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The potential relationship between spicy taste and risk seeking

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Abstract

We conducted three studies to examine the relationship between spicy tastes and risk seeking. In Study 1, results from a personality judgment task indicated that people were more inclined to attribute a higher level of risk seeking to individuals who enjoy spicy foods. The second study examined whether people who like spicy foods are actually more risk seeking. In fact, people who reported a preference for spicy tastes scored higher on risk taking, as assessed via the Domain-Specific Risk-Taking Scale (Chinese version). Finally, Study 3 employed an experimental design to manipulate risk-seeking tendencies by having participants experience spicy food tastes in the lab. Momentarily savoring spicy foods increased participants' risk taking in the Iowa Gambling Task. The present findings suggest that preferences for spicy tastes could relate to risk-seeking tendencies and subsequent risk-seeking behaviors.

Keywords: spicy taste, risk seeking, personality.

1 Introduction

In the past decade, psychologists and nutritionists have examined the relationship between personality traits and food choices. Several studies suggest that personality traits influence consumption of specific foods or substances. For example, among the Big 5 personality factors, conscientiousness and openness to experience are positively associated with vegetable and fruit consumption (Raynor & Levine, 2009) and negatively associated with eating meat products (Mõttus et al., 2012). Research has also shown that an increased preference for caffeine is associated with higher levels of sensation seeking (Mattes, 1994). More abstractly, scholars have addressed factors underlying taste preferences, particularly the relationship between taste preferences and personality. For instance, individuals with a preference for sweet foods score higher on measures of agreeableness (Meier, Moeller, Riemer-Peltz & Robinson, 2012) and neuroticism (Keller, Steinmann, Nurse & Tepper, 2014; Kikuchi & Watanabe, 2000). As for spicy tastes (i.e., tastes elicited from spices that produce oral irritation), preferences have been observed around the world (especially Africa, India, China, and Mexico; Ji, Ding, Deng, Ma & Jiang, 2013), in spite of these foods (at least initially) being seemingly unpalatable. In contrast, several people are averse to spicy foods due to resultant painful sensations. While physiological reactions affect preferences for spicy tastes, additional evidence suggests that these taste preferences could be influenced by personality factors (Bartoshuk, 1993; Duffy, 2007; Duffy & Bartoshuk, 2000; Miller & Reedy, 1990), social and cultural contexts (Rozin & Schiller, 1980; Stevens, 1990), and repeated exposure to spicy cuisine (Logue & Smith, 1986). Thus, there is merit in exploring the relationship between spicy tastes and personality traits.

The most common personality construct associated with spicy taste is sensation seeking, which has been associated with a preference for, and consumption of, spicy foods. For instance, several studies have reported a positive relationship between sensation-seeking behaviors and enjoying chili-containing foods (Byrnes & Hayes, 2013, 2015). Spicy tastes create strong sensations (Ludy & Mattes, 2012), and sensation seeking is an important predictor of risky behaviors, including aspects of criminality and social violations (Horvath & Zuckerman, 1993). More direct evidence is indicated by a positive relationship observed between eating spicy foods and risk-taking subscale scores from the DSM5 Personality Inventory (PID–5) (Byrnes & Hayes, 2016).

Additionally, the theory of benign masochism provides a possible explanation for why spicy consumption is related to risk-seeking tendencies. Benign masochism refers to the enjoyment derived from negative experiences that we initially perceive as threatening (e.g., eating peppers, riding roller coasters, etc.; Rozin & Schiller, 1980; Schweid, 1980). Although eating spicy foods is typically accompanied by defensive responses within the body (e.g., teary eyes and a runny nose), certain individuals' preferred level of piquancy is below any tolerance level. Thus, while our body interprets eating spicy food as risky, our mind seems to regard this behavior as safe or at least a "constrained risk". Furthermore, Rozin and colleagues provided systematic evidence

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for benign masochism across a range of activities, including spicy taste consumption, and observed a positive correlation between benign masochism and sensation seeking (Rozin, Guillot, Fincher, Rozin & Tsukayama, 2013).

Based on the aforementioned literature, we explored the relationship between spicy taste and risk-seeking traits and behaviors. Study 1 implemented a personality judgment task to examine beliefs that pertain to preferences for spicy foods and risk seeking. We hypothesized that participants would ascribe a higher level of risk seeking to individuals who enjoy spicy tastes. Study 2 was an extension of Study 1 and examined whether people who like spicy foods actually engage in more risky behaviors. More specifically, do people's taste preferences vary according to personality? We sought to answer this question, particularly as it pertains to preferences for spicy tastes coinciding with risk-seeking tendencies. We hypothesized that individuals who enjoy spicy foods would be more likely to take risks. Similar to Study 1, Study 2 relied on self-report assessments of these constructs. Finally, Study 3 investigated actual behavioral links to spicy taste preferences and risk seeking. Thus, we examined whether momentarily savoring a spicy food would influence risky decisions. In line with predictions from Studies 1 and 2, we expected that momentarily savoring spicy tastes would increase individuals' risk-seeking behaviors.

2 Study 1

2.1 Methods

2.1.1 Participants

Forty-nine Chinese students (28 females) from Nanjing University voluntarily participated in this study. The mean age of the sample was 21.36 years (SD = 2.14), ranging from 18 to 27 years.

2.1.2 Materials

The Chinese Facial Affective Picture System. Previous research has demonstrated the existence of facial stereotypes whereby people tend to associate attractiveness with positive personality traits. Thus, we utilized a personality judgment task aimed at preventing participants from determining attractiveness based on these personality judgments (Ji et al., 2013; Meier et al., 2012; Meier, Robinson, Carter & Hinsz, 2010). We selected 20 facial images displaying a neutral expression from the Chinese Facial Affective Picture System (Gong, Huang, Wang & Luo, 2011). We sampled an equal number of male and female faces (10 each). Photographs were taken from the neck to the top of the head and are in black and white. Each photograph was paired with a statement indicating that individual's taste preferences. In previous work, food items, such as lemons, have been used without indicating a particular type of taste (Ji et al., 2013; Meier, Moeller et al., 2012). However, we believed that enjoyment of a specific food item would not necessarily be the same as a preference for a certain taste type. For instance, it is possible that participants would infer someone else's personality based other food characteristics beyond taste. Thus, we used direct statements, such as "I have a preference for spicy tastes", in the task. To preclude any facial expression effects, each facial expression was judged according to four tastes (including sour, sweet, bitter, and spicy). Participants were required to make a total of 80 judgments. The taste-face pairings were the same for each participant. Finally, we calculated average scores among the 20 taste-face pairings for each taste.

For each judgment, the face image and its corresponding statement were presented to participants for 1.5 seconds. Next, information was removed, and participants were required to judge the extent to which the person shown in the picture was likely to be "irritable" and "risk seeking", using a 7-point Likert scale, where 1 = *not at all* and 7 = *extremely*. The personality trait "irritable" was used based on previous evidence of a relationship between spicy preferences and irritability (Ji et al., 2013), and the personality trait "risk seeking" was the target trait in our experiment.

2.1.3 Procedure

Participants were informed that they were going to perform a facial recognition task. An initial inquiry revealed that no participant had previously taken part in similar tasks involving these black and white facial pictures. After providing written consent, each participant completed the personality judgment task according to the experimental instructions. After completion, the participants were thanked and debriefed.

2.2 Results

All participants performed the tasks as directed. However, the final inquiry revealed that two male participants had insights into the study's aims; thus, these participants were excluded from the analyses. A repeated-measures analysis of variance (ANOVA), based on the means of each condition for each participant, was conducted to examine the effects of taste type on personality judgments. Results are provided in Table 1. We observed that taste type significantly affected judgments of irritability and risk seeking (as shown by the F tests in the leftmost column of Table 1). For both irritability and risk-seeking, all three other tastes were rated significantly lower than spicy (as shown by the t tests in Table 1).[1]

[1]The analysis in Table 1 was supported by an additional analysis using the lmer() function in the lme4 package for R (Bates et al., 2015). This allowed us to examine both subjects and faces as crossed random effects. All tests were, like those shown in Table 1, highly significant.

Table 1: Descriptive statistics and t-values for the personality judgment task.

	Taste	N	M	SD	t	p
Irritable (F(3,44)=9.10)	spicy	47	4.43	.88		
	sour	47	3.98	.73	t=3.42	< .01
	sweet	47	3.68	.99	t=4.12	< .01
	bitter	47	4.00	.73	t=2.97	< .01
Risk seeking (F(3,44)=13.18)	spicy	47	4.37	.89		
	sour	47	3.87	.78	t=5.39	< .01
	sweet	47	3.41	.86	t=5.25	< .01
	bitter	47	3.96	.82	t=2.56	< .05

t-value indicates the comparison between the spicy taste and one of the other three tastes.

F-value indicates the comparison among the overall four tastes.

3 Study 2

3.1 Methods

3.1.1 Participants

One hundred thirteen Chinese students (57 females) from Nanjing University voluntarily completed two questionnaires. Participants' mean age was 20.13 years (*SD* = .85), ranging from 18 to 23 years.

3.1.2 Materials

Domain-Specific Risk-Taking Scale (DOSPERT)/Chinese (DOSPERT-C). Weber, Blais and Betz (2002) designed the Domain-Specific Risk-Taking Scale (DOSPERT) to assess the propensity to take risks across six content domains: investment, gambling, health/safety, recreational, social, and ethical decisions. Due to cultural differences, a Chinese version was utilized in our study (Hu & Xie, 2012), where the social and investment domains were combined into one factor. Thus, there were five specific domains in the Chinese version: gambling (items 3, 9, 19, 28), health/safety (items 24, 27, 31, 34, 35), recreational (items 2, 5, 13, 15, 18, 26, 32, 33), ethical (items 4, 7, 10, 11, 12, 23,) and social-investment (items 1, 6, 8, 14, 16, 17, 20, 21, 22, 25, 29, 30). Participants were instructed to rate these 35 items on a 7-point scale that ranged from 1 "strongly disagree" to 7 "strongly agree". In the present study, the Cronbach's α for the total scale was 0.83.

Table 2: Descriptive statistics and results of bivariate correlation analyses for relationships between taste preferences and DOSPERT-C total scale scores.

	N	M	SD	*r*	*p*
Liking sour tastes	113	1.79	0.88	.02	>.05
Liking sweet tastes	113	2.22	1.00	–.12	>.05
Liking bitter tastes	113	1.56	0.83	.13	>.05
Liking spicy tastes	113	3.08	1.04	.37	<.01

r-value indicates the correlation between liking a taste and DOSPERT-C total scale score.

3.1.3 Procedure

Participants were asked to rate their enjoyment of four taste types (sour, sweet, bitter, and spicy) on a 7-point scale (1 = *strongly dislike*, 7 = *strongly like*). Subsequently, we instructed participants to complete the DOSPERT-C scale. After completion, participants were debriefed and thanked.

3.2 Results

All participants' data were used (Table 2). As predicted, bivariate correlation analyses revealed that liking spicy tastes was positively correlated with a propensity to take risks (r = 0.37, p < .01). When individual enjoyment for other taste types were controlled with partial corrlation, the correlation coefficient between liking spicy taste and DOSPERT-C was essentially unchanged (r_{bitter} = .37, p < .01; r_{sour}= .37, p < .01; r_{sweet} = .38, p < .01). A regression analysis also indicated that liking spicy tastes was the only significant predictor of risk-seeking attitudes (β = .37, p < .01, R^2 = .18). We further examined the relationship between liking spicy tastes and scores on the DOSPERT-C domain scores. Significant correlations were observed between liking spicy tastes and scores on all five domains: gambling (r = .24, p < .05), recreational (r = .29, p < .01), ethical (r = .24, p < .05), social-investment (r = .25, p < .01), and healthy (r = .17, p < .10).

4 Study 3

4.1 Methods

4.1.1 Participants

Fifty-one Chinese students (30 females) from Nanjing University voluntarily participated in Study 3. Participants were provided with either course credits or 15 Yuan for their participation. Participants' mean age was 19.78 years (*SD* = .88) and ranged from 18 to 21 years. They were assigned at random to two conditions: spicy and control.

4.1.2 Materials

Iowa Gambling Task (IGT). The Iowa Gambling Task was initially developed to assess and quantify decision-making difficulties among patients with neurological deficits (Bechara, Damasio, Damasio & Anderson, 1994). We used it because it simulates real-world decision-making under uncertainty. The IGT consists of four card decks: A, B, C, and D. Participants are provided an imaginary loan of $2000 and are required to win as much money as possible during the task. Each card type accompanies an immediate reward: $100 for decks A or B and $50 for decks C or D. However, a penalty is imposed for every ten cards chosen. The penalty is large among decks A and B and small among decks C and D. Players cannot predict when a penalty will occur. Therefore, decks A and B are "risk-seeking" decks. By contrast, decks C and D are "risk-aversion" decks. A higher percentage of choosing from decks A and B is assumed to assess risk-seeking behavior. Participants perform 50 trials, with 5 penalty trials. We compared the two groups in the percentage of choosing the risk-seeking decks (deck A or deck B) relative to the risk-aversion decks (decks C or D).

Positive and Negative Affect Schedule (PANAS). The Positive and Negative Affect Schedule was developed by Watson, Clark, and Tellegen (1988) and is comprised of 2, 10-item mood scales. The PANAS is a valid and reliable tool for measuring positive and negative affect. In our study, we adopted a Chinese version of the PANAS (Huang, Yang & Ji, 2003). The PANAS requires participants to report the extent to which they are currently experiencing 10 positive feelings and 10 negative feelings on a 5-point scale (1 = *very slightly*, 5 = *extremely*). The means for positive affect and negative affect are calculated by averaging scores for the 10 positive and 10 negative feeling states, separately. The Cronbach's α for the positive affect scale was .87, and the Cronbach's α for the negative affect scale was .88.

4.1.3 Procedure

Participants were informed that they would be involved in a study on "food tasting". Assessments at the end of the experiment revealed that participants did not know the actual purpose of our study. Participants were assigned to one of two conditions: a spicy condition (N = 25) or a control condition (N = 26). First, participants completed the DOSPERT-C. Next, those in the spicy condition were instructed to eat a piece of tasteless bread covered in chili sauce. We used the same chili sauce, which is regarded as very spicy for most Chinese people. Before tasting, we asked participants whether they would be willingly to taste the chili and whether they would have any acute physical reactions to the chili sauce (e.g., an allergy). Eating a piece of tasteless bread covered in chili sauce may be more acceptable for participants than just eating chili sauce, though it seems less common in daily life. Participants in the control condition were instructed to just eat a plain piece of tasteless bread. Next, participants were asked to complete the PANAS. After completing the PANAS, participants did the IGT, which was presented in Inquisit 3.0 on a computer. After completion, participants were debriefed and thanked.

4.2 Results

All participants' data were available for analyses. Independent-samples *t*-tests were conducted to compare differences between the spicy group and the control group. As shown in Table 3, baseline assessments revealed no significant differences between the two groups ($t_{(49)} = -.33$, $p > .05$, $ESd = -.10$). Additionally, positive affect ($t_{(49)} = -.24$, $p > .05$, $ESd = .14$) and negative affect ($t_{(49)} = -.15$, $p > .05$, $ESd = -.04$) did not significantly differ between the two groups. Further analyses revealed that individuals in the spicy group were more inclined to take risks during the IGT compared to those in the control group ($t_{(49)} = 3.08$, $p < .01$, $ESd = .86$).[2]

DOSPERT-C scores correlated non-significantly in the predicted direction ($r = .06$) with IGT. There could be several reasons for this low correlation, aside from the small sample size. Firstly, the DOSPERT and IGT are very distinct methods for measuring risk-taking tendencies, which could result in low interrelationships. Secondly, the chili sauce manipulation could elicit different effects on IGT performance, even if participants' initial DOSPERT scores were similar across groups. Finally, although Hu and Xie (2012) revised the DOSPERT for Chinese participants, some items on this scale are still regarded as problematic according to participants' feedback. Thus, participants' reports could have been affected by problematic expressions.

5 Discussion

Previous research suggests that gustatory experiences are often involved in our understanding of social cognition. For example, sweet tastes are related to prosocial personality traits (Meier et al., 2012) and romantic perceptions between lovers (Ren et al., 2015), while bitter tastes are associated with survival motivation and moral disgust (Chapman et al., 2009; Chen & Chang, 2012; Eskine et al., 2011). Our studies attempted to establish a relationship between spicy taste preferences and risk-seeking tendencies/behaviors. Study 1 showed that participants perceived individuals that liked spicy tastes as being more risk seeking. This belief has been

[2]Additional analysis confirmed this effect by fitting a straight line to each participant's choice of the risky decks and examine the intercept at the point of the last choice. This analysis was thus more sensitive to experience with the task and less sensitive to initial tendency to choose one deck or another. The intercept also also showed a highly significant group difference ($t_{45} = 3.66$, $p = .001$.

Table 3: Descriptive statistics and *t*-values for the DOSPERT-C, PANAS, and IGT.

	DOSPERT-C		Positive affect		Negative affect		IGT	
	Spicy	Control	Spicy	Control	Spicy	Control	Spicy	Control
N	25	26	25	26	25	26	25	26
M	2.74	2.78	2.96	2.85	1.75	1.78	61.60	52.85
SD	.33	.46	.81	.71	.49	.83	11.62	8.51
t	–.33		.50		–.15		3.08	
p	>.05		>.05		>.05		<.01	

t-value indicates the comparison between the control group and the spicy group.

observed within a variety of cultures worldwide. For example, in some areas of China, such as Sichuan and Chongqing, local residents with a preference for spicy foods are regarded as big-hearted, brave, and irritable (Ji et al., 2013). There is also a stereotype within Mexican culture that people who enjoy chili peppers are perceived to be more masculine (Rozin & Schiller, 1980). In the US, eating chili peppers is grouped with several risk-seeking activities, including gambling and riding roller coasters (Byrnes & Hayes, 2013). Study 2 demonstrated that people reporting a preference for spicy tastes actually scored higher on a risk-seeking measure (DOSPERT-C). This finding provides support for the perceived association between spicy taste preferences and risk-seeking tendencies. Finally, in Study 3, a propensity for actually engaging in risky behaviors increased after consuming a spicy food. Together, these three studies provide evidence that spicy food preferences may be reliably linked to risk-seeking attitudes and behaviors.

In the three studies, we found supportive evidence for the link between spicy tastes and risk-seeking personality traits. The biological underpinnings linking spicy taste experiences and risk-seeking behavior may also support this relationship. Dopamine is a neurotransmitter associated with the brain's reward system and is involved in risky behaviors and decision making, including gambling and addiction. Byrnes and Hayes (2016) revealed a positive relationship between reward sensitivity and yearly spicy food intake. It is possible that the dopaminergic reward system could play a role in savoring spicy food and resultant risk-taking tendencies/behaviors. Spicy taste could stimulate dopamine.

Study 3 observed that spicy food consumption led to more risk-seeking behaviors, but we were unable to fully conclude that spicy taste consumption actually predicts risk-seeking behaviors. Although personality traits are somewhat affected by situational factors (Schwarz, 1999), such traits tend to be relatively stable over time (McCrae & Costa, 1994). Furthermore, there are inconsistencies in whether the IGT actually uncovers true risk-seeking patterns (Dunn, Dalgleish & Lawrence, 2006); thus, more risk-seeking tendencies on the IGT do not necessarily represent a dispositional trait. In addition, it is highly possible that personality plays a significant role on determining spicy food preferences (Stevens, 1996). Thus, any causal association between spicy tastes and risk-seeking should be carefully addressed in future studies.

Our studies observed potential relationships between spicy tastes and risk-seeking, which constitutes a contribution to existing literature. Firstly, we provided evidence that individuals assume that others' who prefer spicy tastes are more likely to take risks (Study 1). This was confirmed by individuals who reported spicy taste preferences actually endorsing more risk-taking behaviors (Study 2). Finally, we observed that risky behaviors were facilitated by the actual consumption of spicy foods in the lab. While previous literature assessing spicy taste preferences has been conducted on Western samples, the current studies extended our understanding of spicy tastes and risk seeking among Chinese samples. China has a long history of producing and consuming spicy food, legitimizing assessments into these taste-personality links within this context.

A few study limitations should be noted. For instance, in Study 3, we compared only two conditions (spicy group and control group) and did not address other taste conditions (e.g., sour, sweet, and bitter). It is unknown whether other tastes would affect IGT performance, which limits interpretations of our present findings. And we found no correlation between the DOSPERT-C and the IGT (and did not examine individual differences in spicy taste preferences); this problem does not affect the main result (an effect of eating spicy food on the IGT), because of random assignment to conditions. Overall, the present results are an initial step toward understanding the potential relationship between spicy tastes and risk taking. Future work will need to continue carefully examining additional variables that could possibly influence this relationship.

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