiveness* (e.g., “How hard is it to think about anything else?”). The FCQ-S contains 15 items and measures



current *desire to eat* (e.g., “I have an intense desire to eat one or more specific foods.”), *anticipation of positive reinforcement* (e.g., “Eating one or more specific foods would feel wonderful.”) and *relief from negative states* that may result from eating (e.g., “I would feel more alert if I could satisfy my craving.”), *lack of control over eating* (e.g., “If I had one or more specific foods, I could not stop eating it.”), and *hunger* (e.g., “I am hungry.”).

There are several questionnaires for the assessment of the frequency of food cravings, that is, for measuring food craving as a trait. These include questionnaires, which measure the frequency of cravings for chocolate and other foods such as the *Attitudes to Chocolate Questionnaire* (29), the *Orientation to Chocolate Questionnaire* (30), and the *Food-Craving Inventory* (31). The CEQ also contains a frequency form (27). The *Food Cravings Questionnaire-Trait* (FCQ-T)(28) contains 39 items and measures several dimensions of food cravings in general, but items can be easily modified to refer to craving for a particular food only (e.g., chocolate)(8). A short version of the FCQ-T, the FCQ-T-reduced (3, 32), contains 15 items, the chocolate-adapted items of which are displayed in Table 1. The FCQ-T-r has reasonable retest-reliability over six months, suggesting that scores do indeed represent food craving as a stable trait (33). Moreover, validity of the concept of trait food craving has been supported in experimental studies showing that individuals scoring high on the FCQ-T (i.e., “trait food cravers”) exhibit higher reactivity in response to and an approach bias towards high-calorie, palatable food-cues (34, 35).

**Food craving and dieting** There has been a considerable interest in the question if food restriction induces food cravings. However, research findings have been fairly mixed. Some studies reported a positive association between dietary restraint and food cravings. In a study by Massey & Hill (2012), for example, food cravings were measured with daily diaries across seven days and it was found that current dieters reported more food cravings than non-dieters (36). However, a causal influence of dieting on

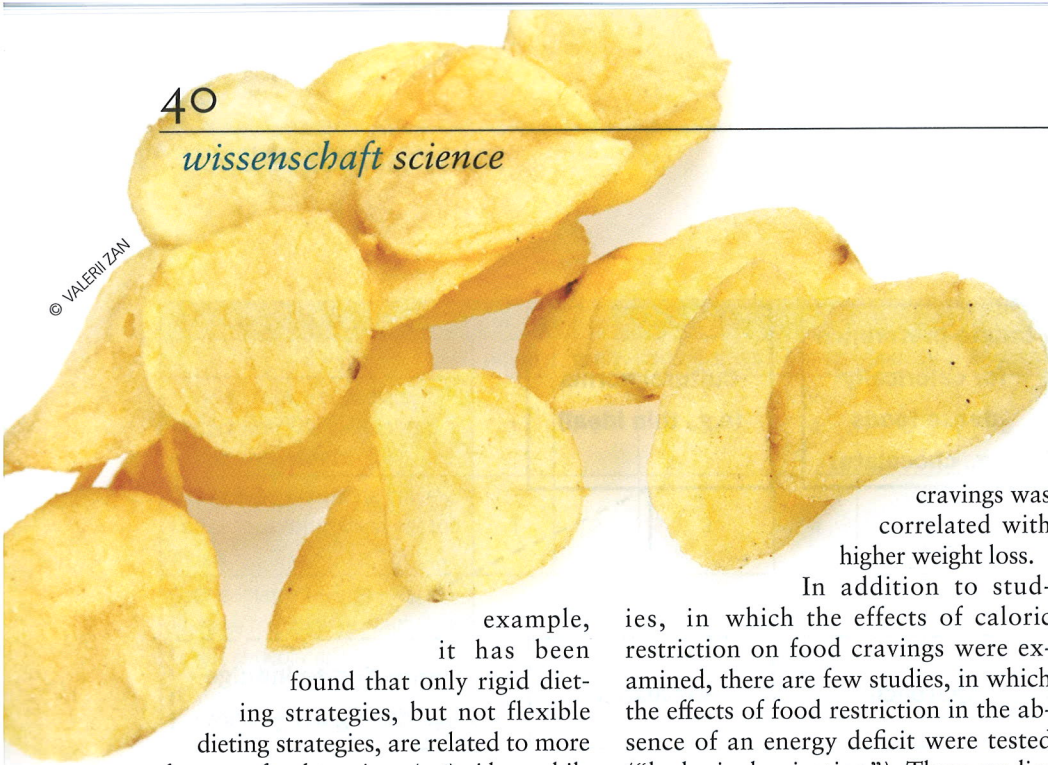


**Figure 2.** Hypothetical model of craving etiology by Orloff & Hormes (2014). Craving is hypothesized to be due to competing approach-avoidance conflicts brought about by exposure to foods that are perceived as being simultaneously appealing (due to an innate preference for high-calorie, sweet, and fatty foods) and forbidden (due to cultural norms prescribing restrained intake and a thin figure). Most individuals are thought to attempt to resolve the resulting ambivalence in favor of abstinence (solid lines). The perimenstrum and pregnancy are hypothesized to be culturally sanctioned disinhibitors, allowing women to circumvent their usual conflicting response and efforts to restrict intake and indulge in foods that they would otherwise avoid (dashed lines). This may result in increased energy intake and heightened risk for weight gain, specifically during pregnancy.

the likelihood of experiencing food cravings cannot be inferred from such studies as dieters may have a higher predisposition for experiencing cravings in the first place. In other words, the susceptibility for experiencing cravings (and giving in

to them) may lead to weight gain and subsequent dieting attempts (and not the other way around). Moreover, it appears that dieters or restrained eaters represent rather heterogeneous groups and, thus, can be further differentiated. For





example, it has been found that only rigid dieting strategies, but not flexible dieting strategies, are related to more frequent food cravings (16). Also, while current dieters reported more food cravings related to cognitive and affective aspects (thoughts about food, guilt after giving in to cravings) than non-dieters, dieters could be further sub-classified into successful and unsuccessful ones with the latter reporting that their food cravings were associated with more intentions to eat and a lack of control over consumption (15). Thus, although dieters may be more susceptible to experience food cravings in general, a subset of these dieters appear to have a self-control mechanism at their disposal that enables them to successfully overcome these temptations (37).

As opposed to these findings, a substantial amount of studies show that restrictive diets that are associated with an energy deficit can, in fact, lead to a decrease in food cravings. Reductions in food cravings have been shown during fasting, very low-calorie diets, and cognitive behavior therapy-based weight-loss interventions (1, 38, 39). In some of these studies, decreases in craving generalized across food groups and did not rebound during re-feeding. An interesting result was obtained by Martin and colleagues (2011), who compared effects of a low-carbohydrate diet vs. a low-fat diet: cravings for carbohydrates/starches particularly decreased in participants adhering to the low-carbohydrate diet, while cravings for high-fat foods particularly decreased in participants adhering to the low-fat diet (40). In another study (39), weight loss depended on baseline levels of trait food craving: high trait food cravers lost less weight than those with lower trait food craving scores. Furthermore, a larger reduction in food

cravings was correlated with higher weight loss.

In addition to studies, in which the effects of caloric restriction on food cravings were examined, there are few studies, in which the effects of food restriction in the absence of an energy deficit were tested (“hedonic deprivation”). These studies instructed participants to selectively refrain from eating rice or bread (41), vanilla- or chocolate-containing products (42–44), or high-carbohydrate or high-protein foods (45) for a few days or up to two weeks. In essence, these studies showed that a specific deprivation of a craved food increases craving for that given food. In a recent study from our lab (46), effects of a selective chocolate deprivation on state chocolate craving was examined as a function of trait chocolate craving. Chocolate deprivation did not affect state chocolate craving of low trait chocolate cravers, but increased state chocolate craving in high trait chocolate cravers.

To conclude, simply stating that dieting leads to an increase in food cravings would be an oversimplification of the complex relationship between dieting and food cravings. While a short-term deprivation of a specific food may likely increase craving for that food in high trait cravers, it may not do so in others (e.g., in low trait cravers or dieters with high self-control or with flexible dieting strategies). On the contrary, long-term caloric restriction may even lead to a decrease in food cravings.

**Craving regulation strategies** Because of its relevance in eating- and weight-regulation, numerous techniques for the regulation of food craving have been tested in recent years. Positive, that is craving-reducing effects have been reported for cognitive, behavioral, and physiological approaches such as:

- cue exposure and response prevention (47)
- approach-avoidance trainings (48–50)

- self-help manuals (51)
- visuospatial distraction (52–56)
- olfactory distraction (57, 58)
- cognitive imagery replacement (59)
- cognitive reappraisal (60, 61)
- brief guided imagery and body scanning (62)
- mindfulness and acceptance-based approaches (63–65)
- bio- and neurofeedback (66–69)
- transcranial direct current or magnetic stimulation (70–74)
- vagus nerve stimulation (75)

While some of these interventions can be easily implemented in daily routine (mainly the cognitive-behavioral approaches), others are hardly feasible in everyday life (mainly the physiological approaches). While research on the phenomenology and prevalence of food cravings and their correlates substantially increased during the 1990s (1, 38), a significant amount of studies has been conducted in the past 15 years in an effort to understand the mechanisms that underlie food craving experiences and to derive possible strategies for preventing or attenuating food cravings. Although food cravings are common experiences that usually do not require concern and treatment, those who experience distress as result of their cravings have a variety of efficacious intervention strategies available that may help them to successfully cope with food cravings.

**Acknowledgment** This work was supported by the European Research Council (NewEat ERC-StG-2014 639445).

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