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Thoughts of social distancing experiences affect food intake and hypothetical binge eating: Implications for people in home quarantine during COVID-19

Yevvon Yi-Chi Chang^a, Pai-Lu Wu^b, Wen-Bin Chiou^{c,*}

^a Department of Hospitality Management, Tunghai University, Taichung, 407224, Taiwan

^b Center for Teacher Education, Cheng Shiu University, Kaohsiung, 83347, Taiwan

^c Institute of Education, National Sun Yat-sen University, Kaohsiung, 80424, Taiwan

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ABSTRACT

Background and rationale: Social distance regulations have been suggested as one of the best ways to control and prevent the spread of COVID-19. Social connection and food are intertwined because both have played critical evolutionary roles in human survival. We tested whether the substitutability hypothesis in human motivation applies here in that cues signaling scarcity in one domain (e.g., social connection) might enhance the desire to acquire resources in another domain (e.g., food).

Methods: We recruited 140 adults from Kaohsiung City (the largest city in southern Taiwan) to participate in a laboratory experiment. Participants were randomly assigned to receive either social distancing or neutral primes via an emotional-event recollection technique. The amount of ice cream eaten during a taste test and the self-reported likelihood of binge eating served as the dependent measures.

Results: We found that, compared with controls, participants primed with social distancing consumed more ice cream in a taste test and reported a greater likelihood that they would engage in binge eating if they were placed in home quarantine.

Conclusions: We may be the first to provide experimental evidence that social distancing can enhance the desire for food. The link between social distancing and the desire for food is pertinent to understanding how strongly social distance regulations may influence weight gain. Our findings have far-reaching implications for weight control under social distance regulations for prevention and control of COVID-19.

1. Introduction

To prevent and control the spread of COVID-19, social distance regulations have been implemented in many countries (Parmet and Sinha, 2020; Lunn et al., 2020). However, humans rely on one another to obtain what they want and need (Lasaleta and Vohs, 2013; Lasaleta et al., 2014), and this social interdependency nourishes a strong desire for social connection (Baumeister and Leary, 1995). Evolutionary psychologists argue that the desire to form and maintain social bonds has an evolutionary basis (Ainsworth, 1989; Baumeister and Leary, 1995; Buss, 1991). Additionally, from an evolutionary perspective, one of the primary challenges for human survival is to collect or produce enough food (Briga et al., 2017; Diamond, 1997). Hence, both food (Diamond, 1997) and social connection (Lasaleta et al., 2014) should be considered as

subsistence resources for human survival.

Given that social connection is important to human survival, a meaningful life, and well-being (Stavrova and Luhmann, 2016), it is crucial for people to monitor the abundance or scarcity of social connection. According to the fundamental principle of self-regulation of motivation and action (Carver, 2004), cues that signal deprivation (abundance) of one of the subsistence resources should increase (decrease) the incentive value of others (Briers et al., 2006). Some behavioral evidence supports this *substitutability hypothesis* (Lasaleta and Vohs, 2013). For example, Briers et al. (2006) showed that hungry participants were less likely to make monetary donations than were satiated participants. Zhou, Vohs, and Baumeister (2009) demonstrated that participants under a social rejection condition donated less money than those under a social acceptance condition. Lasaleta et al. (2014)

* Corresponding author. National Sun Yat-sen University, 70 Lien-Hai Rd., Kaohsiung, 80424, Taiwan.

E-mail addresses: yevvon@thu.edu.tw (Y. Yi-Chi Chang), pailu@gcloud.csu.edu.tw (P.-L. Wu), wchiou@mail.nsysu.edu.tw (W.-B. Chiou).

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reported that a sense that social connection was plentiful decreased the desire for money.

According to the principle of the substitutability of subsistence resources (Briers et al., 2006; Lasaleta and Vohs, 2013), cues signaling scarcity in one subsistence resource should motivate people to acquire other subsistence resources. Yet, little research has empirically tested whether experiencing scarcity in social connection (i.e., social distancing) increases the desire for food. The current study was aimed at rectifying this deficit in the research literature. Therefore, our investigation examined the hypothesis that when people feel that social connection with others is scarce, their desire for food increases. We contend that priming with social distancing may enhance the desire for food, especially under social distance regulations intended to deal with the threat of COVID-19. We predicted that people who are reminded of social distancing (i.e., scarcity in social connection) may experience an increase in the desire for food, as manifested by their eating more ice cream in a taste test and reporting greater likelihood of binge eating.

2. Methods

2.1. Participants

A total of 140 adults (73 females; aged 19–59 years, $M = 27.9$, $SD = 9.5$) were recruited to participate in this experiment through campus posters and flyers distributed in 7 district offices in Kaohsiung city, Taiwan. During recruitment, the participants were screened to meet the following criteria: no eating disorders, no dieting, no current weight reduction therapy, and not taking weight reduction supplements. The sample size was estimated by calculating the number of participants required to test the mean difference between two independent groups under the following conditions: $\alpha = 0.05$, $d = 0.50$ (medium effect size; Cohen, 1988), and power = 0.90. The current research was conducted for 56 days during summer (June–August) 2020, when social distance regulations were implemented in Taiwan. This study was approved by the Institutional Review Board of our university. The informed consent was obtained from all participants.

2.2. Procedure

Upon arrival, participants were told that they were helping to test unrelated tasks that would be used in future studies (i.e., a self-reflection task and a taste test). After providing consent, participants reported the time since their last meal (in hours) and rated their intention to lose weight on a five-point scale (1 = very low, 5 = very high).

By employing block randomization schedules, every two participants were assigned to one of the two study conditions (social distancing vs. control). We employed the emotional-event recollection technique (Chao et al., 2011; Leith and Baumeister, 1996) to prime experiences of social distancing. For the social distancing condition, participants were asked to recall a salient and impressive event that made them feel a strong sense of social disconnection due to the government’s social distance regulations around COVID-19. For the control condition, participants were asked to recall a routine event from before the COVID-19 pandemic. In a pretest ($N = 56$; 30 females) conducted to check on the effectiveness of our manipulation, participants in the social distancing condition reported a higher level of felt social disconnection ($M = 4.79$, $SD = 1.50$) than those in the control condition ($M = 3.75$, $SD = 1.51$), $t(54) = 2.579$, $p = 0.013$, Cohen’s $d = 0.75$. These results confirmed that our manipulation affected immediate feelings of social disconnection.

Later, participants were asked to complete a filler questionnaire while the experimenter prepared the taste test. The short survey included a question assessing felt sense of social disconnection (1 = not at all, 7 = very much). For the taste test, we provided participants with two different flavors of ice cream (each ~200 g, equivalent to 400 kcal). To disguise the real purpose of the study, participants were asked to compare these two ice creams and complete a sensory evaluation

questionnaire (e.g., Kuo et al., 2016). In the demographic section of that questionnaire, we embedded an item to measure the likelihood of binge eating in a social disconnection situation (“If you had to be placed in home quarantine, how likely would you be to engage in binge eating?”). Participants answered the question using a scale from 1 (very unlikely) to 7 (very likely). The amount of ice cream consumed and the self-rated likelihood of binge eating were used as the dependent measures. In addition, self-reported height and weight were used to calculate the body mass index (BMI; kg/m^2). At the end of this experiment, participants were probed to examine whether they had suspected the true purpose of the study. None of them guessed the true goals of this experiment.

3. Results

No missing values were detected among the variables of interest. The demographic characteristics of the participants are presented in Table 1. The independent sample t -test showed that the intention to lose weight ($t(138) = 0.984$, $p = 0.327$), time since the last meal ($t(138) = 0.319$, $p = 0.750$), and participant BMI ($t(138) = 1.556$, $p = 0.122$) did not differ between the social distancing and control conditions (see Table 2), indicating that the random assignment created equivalent groups. In addition, Pearson’s correlation analyses revealed that the amount of ice cream eaten was not associated with the intention to lose weight ($r = -0.107$, $p = 0.208$), the time since the last meal ($r = 0.042$, $p = 0.624$), and participant BMI ($r = 0.073$, $p = 0.392$). The self-reported likelihood of binge eating was also not related to the intention to lose weight ($r = -0.120$, $p = 0.157$), the time since the last meal ($r = 0.128$, $p = 0.132$), and participant BMI ($r = 0.086$, $p = 0.311$).

Table 2 shows that participants receiving the social distancing prime felt more socially disconnected ($M = 4.91$, $SD = 1.45$) than those receiving the neutral prime ($M = 3.96$, $SD = 1.23$; independent sample t -test, $t(138) = 4.204$, $p < 0.001$, Cohen’s $d = 0.71$, 95% $CI [0.51, 1.41]$). Although the intention to lose weight, the time since the last meal, and participant BMI were not related to the two dependent measures, these variables were treated as control variables to provide information about the net effects of the experimental manipulation and the robustness of the covariate effects. As hypothesized, analysis of covariance (ANCOVA) revealed that participants in the social distancing condition ate more ice cream during the taste test (adjusted $M = 151.54$ g) than those in the control condition (adjusted $M = 137.84$ g), $F(1, 135) = 12.316$, $p = 0.001$, partial $\eta^2 = 0.08$. In addition, the ANCOVA showed that three covariate effects of the model (intention to lose weight: $F = 3.222$, $p = 0.075$; the time since the last meal: $F = 0.353$, $p = 0.553$; and participant BMI: $F = 0.881$, $p = 0.349$) did not reach significance ($ps > 0.05$). The effect of social distancing on the desire for food was also evidenced by the reported likelihood of binge eating in the three-covariate ANCOVA.

Table 1
Demographic of the participants.

	Condition		Total
	Social distancing	Control	
Age, years			
19–30	46 (65.7)	44 (62.9)	90 (64.3)
31–40	12 (17.1)	15 (21.4)	27 (19.3)
≥ 41	12 (17.1)	11 (15.7)	23 (16.4)
Sex, female	37 (52.9)	36 (51.4)	73 (52.1)
Education			
High school degree	11 (15.7)	13 (18.6)	24 (17.1)
University students	38 (54.3)	37 (52.9)	75 (53.6)
College degree	17 (24.3)	15 (21.4)	32 (22.9)
Graduate degree	4 (5.7)	5 (7.1)	9 (6.4)

Note: Each condition involved 70 participants. Data are shown as number (%). Experimental conditions were not significantly associated with age group ($\chi^2(df = 2) = 0.421$, $p = 0.810$), participant sex ($\chi^2(df = 1) = 0.029$, $p = 0.886$), and education ($\chi^2(df = 3) = 0.416$, $p = 0.937$).

Table 2
Means and 95% confidence intervals for the measures.

Measures	Condition				p-value
	Social distancing		Control		
	Mean	95% CI	Mean	95% CI	
Intention to lose weight (1–5)	3.03	[2.77, 3.29]	2.86	[2.62, 3.09]	0.327
Time since last meal (hr)	1.70	[1.58, 1.82]	1.67	[1.54, 1.80]	0.750
Participant BMI (kg/m ²)	23.61	[23.08, 24.15]	23.03	[22.50, 23.56]	0.122
Felt social disconnection (1–7)	4.91	[4.57, 5.26]	3.96	[3.66, 4.25]	<0.001
Amount of ice cream eaten (g)	151.53	[146.11, 156.95]	137.86	[132.36, 143.35]	0.001
Likelihood of binge eating (1–7)	4.50	[4.18, 4.82]	3.63	[3.30, 3.96]	<0.001

Note: Each condition involved 70 participants. Units of the dependent measure are presented in parentheses. CI = confidence interval. BMI = body mass index. The significance levels of between-group difference are shown at the rightmost column.

Participants primed with social distancing were, by self-report, more likely to engage in binge eating if they were placed in home quarantine (adjusted $M = 4.49$) than were control participants (adjusted $M = 3.64$, $F(1, 135) = 14.157$, $p < 0.001$, $d = 0.64$). The three covariate effects were not significant ($F_s < 3.034$, $p_s > 0.084$).

Furthermore, Pearson’s correlation analyses indicated that participants’ ratings of felt social disconnection were associated with the amount of ice cream consumed in the taste test ($r = 0.523$, $p < 0.001$) and with a higher reported likelihood of binge eating ($r = 0.533$, $p < 0.001$). Additionally, the interaction between participant sex and condition had no significant effect on the amount of ice cream eaten in the taste test ($F(1,133) = 1.825$, $p = 0.179$) or the likelihood of binge eating ($F(1,133) = 0.381$, $p = 0.538$) in the two-way ANCOVA (factors: participant sex and condition) with three covariates.

The mediating role of felt social disconnection was tested against our two indicators of desire for food. The experimental condition was dummy coded (1 = social distancing, 0 = control), while treating the intention to lose weight, the time since the last meal, and participant BMI as the covariates. Hierarchical regression analyses showed that the effect of social distancing on the amount of ice cream eaten during the taste test ($B = 13.70$, $SE = 3.90$, $t = 3.509$, $p < 0.001$) was not significant ($B = 6.02$, $SE = 3.73$, $t = 1.614$, $p = 0.109$) after controlling for felt social disconnection. The 95% bias-corrected CI [3.82, 13.07] for the indirect effect ($B = 7.71$, $SE = 2.29$; bootstrap resamples = 5000) was significant in a bootstrap analysis (Preacher and Hayes, 2004), indicating that felt social disconnection played a mediating role (See Fig. 1). The partial effects of the three covariates on the amount of ice cream eaten were not significant ($p_s > 0.463$). The mediating effect of feeling socially disconnected was also observed regarding the self-reported likelihood of binge eating. When felt social disconnection was controlled for, the relationship between social distancing and the likelihood of binge eating ($B = 0.86$, $SE = 0.23$, $t = 3.763$, $p < 0.001$) was not significant ($B = 0.42$,

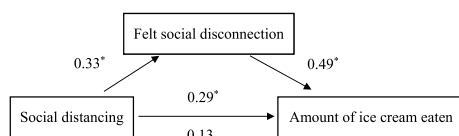


Fig. 1. Mediation of the effect of social distancing on the amount of ice cream eaten in a taste test. Values are standardized regression coefficients. On the lower path, the values below and above the arrow are the results of analyses in which the mediator was and was not included in the model, respectively. An asterisk indicates a p-value of less than 0.05.

$SE = 0.22$, $t = 1.934$, $p = 0.055$). Furthermore, the bootstrap analysis showed that the indirect effect of felt social disconnection ($B = 0.44$, $SE = 0.14$, 95% bias-corrected CI: 0.20 to 0.78; bootstrap resamples = 5000) was significant, indicating that felt social disconnection mediated the effect of social distancing on participants’ self-reported likelihood of binge eating. Additionally, the partial effects of the three covariates did not reach significance ($p_s > 0.495$).

4. Discussion

Building on the notion that social distancing may signify scarcity in one subsistence resource and thereby motivate people to acquire other subsistence resources (e.g., food), we conducted a laboratory experiment to test the possibility that participants primed with social distancing would eat more ice cream in a taste test and would be more likely to engage in binge eating. The present findings suggest that under social distance regulations, the desire for social connection may enhance the desire for food. To our knowledge, this study may be the first to provide experimental evidence that confirms the psychological effect of social distancing on the desire for food.

Our findings contribute to the literature in several important ways. The observed link between social distancing and the desire for food provides support to the substitutability principle regarding human motivation regulation (Carver, 2004; Lasaleta and Vohs, 2013). When one subsistence source is seen as scarce, people are motivated to pursue another. We found that social distancing increased the desire for food, in keeping with the theory that social connectedness and food operate as entwined subsistence resources. Furthermore, the present findings are in line with prior research on the reciprocal substitutability of social connection and money. For example, three experiments conducted by Lasaleta and Vohs (2013) showed that social support primes a decreased desire for money, as manifested by ranking financial success as less important, reporting less worry over money, and seeing money as less important. Twenge, Baumeister, DeWall, Ciarocco, and Bartels (2007) found that participants who were led to believe that they were likely to be alone later in life donated less money than did participants led to expect future belonging and the control group (Experiment 1). Finally, Zhou et al. (2009) demonstrated that participants in the social rejection group donated less money than those in the social acceptance group. Just as priming with money can buffer the impact of social exclusion by making one feel strong, the current research indicates that social distancing may increase the desire for food by making one feel less socially connected. Finally, part of our contribution lies in providing a viable explanation for a prevalent phenomenon under the impact of COVID-19, namely, that people who can afford extra food may compulsively hoard more than they need (Long and Khoi, 2020; Naja and Hamadeh, 2020).

4.1. Limitations and future directions

With regard to limitations and future directions, this was a simulation-based, relatively small-scale experimental study. Larger-scale studies are needed to validate the present findings before they can be generalized to the real world. We employed the amount of ice cream eaten in a taste test and self-reported likelihood of binge eating as indicators of a desire for food. Use of other measures such as daily food consumption or weight gain may support the practical and external validity of this approach. Second, potential mediators and moderators of the link between social distancing and food consumption should be addressed. Ice cream has been demonstrated to be a comfort food (see Spence, 2017, for a related review). Feeling socially disconnected may induce negative feelings (e.g., depression, anxiety); eating comfort food (e.g., ice cream) could help to relieve these feelings, further reinforcing such behaviors. Thus, including measures of the affective states related to food consumption (such as anxiety, fear, and depression) may allow us to rule out alternative explanations and observe the net effect of social

distancing priming on the desire for food. With respect to moderating factors, the participants' preferences for ice cream may have affected the amount of ice cream consumed during the taste test. Moreover, the propensity to consume more food and make more accurate judgments in the taste test through repeated sampling might have led participants to eat more ice cream. Because our random assignment method appeared to create equivalent groups, personal factors associated with consumption of ice cream consumption should not have significantly differ between the two study groups. Although our findings demonstrated that, compared with participants exposed to neutral primes, those exposed to social distancing primes expressed a greater desire for food (reflected in the eating of more ice cream in a taste test and a greater self-reported likelihood of binge eating), we suspect that this priming effect is not invariant. Living alone, a preference for solitude, and food scarcity might be important moderators of the association between social distancing experiences and food consumption. We predict that the priming effect of social distancing on the desire for food would be more prominent in people living alone or facing food scarcity and be less pronounced in people with a high preference for solitude. Third, previous research has shown that money and food are entwined and interchangeable (Briers et al., 2006; Nelson and Morrison, 2005; Pettijohn and Jungeberg, 2004). Future research may test whether social distancing might also promote the desire for money. Drawing on the notion of the substitutability hypothesis, how people choose from potential substitutes (food, money, and hoarding) could also be an interesting area for future study. For example, wealthy people might be more likely to hoard food and materials. In contrast, less wealthy people might consume cheaper food products, engage in loan shopping, or commit a delinquent act to obtain money. In addition, we observed that priming with social distancing induced a heightened desire for food. The question of whether socially disconnected people are vulnerable to overeating and obesity-related problems is worthy of investigation. Finally, an important area for future research is the overlap in neurological activation (e.g., anterior cingulate cortex and dorsomedial prefrontal cortex) between the incentive value of social connection (Redcay and Schilbach, 2019) and that of food (Martin et al., 2010). Neurological evidence showing that these two reward systems share common brain regions has important implications for weight control and interventions using comfort food. Future research should test whether thoughts of social distancing can activate neural mechanisms associated with food motivation or whether consumption of comfort food buffers the pain of social disconnection.

5. Conclusions

The current research indicates that merely reminding people of social distancing, without reaching an intense level of ostracism, may promote the desire for food. Social distance regulations have been widely adopted for prevention and control of coronavirus disease. Our findings suggest that social distancing may increase the desire for food. Prolonged home stay (e.g., working from home or self-isolation) is related to reduced physical activity, i.e., low energy expenditure (Di Corrado et al., 2020; Jiménez-Pavón et al., 2020). Thus, social distance regulations for COVID-19 control contribute to weight gain not only by increasing energy intake but also by reducing energy expenditure. Perhaps the impact of social distancing under COVID-19 regulations is so powerful that individuals feel less socially connected and feel that way more often. Accordingly, to the degree that social connection and food are interchangeable subsistence resources, people might eat more food to appease their social pain, thereby, simultaneously, sacrificing their physical health. However, consuming *healthy comfort food* (e.g., black bean brownies, butternut squash fries, cauliflower rice, oatmeal cookies, lentil meatloaf, turkey taco salad, vegetarian pizza or lasagna) may promote both physical and mental health during the COVID-19 epidemic. The government should try to use mass and social media to disseminate information about the benefits of eating healthy comfort

food. The impact of social distance regulations during and after the global pandemic on humans' striving for food should receive more attention than it presently does.

Credit author statement

Yevvon Yi-Chi Chang: Conceptualization; Investigation; Methodology; Writing – original draft; Writing – review & editing; Pai-Lu Wu: Conceptualization; Methodology; Resources; Writing – review & editing; Wen-Bin Chiou: Conceptualization; Formal analysis; Methodology; Supervision; Writing – original draft; Writing – review & editing.

Supplementary data

Supplementary data to this article can be found on the Mendeley Data (<https://data.mendeley.com/datasets/65dt6ww3mt/draft?a=e854ed06-0cdc-4328-8b1b-fe8dccc4d4248>).

Declaration of competing interest

The authors declare no competing interests.

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