Emotional reinforcement as a protective factor for healthy eating in home settings

Ji Lu, Catherine Huet, and Laurette Dube`

ABSTRACT

Background: According to the literature, meals consumed at home are healthier than those consumed away from home (AFH), but reasons underlying this protective effect have not been fully understood. Emotional reinforcement of healthy eating patterns at home is examined as a putative contributing mechanism.

Objective: This study examined expectations for within-individual emotional reinforcement of healthy eating at home, reflected in reports of 1) more intense positive and less intense negative affects after healthier meals than at baseline at home (and not in AFH settings) and 2) more intense positive and less intense negative affects reported before a meal being predictive of healthier meals than at baseline at home (and not in AFH settings).

Design: A total of 160 nonobese women reported their eating behavior and momentary emotional states every 2 h, 6 times/d over 10 observation days. We examined observations with meals (breakfast, lunch, or dinner). The participants indicated how momentary eating patterns compared with their own baseline eating patterns (healthier, equal, or less healthy). Concurrent (after meal) and lagged (before meal) emotion scores were specified.

Results: At-home meals were followed by more intense positive emotions and less worry than were AFH meals. As expected, home meals that were healthier than a person’s baseline meals were followed by more intense positive emotions, with a relation of opposite direction being observed in AFH settings. At home, more intense premeal positive emotions cued healthier next-meal eating patterns than did those at baseline, with no such relation being observed in AFH settings.

Conclusion: The home is a privileged environment that nurtures healthy eating and in which healthier food choices trigger and are triggered by more positive emotions.

INTRODUCTION

It has been widely observed that the nutritional quality of food consumption is typically healthier at home than away from home (AFH) (1–5). Because the intensity of high-fat and high-sugar foods and related cues have increased equally in home and AFH settings (6, 7), questions have arisen about the reasons for the protective effect of the home setting on healthy eating. Because home meals still constitute the bulk of food consumption worldwide, despite increases in AFH eating (8), identifying underlying mechanisms for the protective quality of home settings may provide important insights into novel approaches to the promotion of healthy eating to help curb the obesity epidemic.

Food in general is a natural reinforcer (9, 10), and a long tradition of animal research (11) and recent findings in human neuroscience (12, 13) have shown that it is particularly so for high-fat and high-sugar foods. Over the course of evolution in a world of food scarcity, humans and animals alike have been biologically programmed to elicit more powerful food reward responses to high-caloric foods than to healthier counterparts. However, considering the tightly integrated nature of autonomic, motivational, and emotional responses underlying eating behavior (14), it is reasonable to propose that the contingent presence of positive affective experiences (and the absence of negative ones), if frequently associated with food, may convey significant emotional reinforcement, particularly for healthy foods that do not originally possess strong biological reinforcing value (15). It has been shown that individuals typically experience more intense positive emotions and less intense negative emotions at home than in workplaces and other AFH contexts (16, 17). Furthermore, individuals tend to associate the ambient affects with the ongoing activities they perform in a given environment (18), in particular when actions are performed frequently and in stable contexts, as is the case for eating in home settings (19). Through repeated interactions with food in the positively reinforcing emotional context of home settings, individuals may associate such affective states with healthy meals consumed in home settings.

The current study aimed to empirically examine expectations for within-individual emotional reinforcement of healthy eating at home, reflected in reports of (1) more intense positive and less intense negative affects after healthier meals than at baseline at home (and not in AFH settings) (2); more intense positive and less intense negative affects reported before a meal are predictive.

1 From the Department of Business and Social Sciences, Nova Scotia Agricultural College, Truro, Canada (JL); the School of Dietetics and Human Nutrition, McGill University, Montreal, Canada (CH); and Desautels Faculty of Management, McGill University, Montreal, Canada (LD).

2 Supported by research operating grants from the Social Sciences and Humanities Research Council of Canada and the Fonds de la Recherche en Santé du Québec (to LD) and a doctoral fellowship from Psychosocial Oncology Research Training (to JL).

3 Address correspondence to L Dubé, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada. E-mail: laurette.dube@mcgill.ca.

Received October 15, 2010. Accepted for publication April 27, 2011. First published online May 25, 2011; doi: 10.3945/ajcn.110.006361.
of healthier meals than are baseline meals at home (and not in AFH settings).

SUBJECTS AND METHODS

Participants

Participants were 160 white adult nonobese (body mass index < 30; in kg/m²) women ranging in age from 18 to 83 y (mean ± SD: 44.91 ± 17.29). Participants were recruited from the general population of a large North American city by local advertisement. The protocol was approved by the human-subjects ethics committee of McGill University. All participants signed an informed consent form before engaging in a series of studies and received monetary compensation for their participation. The data were collected in the year 2004 as part of a broader study on age differences in affects, emotions, and lifestyle behaviors in women.

Data collection

Borrowing from research methods in health psychology and consumer research (20–24), we used the Experience Sampling Method (ESM) to examine the emotional experience and related nutritional quality of individual eating patterns across different meal occasions for a large sample of adult women. The ESM provides the advantage of assessing the effect of contextual factors affecting individual choices on repeated episodes, taking into account the variability between episodes for each participant and the between-subject variability in a hierarchical manner (25). Following consumer and food research (22, 26), we measured the nutritional quality of eating patterns from a meal-specific and individual-centered perspective, asking participants to report their perceived nutritional quality of each meal in comparison with their own corresponding baseline meal for breakfast, lunch, or dinner.

Participants first received instructions on the ESM protocol in a one-on-one introductory session conducted in the laboratory. They were explained that, during the 10 observation days, a beeper would prompt them 6 times/d to fill out a short paper-and-pencil questionnaire at the next available moment. Data collection occurred over 20 d, with systematic alternation between observation and nonobservation days. Participants were beeped every 2 h during typical waking time (ie, 0800 to 2100). Per this setting, ideally, there would be 60 episodes reported by each participant. In each episode, participants were asked to report on their momentary emotional states and on their eating behavior (meals and snacks) in the preceding 2 h. For reporting episodes that entail a meal, each participant was asked to report on the nutritional quality of that meal, based on her own idiosyncratic baseline meal. In total, 9365 observations were made and 3950 meal episodes were reported (an average of 24.69 meal episodes per participant). These episodes are the object of the current study.

Measures

We assessed meal-level nutritional quality by asking participants to rate the nutritional quality of each meal in relation to their baseline habit at the corresponding meal (equal, healthier, or less healthy than baseline breakfast, lunch, or dinner). This relative measurement approach allows for the variance associated with the between-meal differences in eating patterns to be accounted for. It has been shown that the nutritional quality of food systematically varies across daily meal occasions (ie, breakfast, lunch, or dinner), with low-caloric foods being most likely chosen at breakfast (27) and tasty caloric-intense foods at dinner (28). Such habitual variation in the nutritional quality of meals across occasions (eg, a typical breakfast is healthier than a typical dinner) is referred to as the baseline habit, and individuals were generally found to have stable baseline habits in their food choices (22). Such baseline habits are formed by social-cultural forces and the variety of contextual forces in which individuals have been conditioned. However, of interest to this study was that the change in contextual or situational factors, such as a different meal location and a better or worse premeal emotional state, may lead an individual to choose foods different from their baseline habit, ie, that deviate from their baseline habit (eg, today’s dinner is healthier than the participant’s typical dinner).

To establish baseline habits, in a face-to-face introduction session, participants were first asked to describe their own typical food choice for each of the 3 meal occasions (breakfast, lunch, and dinner). Experimenter further provided typical nutrition information with regards to the nutritional and caloric quality of food typically consumed on each meal occasions (29). The experimenter then explained to participants that, throughout the entire study, they should report on the relative nutritional quality of the meal by indicating how each specific meal compared with the baseline meal they had just described. In each momentary report questionnaire used in ESM, participants were asked, “If you have eaten a meal, … how does this meal compare to the typical meal you generally take at the same time of the day in terms of composition (i.e., the types of food you had) (1): same as usual (2), healthier food than usual, or (3) less healthy food than usual.” In the following analyses, meals with composition “same as usual” were defined as baseline meals.

To control the effect of total caloric intake, the meal size was also reported by participants in a similar manner (smaller or larger in comparison with the baseline meal). Using dichotomous measures, participants indicated the location context of the meal, that is, whether this meal episode had taken place at home or in an AFH setting. Whether the meal was eaten alone (not in the company of another person) or with others was measured and used as a control variable.

Participants reported their momentary emotional states for every episode on a 28-item scale of emotions selected to cover the whole spectrum of positive and negative affects. The selected items were adapted from the Consumption Emotions Set (CES) (30), which includes 47 emotion descriptors (items) nested in 17 scales representing the wider range of emotions consumers most frequently experience in consumption situations. To keep the questionnaire concise (which is important given that participants were required to fill out 60 questionnaires), we selected emotion descriptors that are found most relevant to food consumption in literature on eating (15) and excluded those less eating-relevant emotions, such as those associated with jealousy, romance, and sex. Participants were asked to indicate the degree to which they were feeling each emotion at that present moment by placing a mark on a 15-cm visual analogue scale (0–15 cm scale rated from “not at all” to “very much”). These scales were then transformed into numerical scales ranging from 0 to 150 mm with 1-mm gradations.
Empirical validation of emotion variables

Because only selected items from the CES were included in the current study, it is necessary to unravel and validate factor structure, which may be extracted from the selected 28 items. Furthermore, given that some CES scales contain only 2 items, for one study alone, it is difficult to validate in terms of their internal consistency. For each emotion item, we first calculated the day-level mean for each participant and then obtained each episode’s deviation from the day mean. On these deviation scores, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted by using chain-P factor analysis (31). To unravel and validate the structure of emotions, the sample was randomly divided into 2 subgroups with equal sample size; EFA was performed on the first half sample, and the emerging structure was validated by conducting CFA on the second half subgroup. EFA (with varimax rotation) of emotions revealed a 5-factor structure (Table 1) as the most appropriate, based on factors with eigenvalues > 1. CFA on the other half of the participants validated this factor structure extracted by EFA. Confirming the 5-factor structure, the model fit was excellent ($\chi^2$ (340) = 4636.93, $P < 0.001$; CFI = 0.90; RMSEA = 0.054), according to the criteria suggested by Hu and Bentler (32). All factor loadings were significant ($P < 0.001$), and the average loading (standardized solution) was 0.64. In terms of internal consistency, we tested the reliability of our measurement on the second half of the participants. The Cronbach’s $\alpha$ calculated for each factor was acceptably high ($\alpha > 0.63$).

Individual average scores were computed for each factor and were used in subsequent analyses. There were 2 positive-emotion (PE) factors: one general PE factor (PE-general; 12 items; $\alpha = 0.88$) encompassing a diversity of affects, such as happiness, amusement, and warm-heartedness; the other focuses on emotions that relate to calm and serenity (PE-peacefulness; 4 items, $\alpha = 0.78$). Negative emotions (NEs) were also differentiated. A first general factor grouped a diversity of negative emotions, including frustration, anger, and depression (NE-general; 6 items, $\alpha = 0.82$), with the second and third factors being respectively dominated by shame (NE-shame; 3 items, $\alpha = 0.60$) and worry (NE-worry; 3 items, $\alpha = 0.74$).

Statistical analyses

One of the major advantages of ESM lies in the nature of the data it generates, which can capture the within-individual levels of variability by controlling the individual habitual pattern and between-individual differences. On the basis of the nature of its structure, the data were analyzed by 2 sets of hierarchical (generalized) linear models (HLMs) described below. Detailed model specifications are described in Appendix A. Only the 3950 meal episodes were included in the analyses. In all models, we calculated the predicted values and odds ratios from the estimated model coefficients and performed post hoc multivariate comparisons as appropriate. The analyses were conducted by using HLM for Windows Software package (version 6.0, 2004; Scientific Software International Inc, Lincolnwood, IL). The HLM modeling approach can be intuitively understood as iteratively running a series of regressions: at the first level of analysis (episode-level), the within-day (nested in individuals) relations between emotional states and eating patterns are investigated. At the higher level (day-level and individual-level), the parameters estimated (intercepts and slopes) at level 1 are regressed on higher level predictors. In terms of the variance component, HLM uses a random-effects model to simultaneously estimate within-day, within-subject, and between-subject variance.

The first set of analyses examined the emotional consequences of having meals with different nutritional qualities, testing the direct and moderating effects of home and AFH settings. This model used the 5 factors of momentary emotion reports as dependent variables in a series of 3-level linear models (episode-, day-, and individual-level). On the basis of the ESM procedure used in this study, there was a maximum 2-h delay between the meal and the time of emotion report. For each dependent variable, the episode-level predictors included a dummy variable of meal location (1 if ate at home; 0 if ate in AFH setting), 2 indicators of the nutritional quality of a specific meal (healthier indicator: 1 if the meal was healthier than usual, 0 otherwise; less healthy indicator: 1 if the meal was less healthy than usual, 0 otherwise), and their interactions, controlled by social context (1 if ate with others; 0 if ate alone), meal size (quantity smaller: 1 if the meal was less than usual, 0 otherwise; quantity larger: 1 if the meal was less than usual, 0 otherwise), and all 2-factor interactions. At the day-level, the episode-level intercept was modeled as a fixed effect of weekend (1 if weekend or holiday; 0 otherwise) as a control variable and a random component, which can account for the between-day variance of emotional states. The individual-level model only included an aggregate intercept and a random component to capture the between-individual variance of emotional states.

The second set of analyses examined the premeal emotional states as the antecedent of the food choice (ie, the episode-level nutritional quality). Emotions reported at the preceding episode (t-1) were used as the lagged predictor of nutritional quality of subsequent meals. As per the ESM protocol, the maximum time interval between a meal and the report time of premeal emotional states was 2 h. The strength of using the lagged variable as premeal emotions is that it prevents participants from retrospectively reporting on their antecedent emotions of eating (33). In terms of the outcome variable, the nutritional quality of meal-level eating pattern was a multinomial dependent variable with 3 possible responses, namely, healthier, less healthy, and baseline (1 if less healthy than baseline, 2 if healthier, and 3 if baseline). Through logit link functions, the model was specified to account for the odds ratios of healthier compared with baseline and less healthy compared with baseline. A 3-level model with individual-

---

**Table 1**

<table>
<thead>
<tr>
<th>Emotional factor structure at the within-day level¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Components</strong></td>
</tr>
<tr>
<td>PE-general</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>PE-peacefulness</td>
</tr>
<tr>
<td>NE-general</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

¹ Data are based on chain-P factor analysis, factor extraction method (principal components analysis), and rotation method (varimax with Kaiser normalization). PE, positive emotions; NE, negative emotions.
day-, and episode-level specifications showed that the day-level variance was close to zero, which suggested that a 2-level model was sufficient to explain the data. In each analysis, 1 of the 5 lagged emotions (t-1) reported in the preceding episode was included as an episode-level predictor, as were its interactions with location and social context. The emotional state and the interactions were mean-centered for each participant. The episode-level predictor also included the indicator of location, controlled by a dummy variable of social context, weekend, and all 2-factor interactions. In individual-level models, the episode-level intercepts are specified as an aggregate intercept and an individual-level random component, which can capture the between-individual variation of nutritional quality.

RESULTS

The emotional consequences of eating

In the examination of postmeal affective states, expectations for the higher general reinforcing value of eating at home compared with AFH and for the stronger effect in the specific case of healthy meals were supported. The estimated coefficients for the models predicting the emotional consequences of eating are listed in Table 2. Participants reported more intense PE-peacefulness ($\chi^2_1 = 15.19, P < 0.001$) and less NE-worry ($\chi^2_1 = 4.98, P < 0.03$) across all meals at home compared with AFH meals. The difference between home and AFH in the emotional reinforcing value of healthy eating was indicated by the significant interactions between location and healthier quality (PE-general: $t(2843) = 3.05, P < 0.01$; PE-peacefulness: $t(2828) = 2.07, P < 0.04$; NE-general: $t(2792) = -2.55, P < 0.02$). Specifically at home, having healthier meals resulted in more positive emotions (PE-general: $\chi^2_1 = 12.75, P < 0.001$; PE-peacefulness: $\chi^2_1 = 8.62, P < 0.01$) compared with the baseline quality, and no such facilitation effect was found for meals eaten AFH (Figure 1). In fact, for AFH meals, consuming healthier meals was associated with more negative emotions (NE-general: $\chi^2_1 = 4.04, P < 0.05$), compared with the baseline nutritional quality.

As a control variable, eating with another person or others was associated with more positive emotions and less negative emotions compared with eating alone ($P < 0.01$). Such effects were particularly salient for AFH meals, as indicated by the significant interaction between location/setting and social context ($P < 0.03$). In terms of meal quantity, no significant difference was found for the emotional consequences after baseline meals compared with smaller and larger meals ($P > 0.05$). The coefficient of weekend was found to be significant in all models ($P < 0.04$), which indicated that more positive emotions and less negative emotions were reported during weekends and holidays.

Premeal positive emotions as a trigger for healthy eating patterns

In this set of analyses, the nutritional quality of a given meal was predicted by the meal home/AFH settings and the lagged emotions reported at the 2-h preceding episode (t-1). As for the emotional triggers, the results supported the proposition that more positive emotional experiences precede healthier eating choices in the domestic setting (Table 3).

### Table 2

<table>
<thead>
<tr>
<th>Model</th>
<th>PE-general</th>
<th>PE-peacefulness</th>
<th>NE-general</th>
<th>NE-worry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>P</td>
<td>Coefficient</td>
<td>P</td>
</tr>
<tr>
<td>Fixed effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>40.50 ± 3.02</td>
<td>&lt;0.001</td>
<td>52.48 ± 3.68</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Weekend</td>
<td>3.92 ± 1.17</td>
<td>0.001</td>
<td>4.66 ± 1.36</td>
<td>0.001</td>
</tr>
<tr>
<td>Location</td>
<td>3.81 ± 2.10</td>
<td>0.009</td>
<td>7.71 ± 3.02</td>
<td>0.011</td>
</tr>
<tr>
<td>Social context</td>
<td>9.07 ± 2.19</td>
<td>&lt;0.001</td>
<td>5.16 ± 2.90</td>
<td>0.074</td>
</tr>
<tr>
<td>Location × social</td>
<td>-5.33 ± 2.39</td>
<td>0.026</td>
<td>-4.02 ± 3.01</td>
<td>0.182</td>
</tr>
<tr>
<td>Healthier</td>
<td>-6.59 ± 2.35</td>
<td>0.006</td>
<td>-6.70 ± 3.40</td>
<td>0.048</td>
</tr>
<tr>
<td>Less healthy</td>
<td>0.21 ± 3.01</td>
<td>0.945</td>
<td>-1.46 ± 4.02</td>
<td>0.716</td>
</tr>
<tr>
<td>Quantity smaller</td>
<td>0.48 ± 2.14</td>
<td>0.825</td>
<td>-4.19 ± 3.14</td>
<td>0.182</td>
</tr>
<tr>
<td>Quantity larger</td>
<td>6.82 ± 3.47</td>
<td>0.049</td>
<td>7.49 ± 4.23</td>
<td>0.077</td>
</tr>
<tr>
<td>Location × healthier</td>
<td>8.27 ± 2.72</td>
<td>0.003</td>
<td>7.99 ± 3.87</td>
<td>0.039</td>
</tr>
<tr>
<td>Location × less healthy</td>
<td>2.48 ± 2.91</td>
<td>0.394</td>
<td>1.71 ± 3.27</td>
<td>0.602</td>
</tr>
<tr>
<td>Location × smaller</td>
<td>-3.34 ± 2.58</td>
<td>0.195</td>
<td>0.01 ± 3.35</td>
<td>0.998</td>
</tr>
<tr>
<td>Location × larger</td>
<td>-4.80 ± 3.20</td>
<td>0.134</td>
<td>-3.38 ± 3.33</td>
<td>0.311</td>
</tr>
<tr>
<td>Social × healthier</td>
<td>8.11 ± 2.49</td>
<td>0.002</td>
<td>9.63 ± 3.46</td>
<td>0.006</td>
</tr>
<tr>
<td>Social × less healthier</td>
<td>2.48 ± 2.78</td>
<td>0.372</td>
<td>3.91 ± 3.72</td>
<td>0.294</td>
</tr>
<tr>
<td>Social × smaller</td>
<td>-3.91 ± 2.36</td>
<td>0.098</td>
<td>-1.89 ± 3.25</td>
<td>0.560</td>
</tr>
<tr>
<td>Social × larger</td>
<td>-2.69 ± 2.64</td>
<td>0.308</td>
<td>-5.71 ± 3.73</td>
<td>0.126</td>
</tr>
</tbody>
</table>

Random component (SD)

<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficient</th>
<th>P</th>
<th>Coefficient</th>
<th>P</th>
<th>Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Episode-level</td>
<td>16.86</td>
<td>21.74</td>
<td>15.26</td>
<td>18.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day-level</td>
<td>12.71</td>
<td>&lt;0.001</td>
<td>15.30</td>
<td>&lt;0.001</td>
<td>8.97</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Subject-level</td>
<td>26.13</td>
<td>&lt;0.001</td>
<td>29.02</td>
<td>&lt;0.001</td>
<td>14.79</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

1 Because of the lack of significant results, model estimation for NE-shame is not presented.
2 Estimated coefficient ± SE (all such values).
We found that an intense positive state (PE-general) was a more powerful trigger of healthier choice in a subsequent meal at home, compared with AFH settings [as indicated by the interaction of PE-general by home/AFH setting in explaining the odds ratio of healthier/baseline: $t(2750) = 2.56, P < 0.02$]. Specifically, more intense premeal positive emotions in home settings were predictive of a higher likelihood of eating patterns of healthier nutritional quality over the baseline meal (PE-general: $\chi^2_1 = 3.88, P < 0.05$). For AFH meals, premeal PE-general showed no effect on the nutritional quality of meals ($P > 0.43$). In fact, for the second factor of positive emotions (PE-peacefulness), the effect tended to go in the opposite direction for AFH meals: the more intense PE-peacefulness reported 2 h before was predictive of a lower probability of having a healthier meal over the baseline [$t(2376) = -1.89, P < 0.06$], whereas no such relation was observed for home meals. In a comparison of home with AFH settings in terms of the premeal PE-peacefulness effect on meal nutritional quality, the difference was found to be significant [as indicated by the interaction of PE-peacefulness by location in explaining the odds ratio of healthier/baseline: $t(2736) = 2.28, P < 0.03$].

The nutritional quality of a meal showed less variability at home than in AFH settings [as indicated by a smaller odds ratio of healthier/baseline ($P < 0.05$) and less healthy/baseline ($P < 0.01$) for home meals as compared with AFH meals]. Considering only meals that deviate from the baseline in terms of nutritional quality, home meals tended to be healthier than AFH meals (as indicated by the comparison between home and AFH meals).
in terms of the healthier/less healthy odds ratios: $P < 0.08$). The weekend was also included as a control variable and was found to be significantly predictive of less healthy eating [as indicated by the smaller odds of less healthy/baseline on weekends [$(3.461) = 2.40$, $P < 0.02$] than on weekdays].

**DISCUSSION**

The current study starts to unravel the intrinsic mechanism by which the home may have a protective effect on the quality of one’s diet and the critical importance of emotional reinforcement of food in this protective mechanism. We found that home meals generally have a greater emotional reinforcing value in terms of the superior postmeal affective states than do AFH meals. The emotionally reinforcing quality of home settings was indicated, in this study, by more intense serenity and calm as well as less worry reported after home meals. This result supports the proposed emotional reinforcement process wherein foods are associated with the ambient affects experienced in the consumption environment. The result is also consistent with our expectation that such an emotional reinforcement process at home benefits healthier meals: within the home setting, healthier meals were emotionally more reinforced than were baseline meals, with general positive emotions and calm being experienced after the healthier meal. Healthier meals in the AFH setting, on the other hand, were found to be less emotionally reinforcing than were the baseline meals. It is possible that, without the emotional reinforcing quality of the home environment, the poor hedonic feature of low-caloric food consumed in the AFH setting can saliently influence the entire affective system and contribute to negative affective states.

The examination of premeal emotional states has further shown another protective effect of the home on healthy eating: only at home were more intense positive emotions reported before healthier meals. Reliably being a context factor in the process of pairing healthy eating with positive affective state, the home environment can call on such associative patterns of emotional reinforcement—already built in the mind—and motivate individuals to get healthier food as an emotional reinforcer. This is consistent with recent findings that show that the experience of positive emotions was conducive to subsequent healthy eating (18, 29, 34).

The important facilitating effects of positive emotions on the protective features of the home on healthy eating are highlighted. The results suggest the possibility that the emotional reinforcing quality, competing to some extent with the biological signal derived from palatability, may be a determinant of food choice under some circumstances. The emotional reinforcing value reflected in postmeal positive emotions provides immediate reward to healthy food consumed at home. Such an emotional reinforcing property can at least increase the probability of choosing low-caloric, less tasty foods over unhealthy foods, which are more biologically reinforced. Furthermore, because the emotional reinforcement process engages the affective system, the positive affective states attached to a healthy meal can be a more powerful motive than the cognitive knowledge of the long-term health benefits of low-caloric foods.

The results of the current study add to mounting evidence showing that psychological and contextual factors, beyond health and nutrition knowledge, can compensate for wired-in biological signals that favor the choice of unhealthy food and therefore can help contribute to healthier eating. This leads to insights into the development of novel approaches to self-management and public promotion in healthy eating. It may be a powerful strategy to establish a network of memory, associating healthy food with pleasure and positive affects, to complement adequate nutritional and health education. Such a strategy can rely on interpersonal communications, home design, and atmospheric cues, such as music, dining landscape, and kitchen equipment, which have all been found to be able to induce positive emotions in both everyday and laboratory contexts (18, 35, 36).

Despite the mounting evidence pointing to negative emotion as an antecedent of unhealthy eating, little research effort has been...
made to evaluate the triggering effect of positive emotions on food choice; yet, the available evidence is mixed. For example, a laboratory study found that the mood of joy can increase unhealthy food consumption (37). In contrast, a recent survey study (29) showed that healthy food choice is often preceded by positive emotions, especially for men (compared with women) and for the French-speaking population (compared with Anglophones). Beyond the triggering effect of positive emotional states, the current study assessed, and provided evidence for, the critical moderating influence of contextual factors on the relation between the food choice and antecedent emotions. Hence, for future study, there is a need for more refined hypotheses to indentify the circumstances in which positive emotional states may lead to healthier food choices or otherwise contribute to high-fat, high-sugar food consumption.

The interpretation of these results must take into consideration the study’s limitations. A first set of limitations are tied to the measure of eating patterns on the basis of self-perception of nutritional quality. With such a measure, the current study was able to focus on meal-level contextual differences (22) on emotional consequences and antecedents. However, it would be important to replicate the results by using more direct measurements of actual food intake. Although EMS offers many advantages over traditional survey-based or experimental studies (38), limitations also come from this approach: we used momentary emotions as the measurement of postmeal affective states and lagged emotion variables for premeal affective states. However, it is hard to assess the exact time interval between a certain meal and its emotional consequence and antecedent. Hence the relation between emotions and eating, as shown in this study, should be a mixture of immediate short-term effects or relatively mid-term effects (2 h maximum). In terms of the sample of this study, our participants consist exclusively of nonobese white English-speaking women. The choice of this homogenous sample is justified by its theoretical relevance and the increased power it gives in examining the complex set of interactions between meal settings and the emotions shaping meal-level eating patterns. The generalizability of the results will have to be replicated in samples that vary in sex and culture as well as samples that include children and obese populations. Limitations are also tied to experimental designs; and analysis strategies are also needed to go beyond our correlational analyses. Despite these limitations, the current research provides important insights into the many ways by which home may have a protective effect on healthy eating—insights that can help develop novel and more effective self-management and health-intervention policies.

The authors’ responsibilities were as follows—LD: designed the study, collected data, and contributed to the draft and final manuscript; JL: assisted in quantitative analyses, the draft, and the final manuscript; and CH: contributed to the draft and final manuscript. All authors contributed to the interpretation of the results. None of the authors had a conflict of interest.

REFERENCES

APPENDIX A

The following equations represent the model that was fitted to examine PE-general as the emotional consequence of meals in different home and AFH settings (location), social contexts, and eating patterns. Same-predictors specification applied to other emotional states reported as dependent variables.

Level-1 (episode) model:

\( PE\text{-general} = \pi_0 + \pi_1(\text{Location}) + \pi_2(\text{Social Context}) + \pi_3(\text{Location} \times \text{Social Context}) + \pi_4(\text{Quality Healthier}) + \pi_5(\text{Quality Less healthy}) + \pi_6(\text{Quantity Smaller}) + \pi_7(\text{Quality Larger}) + \pi_8(\text{Location} \times \text{Quality Healthier}) + \pi_9(\text{Location} \times \text{Quality Less Healthy}) + \pi_{10}(\text{Location} \times \text{Quantity Smaller}) + \pi_{11}(\text{Location} \times \text{Quantity Larger}) + \pi_{12}(\text{Social} \times \text{Quality Healthier}) + \pi_{13}(\text{Social} \times \text{Quality Less Healthy}) + \pi_{14}(\text{Social} \times \text{Quantity Smaller}) + \pi_{15}(\text{Social} \times \text{Quantity Larger}) + e \) \hfill (A1)

Level-2 (day) model:

\( \pi_0 = \beta_{00} + \beta_{01}(\text{Weekend}) + r_0 \) \hfill (A2)
\( \pi_1 = \beta_{10} \cdots \beta_{15} = \beta_{150} \)

Level-3 (individual) model:

\( \beta_{00} = \gamma_{000} + u_{00} \)
\( \beta_{01} = \gamma_{010} \cdots \beta_{10} = \gamma_{100} \cdots \beta_{20} = \gamma_{200} \cdots \beta_{150} = \gamma_{1500} \) \hfill (A3)

As an example of the second set of analyses, the following equations represent the model that was fitted to examine lagged PE-general \((t = 1)\) as emotional trigger, home and AFH settings (location), social context, and their interactions’ effects on the quality of meals. Similar models and coding schema were applied to explain the quantity of meals. \( \text{Prob} \ [x] \) means the probability of \( x \).

Level-1 (episode) model:

\( \text{Prob} \ [(\text{Quality}) = \text{Baseline}] = P(1); \)
\( \text{Prob} \ [(\text{Quality}) = \text{Less Healthy}] = P(2); \)
\( \text{Prob} \ [(\text{Quality}) = \text{Healthier}] = 1 - P(1) - P(3) \)
\( \log[P(1)/P(3)] = \beta_{01}(\text{Weekend}) + \beta_{21}(\text{Location}) + \beta_{31}(\text{Social Context}) + \beta_{41}(\text{Location} \times \text{Social Context}) + \beta_{51}(\text{PE-general}_{-1}) + \beta_{61}(\text{Location} \times \text{PE-general}_{-1}) + \beta_{71}(\text{Social} \times \text{PE-general}_{-1}) \log[P(2)/P(3)] \)
\( = \beta_{02} + \beta_{12}(\text{Weekend}) + \beta_{22}(\text{Location}) + \beta_{32}(\text{Social Context}) + \beta_{42}(\text{Location} \times \text{Social Context}) + \beta_{52}(\text{PE-general}_{-1}) + \beta_{62}(\text{Location} \times \text{PE-general}_{-1}) + \beta_{72}(\text{Social} \times \text{PE-general}_{-1}) \) \hfill (A4)

Level-2 (individual) model:

\( \beta_{01} = \gamma_{010} + u_{010} \)
\( \beta_{02} = \gamma_{020} + u_{020} \)
\( \beta_{11} = \gamma_{110} \cdots \beta_{21} = \gamma_{210} \cdots \beta_{71} = \gamma_{710} \)
\( \beta_{12} = \gamma_{120} \cdots \beta_{22} = \gamma_{220} \cdots \beta_{72} = \gamma_{720} \) \hfill (A5)