



Influence of emotions evoked by life events on food choice

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Received: 16 January 2017 / Accepted: 1 December 2017 / Published online: 28 December 2017
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Abstract

Purpose Considering the importance of replicating real-life experiences in studying emotional eating, this study investigated the influence of emotions evoked by life events on food choice in normal-weight and overweight women.

Methods Normal-weight ($n = 21$) and overweight women ($n = 23$) aged 25–42 years were assigned to one of two different conditions: in one, they were shown a video with scenes of daily activities to elicit neutral responses; in the other, they were shown a video with scenes of common problems to evoke negative emotions. The participants were then offered a brunch containing sweet, salty, and healthy food items to evaluate their consumption and food choice.

Results Exposure to negative emotions evoked by life problems increased energy intake in both groups, but they differed in terms of food choice. The normal-weight women increased only the consumption of sweet food ($p = 0.044$), whereas the overweight women significantly increased ingestion of sweet and salty foods (sweet food $p = 0.031$; salty food $p = 0.008$).

Conclusions The results show that common problems of life might trigger food consumption in the presence of high availability. Both groups increased food consumption after negative emotions and the normal-weight group had a higher increase than the overweight group. However, normal-weight women increased consumption of sweet foods, whereas overweight women consumed more salty, fried, and sweet foods. Healthy food was not chosen under these conditions. This should serve as a warning for the risks of excess exposure to high-sugar or high-fat food as everyday problems will not cease to exist.

Level of evidence Level II: evidence obtained from well-designed controlled trials without randomization.

Keywords Emotional eating · Negative emotion · Eating behavior · Food choice · Comfort food

Introduction

Food intake is among the behavioral responses that emotions evoke [1, 2]. A particular emotion can raise food intake in a specific group and reduce food intake in another group. Studies involving participants of different genders [3], nutritional status [1], ages [4], eating habits [2], and cultures [5] have reported divergent results. Stress could increase food intake among women, while it could reduce it among men [3]. Under conditions of negative emotions, overweight and obese individuals report eating larger amounts than normal-weight and underweight individuals [1]. Restrained women

and those prone to binge eating react differently under the influence of emotions [6]. Positive affect has been found to influence the food intake of older individuals and participants with a French cultural background, while negative emotion has been shown to cause increased consumption in younger individuals and participants with an English background [5]. Moreover, different emotions can produce distinct eating behavior patterns in the same group [7]. Emotions and eating behaviors are two multifaceted variables, and their association can be analyzed in many ways. The personal characteristics of the individual experiencing a certain emotion, the features of the emotion itself, and the type of food consumed as a consequence of the emotion represent significant interacting factors.

The results published in studies assessing food intake during negative emotions in individuals with different nutritional status are unclear. Some studies have demonstrated that overweight individuals eat more than normal-weight ones in this condition [1, 8]. Other studies

This article is part of the topical collection on Food Addiction.

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evaluating how negative emotions affect obese individuals have described overeating [9, 10].

Studies have described negative emotions leading women to consume more food, especially high energy density food rich in sugar and/or fat [3, 4, 11–13], and to ingest healthy food (salads) to a lesser extent [3]. However, one study did not find a difference between the amount of chocolate and low-fat food (dried fruit mix) consumed in neutral and ego-threatening conditions [14]. Furthermore, some studies have not demonstrated any major effect of negative emotions on food intake [15–17].

The divergent data in the literature may be associated with methodological considerations, such as the use of different research instruments, e.g., questionnaires [12, 18] or experimental methods [6, 19]. Divergence can also result from little food variety offered in the case of experimental trials [20], which limits participants' choice. In an excellent review of the methods used to study the relationship between emotions and food consumption, Domoff et al. reported that the type of stressor, the current stressor that participants are experiencing outside the laboratory, and the type of food offered are important in gaining a better understanding of emotional eating. The authors emphasized the need for the development of more research on emotional eating, and suggested that a good option for studying this theme is the use of scenes of real-life experiences with control of the situation [21].

Video is one of the techniques most often used in experimental studies on emotional eating because it combines visual and auditory stimuli and is easy to replicate [22–24]. However, the videos validated for manipulating emotions investigate only a specific emotion, such as fear (e.g., “Silence of the Lambs”, “The Champ”, and “The Shining”), anger (e.g., “Cry Freedom”), and happiness (e.g., “When Harry Met Sally” or “Friends”) [6, 25–27], which do not represent the ambiguous feelings often generated by life events [28].

The differentiating factor in this study was the use of scenes picturing everyday problems to promote intensity and realism in negative emotions, and to assess and compare dietary choices among normal-weight and overweight women under such conditions. Knowing situations of risk for an increase in dietary intake, particularly for overweight women, may contribute to understanding and facilitating actions to combat overeating and food addiction.

In this study, we aimed to investigate the influence of emotions evoked by common problems experienced by women in their lives (exhausting work routine, discussions with partner, financial hardship, and concern about children and family members) on food choice (sweet, salty, or healthy) by overweight women and normal-weight women.

Materials and methods

Participants

Participants were recruited via flyers, e-mails, and personal contact in shopping centers, university offices, and beauty salons. The inclusion criteria were as follows: healthy women with a body mass index (BMI) of 18.5–29.9 kg/m² and a regular menstrual cycle over the previous 6 months; without chronic, endocrine, or psychological pathologies; not using psychoactive drugs or drugs that would affect appetite; no food restrictions; in the follicular phase on both days of the experiment (the follicular phase of the menstrual cycle is a phase of the estrous cycle—we evaluated the menstrual cycle by controlling for the first day of menstruation in the 2 months before the experiment). Participants were not informed of the specific objectives of the study during the recruitment phase. This project was approved by the Research Ethics Committee of the University of Sao Paulo, Hospital of the Medical School of Ribeirao Preto, under protocol no. 8347.

The participants were placed in two different groups: normal-weight group (participants with a BMI of 18.5–24.9 kg/m²) and overweight group (participants with a BMI of 24.9–29.9 kg/m²).

A questionnaire was used to collect the participants' socioeconomic data (age, income, marital status, number of children, and educational status) and lifestyle (physical activity practice and hours of sleep) for sample characterization.

Procedures

The study used videos to reproduce life situations, enabling comparison of the effect of negative emotions and neutral responses elicited using drama and routine scenes respectively, and the provision of brunch to reproduce high food availability.

All participants went through two experimental tests on different days (with an interval of 2–7 days between them); one test evoked negative emotions and the other presented the neutral condition. Both experiment days were conducted with a group of women (three to five persons) with similar nutritional status and during the same phase of the menstrual cycle (controlled by the first day of menstruation in the 2 months before the experiment). Except for the video, all procedures conducted during the experiment days were identical.

Participants were asked to fast for 8 h before both experiment days. Before the start of the experiment, the participants signed an informed consent form that did

not provide information about the main objective of the study; i.e., the participants did not know that they would have their food intake evaluated before taking part in the experimental tests.

The experimental tests took place between 8.00 am and 11.30 am. In the first step of the experiment, the participants' nutritional status (weight and height) was assessed by an electronic body weighing scale with a maximum capacity of 150 kg and an accuracy of 0.1 kg, and a fixed stadiometer with 0.5 cm graduation. Next, the questionnaire for socioeconomic data collection was applied. After these initial procedures, participants received a standardized snack (three cookies corresponding to 45 kcal). Then, their initial emotional status was evaluated using a visual analogue scale (VAS), which was followed by one video presentation. The VAS was reapplied after the video presentation to track changes in emotions. Afterwards, participants were invited to a brunch offering different types of food (sweet, salty, and healthy food). This experimental procedure was repeated in showing the second video. "Routine Life Scenes" was presented to evaluate the neutral condition and "Dramas of Life Scenes" was presented to evaluate negative emotions.

The participants' received an informed consent form detailing all the objectives of the study, including the evaluation of food intake, after they finished the second day of the experiment. Participants were told that the data collected would be discarded if they did not agree to their data being used for the food intake evaluation. However, none of the participants quit the study.

Manipulation of emotions

The video "Dramas of Life Scenes" was employed to evoke negative emotions. The selection of the scenes was based on a previous study that identified situations related to common life problems causing negative emotions in women, validated by a study with 123 female participants [29]. This video lasted 40 min and contained common events of real life, such as an argument between spouses, an exhausting work routine, traffic problems, financial hardship, domestic violence, sexual harassment, precarious healthcare issues, and abuse of alcohol by a family member.

For the neutral condition, a video containing scenes from the documentary "Life in a Day" (produced by Ridley Scott and directed by Kevin Macdonald) was presented. This video was entitled "Routine Life Scenes" and lasted 40 min. The video did not evoke specific emotions, but showed everyday life events such as people waking up, eating, walking, and working. This documentary is fully available on the YouTube website (Life in a Day, 2011).

Manipulation check

The participants' emotions were measured using a 0–10 cm VAS applied before and after the presentation of both videos (neutral and negative emotion). The VAS asked how happy, calm, sad, angry, worried, anxious, and outraged the participant felt at that moment and ranged from "not at all" (0) to "very much" (10). To evaluate how effectively emotions were manipulated during the experiments, we sought inspiration from Bongers et al. [25]. To calculate the single emotion score for each time point (four time points: before and after presentation of the neutral video, and before and after presentation of the negative emotions video), the mean of positive emotions (the sum of happy ratings and calm ratings divided by two) was calculated and the mean of negative emotions (the sum of sad, angry, worried, anxious, and outraged feelings divided by five) was subtracted, and a constant was added (10). The single emotion score could range from 0 to 20.

Food intake

To simulate the high food availability of the contemporary world, an ad libitum brunch was offered after each of the videos was presented. The brunch consisted of sweet food (grapes and chocolate) and salty food (baked and fried cheese bread). All food items were of the same size and were round in shape, which facilitated the recording of food intake. A complementary analysis was later performed separating the types of foods used to assess sweet and salty intake.

The participants' food intake was recorded on video recordings to evaluate their eating behavior. Participants only became aware of the recordings after they had participated in the two experimental tests; more specifically, when they were presented with the second informed consent form.

The total energy intake (sum of the calories of all food items consumed) and the types of food chosen by the participants (sweet, salty, and healthy) were evaluated. Moreover, the total number of units of each type of food consumed (sweet and salty) was calculated.

The nutritional composition of the food items was as follows: (1) sweet food: chocolate (63.3 calories; 12.0 g carbohydrate and 2.3 g fat per unit) and grapes (4.7 calories; 1.1 g carbohydrate and traces of fat per unit), and (2) salty food: fried cheese bread (61.4 calories; 5.0 g carbohydrate and 8.0 g fat calories per unit) and baked cheese bread (56.7 calories; 3.0 g carbohydrate and 2.3 g fat per unit). A complementary analysis was also performed, in which grapes were considered a healthy food.

Data analysis

All the analyses were carried out in the PASW Statistic 17.0 (2009) program. Data are presented as mean \pm standard error. A general repeated measures analysis of variance (ANOVA) was employed to assess the effect of the videos on the VAS scale for negative and positive emotions in both experimental tests (neutral condition and negative emotion condition). The type of video was the within factor, and the nutritional status of the group (normal-weight and overweight) was the between factor. Then, 2 (video type) \times 2 (weight group) between-group ANOVA for repeated measures was performed to assess the potential difference in caloric intake as a function of the emotional condition and of the nutritional status of the group; the total calories was the dependent variable. ANOVA was conducted once again to assess each type of food eaten by the participants (sweet and salty), taking the unit as a dependent measure.

When an overall significant effect and interactions were found, Student's *t* test was used to compare paired observations of the energy intake with the food choice (food type) made by the participants in each group of nutritional status (normal-weight and overweight) for each condition (negative emotion and neutral). An independent samples *t* test was used to compare the differences between the normal-weight and the overweight groups. A 95% confidence level was adopted for all analyses.

Results

Sample characteristics

Before the main analysis was carried out, the personal characteristics of the participants in the study groups—normal-weight and overweight—were analyzed. This was important because differences between the groups could affect the results. In all, 247 women were interested in participating in the study; however, most of them were excluded due to lack of availability to attend the 2 days of the experiment, irregular menstrual cycles, smoking, obesity, or using psychotropic

medication. Only 19.43% were selected due to the numerous exclusion criteria.

The study sample comprised 44 adult women aged 25–42 years; 21 participants belonged to the normal-weight group and were 30.1 ± 4.2 years, and 23 participants belonged to the overweight group and were 32.4 ± 5.7 years [$F(1,42) = 1.21, p = 0.276$]. The means and standard deviations of weight, height, and BMI of the normal-weight women were 56.9 ± 7.41 kg, 1.63 ± 0.06 m, and 21.1 ± 1.89 kg/m², respectively, while overweight women had values of 73.04 ± 6.21 kg, 1.63 ± 0.71 m, and 27.35 ± 1 kg/m², respectively.

According to the data shown in Table 1, the study groups had similar socioeconomic characteristics and lifestyles. Indeed, the groups did not differ significantly in terms of age or per capita income [$F(1,42) = 0.003, p = 0.955$], educational status [$F(1,42) = 2.49, p = 0.704$], number of children [$F(1,42) = 3.88, p = 0.126$], regular physical activity practice [$F(1,42) = 1.797, p = 0.370$], or hours of sleep ($p = 0.302$).

The groups formed to participate in the two conditions (neutral and negative) were composed of 3–5 women with the same nutritional status, depending on the similarity of their menstrual cycle (all were in the first week of the follicular phase of the cycle) and the availability of the participants.

Emotions evoked in the study groups

Considering the emotion scores, those in the neutral condition did not change in any of the study groups after the video presentation [normal-weight: $M_{pre} = 11.48, Sd_{pre} = 3.45; M_{after} = 12.28, Sd_{after} = 3.32, F(1,40) = 0.096, p = 0.759$, vs. overweight: $M_{pre} = 11.71, Sd_{pre} = 2.51; M_{after} = 12.15, Sd_{after} = 2.87, F(1,44) = 0.31, p = 0.578$]. On the other hand, the emotion scores were significantly more negative in both groups after the video presentation in the negative emotion condition [normal-weight: $M_{pre} = 11.63, Sd_{pre} = 2.92; M_{after} = 7.31, Sd_{after} = 1.87, F(1,40) = 36.446, p < 0.001, t(20) = 6.531$, vs. overweight: $M_{pre} = 11.77, Sd_{pre} = 3.01; M_{after} = 7.13, Sd_{after} = 2.71; F(1,44) = 31.45, p < 0.001, t(23) = 6.414$]. Therefore, emotions were successfully manipulated in both groups in the neutral condition and in the negative emotion condition.

Table 1 Participants' socioeconomic characteristics and lifestyle

	Normal-weight group (<i>n</i> = 20)	Overweight group (<i>n</i> = 23)	<i>p</i> value
Age (mean/SD)	30.1/4.25 years	32.41/5.7 years	0.3
Monthly income (mean/SD)	BRL 2,013.0	BRL 1,825.0	0.2
Schooling (mean/SD)	14.1/1.6 years	13.7/1.9 years	0.7
Number of children (mean/SD)	0.7	0.9	0.1
Physical activity practice (%)	55.0	47.8	0.4
Hours of sleep (mean/SD)	7.4/1.7	7.4/1.2	0.3

Both study groups had similar VAS scores before and after the video presentation in the neutral condition [$VAS_{pre} F(1,42)=0.69, p=0.793$; $VAS_{after} F(1,42)=0.016, p=0.993$] and the negative emotion condition [$VAS_{pre} F(1,42)=0.003, p=0.960$; $VAS_{after} F(1,42)=0.512, p=0.478$]. The study groups did not differ significantly in terms of the emotion profile recorded after the video presentations, as calculated by the paired *t* test.

Under the negative emotion condition, the data shifted to other positions: positive emotions (calm and happiness) became less intense, while negative emotions (sadness, anger, outrage, anxiety, and worry) intensified.

Effect of negative emotions on food consumption

Under the effect of negative emotions, the intake of sweet, salty, healthy food, and energy by the normal-weight women increased by 69.23, 43.03, 17.95, and 44.5%, respectively, compared with 36.50, 41.63, 8.69, and 38.8% in the case of overweight women, respectively.

The energy intake was higher after the evocation of negative emotions compared with the neutral condition. In the negative emotion condition, participants in both study groups ingested significantly more calories compared with the neutral condition [normal-weight: $M_{neutral} = 770$ kcal, $St_{neutral} = 370.40$ kcal; $M_{emotions} = 1105$ kcal, $St_{emotions} = 491.06$ kcal, $F(1,40)=7.310, p=0.010, t(20)=4.007$, vs. overweight: $M_{neutral} = 1019$ kcal, $St_{neutral} = 262.96$ kcal, $M_{emotions} = 1415$ kcal, $St_{emotions} = 35.356$ kcal, $F(1,44)=8.817, p=0.005, t(22)=-4.65$].

Comparison between the study groups in the negative emotion condition and in the neutral condition revealed that the overweight women consumed significantly more energy than the normal-weight women in both conditions [neutral condition: $F(1,42)=10.165, p=0.003$, vs. negative emotion condition: $F(1,42)=4.819, p=0.034$].

Regarding the normal-weight women, the higher energy intake in the negative emotion condition was due to a significant increase in the consumption of exclusively sweet food [sweet food: $M_{neutral} = 2.47$ units, $M_{emotions} = 4.18$ units, $F(1,40)=4.339, p=0.044, t(20)=-3.177$, vs. salty food: $M_{neutral} = 4.09$ units, $M_{emotions} = 5.85$ units, $F(1,40)=3.808, p=0.193, t(20)=-2.076$]. As for the overweight women, the higher energy intake in the negative emotion condition stemmed from significantly increased consumption of sweet and salty food [sweet food: $M_{neutral} = 3.78$ units, $M_{emotions} = 5.16$ units, $F(1,44)=4.989, p=0.031, t(20)=-2.28$, vs. salty food: $M_{neutral} = 5.86$ units, $M_{emotions} = 8.30$ units, $F(1,44)=7.822, p=0.008, t(20)=-4.848$].

A separate analysis of each type of food offered during the brunch helped characterize the healthy food intake in the

neutral condition and in the negative emotion condition in each study group (see Table 2). Healthy food was the type least consumed by either group in either condition, with no significant differences [normal-weight: $M_{neutral} = 0.95$ unit, $M_{emotions} = 1.42$ unit, $F(1,40)=0.670, p=0.478$, vs. overweight group: $M_{neutral} = 1.47$ unit, $M_{emotions} = 1.69$ unit, $F(1,44)=0.057, p=0.812$]. In addition, there was no significant difference between the study groups (normal-weight and overweight) in any of the conditions [neutral condition $F(1,42)=1.427, p=0.170$, vs. negative emotion condition $F(1,42)=0.126, p=0.724$].

With regard to specific food items, the normal-weight participants consumed significantly more chocolate in the negative emotion condition [chocolate $F(1,40)=4.989, p=0.031, t(20)=-2.38$; fried cheese bread $F(1,40)=3.229, p=0.080, t(20)=-1.383$; baked cheese bread $F(1,40)=0.763, p=0.386, t(20)=-1.263$], while the overweight participants consumed significantly more chocolate and fried cheese bread, but ingested the same amount of baked cheese bread in this same condition [chocolate $F(1,44)=4.037, p=0.049, t(22)=-2.734$; fried cheese bread $F(1,44)=6.008, p=0.018, t(22)=-2.840$; baked cheese bread $F(1,44)=1.728, p=0.196, t(22)=-2.105$]. Table 2 summarizes the differences between the normal-weight and the overweight groups in terms of consumption of the food items offered in the two conditions.

Considering the negative emotion condition, Fig. 1 shows that the study groups exhibited different total food intake profiles. The normal-weight group opted to consume sweet food, while the overweight group increased consumption of sweet and salty food.

The percentage increase data presented for each type of food in Table 2 reinforces the different food preferences of the participants in the face of negative emotions evoked by the negative emotion condition.

Discussion

According to this study, the negative emotions evoked by common problems of daily life increased the energy intake and sweet food consumption in overweight and normal-weight groups, confirming the hypothesis of this work. It also caused an increase in salty high-fat food consumption by the overweight group. The energy intake of overweight women was higher than the energy intake of normal-weight women in the negative emotion and neutral conditions. Nevertheless, the percentage increases in food consumption between conditions were higher in the normal-weight group than the overweight group. Interestingly, the study was able to differentiate the food intake for the normal-weight and overweight groups in the negative emotion condition in greater detail, and also to show that normal-weight group

Table 2 Comparison of energy intake, consumption of sweet and salty food, consumption of healthy food (grapes), chocolate, baked cheese bread and fried cheese bread between the normal-weight and the overweight groups and between the neutral and the negative emotions conditions

	Normal-weight (<i>n</i> = 20)				Overweight (<i>n</i> = 23)				<i>p</i> value normal-weight × overweight	
	Neutral con- dition (mean/ sd)	Negative emotions condition (mean/ sd)	Difference of means (%)	<i>p</i> value	Neutral con- dition (mean/ sd)	Negative emotions condition (mean/ sd)	Difference of means (%)	<i>p</i> value	<i>p</i> value neutral condi- tion (normal-weight × overweight)	<i>p</i> -value negative emotions condition (normal-weight × overweight)
Energy (calories)	770/370.40	1105/491.06	+43.50	0.010	1019/262.96	1415/351.35	+38.86	<0.001	0.003	0.034
Sweet food (units)	2.47/2.13	4.18/3.21	+69.23	0.044	3.78/3.13	5.16/1.98	+36.50	0.031	0.154	0.322
Grapes and Chocolate										
Salty food (units)	4.09/2.60	5.85/2.86	+43.03	0.058	5.86/2.06	8.30/2.47	+41.63	0.008	0.024	0.019
Baked and Fried cheese bread										
Healthy food (units)	0.95/1.56	1.42/2.15	+14.95	0.418	1.47/3.12	1.69/1.92	+8.69	0.812	0.017	0.724
Grapes										
Chocolate (units)	1.52/1.32	2.76/2.16	+817	0.031	2.30/2.21	3.47/1.97	+50.86	0.049	0.049	0.724
Baked cheese bread (units)	2.19/1.66	2.66/1.85	+21.46	0.386	3.26/2.21	4.04/1.65	+23.92	0.196	0.080	0.016
Fried cheese bread (units)	1.90/1.63	2.48/2.54	+30.52	0.080	2.60/1.04	4.26/1.69	+63.84	0.018	0.031	0.021

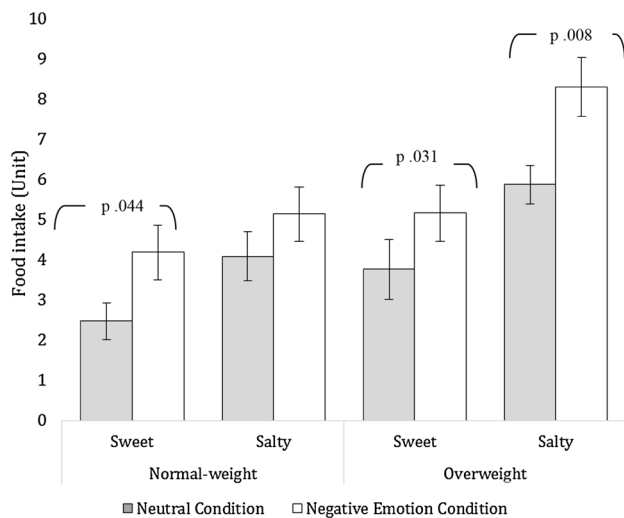


Fig. 1 Intake of sweet and salty food in neutral and negative emotions conditions by the normal-weight and overweight groups

presented a substantial increase in food intake when exposed to negative emotions. Some studies have shown that women tend to consume more energy in the event of negative emotional experiences [3, 27]. The increased consumption of sweet food in the negative emotion condition found here is consistent with the results of other studies [27, 30]. Despite the innate preference for sweet food [31] and the association of this type of food with comfort food [5, 30, 32], the overweight women not only consumed sweet food, but also ingested salty food in the negative emotion condition.

Another possible explanation for these results is that the salty food item the consumption of which significantly increased was also rich in fat. Studies have shown that overweight individuals have a greater craving and liking for food rich in fat compared with food rich in sugar [34, 35]. The analysis shown in Fig. 1 revealed that the normal-weight women in the negative emotion condition focused on consuming sweet food (chocolate), whereas the overweight women tended to ingest salty food (fried cheese bread), which had higher fat content. Interestingly, when Dressler and Smith conducted a taste testing, they found that overweight/obese women had a higher overall liking for more food categories and a much higher liking for spreadable fats compared with normal-weight women [36].

It is important to note that the volunteers ate the brunch in a group (with other participants) and that food consumption can be influenced by social context. The social context can facilitate or inhibit food consumption depending on a number of factors [37]. As noted by Herman et al., the influence of social context on food consumption is related to social norms concerning the amount of food it is acceptable to eat in that context [37]. Moreover, it is known that people with excess weight are stigmatized as “loving” to eat [38], and

sweets are considered unhealthy foods and are linked more strongly to weight gain [34]. Therefore, as in Barthomeuf et al.’s work, the overweight women in this study appeared more restrained in the presence of other people, perhaps not wishing to reveal their real desire to consume food and thus protect their image from strangers; in contrast, the normal-weight women seemed not to care about the appearance of consuming sweets under the influence of negative emotions [39].

The fact that the negative emotion condition did not significantly affect the intake of fruit in any of the study groups showed that healthy food did not seem to be a food choice in this condition. Other studies have also detected higher chocolate consumption than healthy food consumption in stressful situations [40, 41]. It has been suggested that people adopt short-term attitudes in adverse situations—they think more of the enjoyment they derive from palatable food than of the long-term benefits of healthy food.

In our study, healthy food was also the least consumed item in the neutral condition. The normal-weight and overweight groups did not differ regarding the amount or even the proportional participation in the consumption of this type of food in the total food intake, which contrasted with our expectation that normal-weight women would be more concerned about healthy eating habits. Other studies have also found similar vegetable consumption profiles among overweight and normal-weight individuals [42, 43]. Bennett and colleagues [3] showed that knowledge of the beneficial properties of a certain food does not define the choice of food made under the influence of emotion. Hence, we believe that women under the effect of negative emotions opt to consume chocolate even though they know about healthy eating habits and have a choice of healthy food (grapes), regardless of their nutritional status [3]. Kandiah et al. stated that 80% of women report attempting to choose healthy food, but only 34% of them do consume healthy food when under stress [32].

Similar to the validated videos reported in the literature, the video “Dramas of Life Scenes” intensified negative emotions and reduced positive emotions [6, 26, 27], so it satisfactorily fulfilled the objective of the study. Furthermore, compared with similar videos validated in the literature, the video “Routine Life Scenes” was an adequate instrument for maintaining emotions during the neutral intervention. The emotions recorded before and after the presentation of the video did not differ significantly, as described by Macht and Mueller [26]. Positive (calm and happiness) and negative (anger, outrage, sadness, anxiety, and worry) emotions increased and decreased slightly, respectively, as verified in other papers [6, 44]. The connection between the scenes presented in the video and concerns around usual women’s problems influenced the intensity and realism of the emotions evoked [29].

The homogeneity of the study groups in terms of their personal characteristics (socioeconomic data, menstrual cycle, and lifestyle) was noteworthy. Studies have shown that all these factors can interfere with the relationship between emotion and food consumption [4, 14, 45].

The VAS scores indicate that the video instrument effectively induced negative emotions in both study groups. A further strength of this study is that the participants were middle-aged, working women, rather than graduate students, unlike the participants in most studies on this theme. Moreover, the participants did not have chronic, endocrine, or psychological pathologies, nor did they use psychoactive drugs or drugs that would affect the appetite. In addition, this study offered various types of foods, which allowed for greater variety in food choice. The study design was also cautious with the food presentation: all food items were of the same size and shape.

In this study, healthy salty food was not available to the participants. Offering this type of food could enhance our understanding of food choice in the negative emotion condition. The simulation of social context involved in food consumption was important to confirm our premise that in a society with high food availability, stressful situations can be a (potentially constant) trigger for increasing food consumption and fostering obesity. However, the results concerning food choice deserve to be explored individually among participants representing other characteristics, cultures, and nutritional status. It would strengthen the study to increase the sample. The accuracy of the food consumption results obtained by direct observation using video recording is unknown; exploring and comparing these observational data with self-reported food intake would enrich research by making it possible to examine the gap between actual consumption and reported food consumption. Subjects with psychiatric diagnoses (such as depression, eating disorders, mental disorders), using psychoactive drugs or under psychiatric treatment were excluded, but only the participants' reports were considered. Specific tests for these conditions were not applied.

Conclusions

The results of this study show that stressful situations arising in daily life might trigger food consumption in the presence of high food availability. The negative emotions evoked by common problems of daily life increased energy intake in overweight and normal-weight groups, and the percentage increases in food consumption between the conditions were higher in the normal-weight group than in the overweight group. In addition, the food choices differed depending on nutritional status. The normal-weight women increased their consumption of sweet food, while the overweight women

significantly increased their consumption of sweet and salty high-fat food. Recurrent stressful events in the environment with high food availability may cause or aggravate excess weight. This should serve as a warning of the risks of excess exposure to food, especially food with high sugar and fat content, as everyday problems will not cease to exist.

Acknowledgements The authors wish to thank the women who participated in this study.

Compliance with ethical standards

Funding This study was funded by the São Paulo Research Foundation (FAPESP) (Protocol 14732-6).

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study were in accordance with the ethical standards of the national ethics committee and with the 1964 Declaration of Helsinki. The study was approved by the Committee of Research Ethics of HCFMRP-USP under protocol 210.388.

Informed consent Informed consent was obtained from all participants included in the study.

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