



Relationship among Eating Behavior, Effortful Control, and Personality Traits in Japanese Students: Cross-sectional Study

Katsumasa Momoi^{1,2}, Kumiko Ohara¹, Katsuyasu Kouda³,
Tomoki Mase⁴, Chiemi Miyawaki⁵, Tomoko Fujitani¹,
Yoshimitsu Okita⁶, Rumiko Murayama¹ and Harunobu Nakamura^{1*}

¹Graduate School of Human Development and Environment, Kobe University, 3-11 Tsurukabuto, Nada-ku, Kobe, Hyogo 657-8501, Japan.

²Faculty of Health and Welfare, Tokushima Bunri University, 180 Nishihama-hoji, Yamashiro-cho, Tokushima, Tokushima 770-8514, Japan.

³Department of Public Health, Faculty of Medicine, Kindai University, 377-2 Oono-Higashi, Osaka-Sayama 589-8511, Japan.

⁴Faculty of Human Development and Education, Kyoto Women's University, 35 Kitahiyoshi-cho, Imakumano, Higashiyama-ku, Kyoto, Kyoto 605-8501, Japan.

⁵Department of Early Childhood Education, Heian Jogakuin (St. Agnes') College, Shimotachiuri-Nishihairu, Kamigyo-ku, Kyoto, Kyoto 602-8013, Japan.

⁶Graduate School of Engineering, Shizuoka University, 3-5-1 Johoku, Naka-ku, Hamamatsu, Shizuoka 432-8561, Japan.

Authors' contributions

This work was carried out in collaboration between all authors. Author KM conceived and designed the study. Authors YO, KO, TM, CM, TF and HN participated in the study design. Author KM conducted the statistical analysis. Authors RM and KK provided advice on statistical analysis. Author KM drafted the manuscript. Authors HN and KO critically reviewed the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/29729

Editor(s):

(1) Domenico De Berardis, Department of Mental Health, National Health Service, Psychiatric Service of Diagnosis and Treatment, "G. Mazzini" Hospital, Italy.

Reviewers:

(1) Fethi Ben Slama, National Institute of Public Health, Tunisia.

(2) Elvira Bormusov, The Lloyd Rigler Sleep Apnea Research Laboratory, Israel.

(3) Uttara Singh, Panjab University, India.

Complete Peer review History: <http://www.sciencedomain.org/review-history/16770>

Original Research Article

Received 26th September 2016
Accepted 28th October 2016
Published 5th November 2016

ABSTRACT

Purpose: Effortful control is the ability to inhibit a dominant response to perform instead a subdominant response. The Big Five personality traits have been widely used to describe personality in terms of five independent factors. In this study, we investigated the relationships among eating behavior, personality, and effortful control in Japanese university students.

Methods: Participants were 576 Japanese university students (422 males and 154 females). Participants completed a questionnaire measuring effortful control, Big Five personality traits, and eating behaviors.

Results: Restrained eating was positively associated with effortful control in both males and females whereas emotional eating and external eating were negatively associated with effortful control in both genders. Extraversion was positively associated with emotional eating and external eating, whereas other indicators of the Big Five personality traits were negatively associated with emotional eating and external eating.

Conclusion: Our results indicate that eating behaviors are associated with both effortful control and the Big Five personality traits. However, the direction of the associations of effortful control and Big Five personality traits with restrained eating differed from the associations of effortful control and personality with emotional eating and external eating.

Keywords: Personality traits; effortful control; eating behavior; students.

1. INTRODUCTION

Recent studies have reported differences in eating behaviors between males and females, with restrained eating more common in females than in males [1,2]. It is reported that the number of patients with eating disorder increased in females [3]. Females tend to show misperceptions of body shape [4,5] and have a desire for thinness [6-8]. In addition, eating behaviors are associated with a desire for thinness and perception of body shape in females [9,10]. These tendencies lead to eating disorders and various diseases [11-13].

Effortful control is the ability to inhibit a dominant response to perform a subdominant response [14]. That is, effortful control is the ability to voluntarily activate or inhibit impulses to act [15]. Research has shown that effortful control is related to eating pathology [16-18]. In one study, patients with eating disorders and bingeing/purging behavior scored significantly lower on the Effortful Control (EC) Scale [19]. In contrast, other studies have found that effortful control is not associated with severe weight cycling [20], and that the interaction between sensitivity to reward and effortful control does not predict weight cycling [20]. Although some research shows no association between effortful control and eating behaviors [21], other research indicates that lower effortful control is associated with more eating disorder symptoms [22]. In one study, eating disorder symptoms were related to low levels of effortful control and strongly related to high levels of Behavioral Inhibition Scale

reactivity (anxiety) [23]. Thus, the findings in this area are contradictory.

Previous studies reported associations between eating behaviors and personality traits. Eating behaviors were related to the personality facets associated with neuroticism and conscientiousness of Big Five personality traits [24]. Emotional eating is strongly positively associated with neuroticism, and linked to lower conscientiousness and lower extraversion [25]. External eating is mainly associated with the facets of impulsiveness and lower self-discipline [25]. On the other hand, restrained eating was related to higher conscientiousness, extraversion and openness, and lower neuroticism [25]. Other findings indicate that higher levels of neuroticism predict higher scores on cognitive dietary restraint, disinhibition, and susceptibility to hunger [26]. Conscientiousness is a positive determinant of cognitive dietary restraint, and higher levels of agreeableness predict lower scores on susceptibility to hunger [26]. Therefore, there are conflicting findings on the relationships between Big Five personality traits and eating behaviors.

In this study, we investigated the relationships among eating behavior, personality traits, and effortful control in Japanese university students.

2. METHODS

2.1 Participants

The survey was conducted using an anonymous, self-administered questionnaire during university

classes in 2015. A convenient sample of 576 university students (422 males, 18.5 ± 1.3 years; 154 females, 18.5 ± 1.0 years) who attended liberal arts classes participated in the study.

2.2 Measures

To measure effortful control, we used the Japanese version of the EC Scale [27], which was developed from the original EC Scale included in the Adult Temperament Questionnaire [28]. The Japanese version of the EC Scale consists of 35 items, each of which is rated on a 4-point Likert scale (untrue = 1, slightly untrue = 2, slightly true = 3, true = 4) to yield a total score ranging between 35 and 140. It includes the following three subscale scores: (1) the ability to voluntarily manage attention (attentional control or the ability to focus/shift attention when needed = EC-attentional [12 items, range 12–48]); (2) the ability to inhibit a dominant response (inhibitory control or the ability to inhibit behavior = EC-inhibitory [11 items, range 11–44]); and (3) the ability to activate a subdominant response (activation control or the ability to activate behavior = EC-activation [12 items, range 12–48]).

Eating behavior was assessed using the Japanese version of the Dutch Eating Behavior Questionnaire (DEBQ) [29] originally developed by van Strien [30]. A previous study evaluated the validity and reliability of the Japanese version of the DEBQ [29]. The DEBQ is a 33-item self-rated questionnaire divided into three subscales: restrained eating (10 items), emotional eating (13 items), and external eating (10 items). Restrained eating is dietary restraint (eating less than desired to lose or maintain body weight). Emotional eating is eating in response to negative emotions and external eating is eating in response to the sight or smell of food. The participants were asked to rate each question from 1 (never) to 5 (very often). Responses to items were added together for each subscale and then divided by the number of questions in each subscale to produce a score between 1 and 5.

We assessed personality characteristics using the Big Five personality traits [31] based on the five-factor model, which is generally accepted worldwide. The model describes an individual's personality in terms of five dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness. We used the Japanese version of the Big Five personality trait

scale [31], which comprises 70 questions. Scores for each characteristic range from 0 to 12; 12 indicates a high degree of the characteristic. Scores were determined using Windows software accompanying the manual [31] and analyzed. We found internal consistency alpha coefficients for extraversion, agreeableness, conscientiousness, neuroticism, and openness of 0.89, 0.67, 0.73, 0.85, and 0.66, respectively.

2.3 Data Analysis

Student's t-test was used to evaluate the differences in DEBQ score, effortful control, and Big Five personality traits between genders. Pearson's correlation coefficients were calculated for DEBQ scores and effortful control or Big Five personality traits. A multiple linear regression analysis was used to investigate the association between DEBQ scores and Big Five personality traits or effortful control. Statistical significance was set at 0.05. All statistical analyses were performed using SPSS 22.0 J for Windows (IBM Corp., Tokyo).

3. RESULTS

As shown in Table 1, the DEBQ scores for restrained, emotional, and external eating were significantly lower for males than for females (restrained eating, $p < 0.001$; emotional eating, $p = 0.001$; external eating, $p = 0.009$). In addition, scores on the personality trait openness were significantly lower for females than for males ($p < 0.001$). There was no other significant difference between males and females.

Table 2 shows the relationship between DEBQ scores and effortful control. In males, restrained eating was significantly positively correlated with activation control ($r = 0.207$, $p < 0.001$). Emotional eating was significantly negatively correlated with inhibitory control ($r = -0.286$, $p < 0.001$), activation control ($r = -0.157$, $p = 0.001$), and attentional control ($r = -0.188$, $p < 0.001$). External eating was significantly negatively correlated with inhibitory control ($r = -0.257$, $p < 0.001$), activation control ($r = -0.147$, $p = 0.002$), and attentional control ($r = -0.178$, $p < 0.001$). In females, restrained eating was significantly positively correlated with activation control ($r = 0.164$, $p = 0.043$). Emotional eating was significantly negatively correlated with inhibitory control ($r = -0.378$, $p < 0.001$), activation control ($r = -0.189$, $p = 0.019$), and attentional control ($r = -0.180$, $p = 0.025$). External eating was significantly negatively correlated with inhibitory

control ($r = -0.243, p = 0.002$) and attentional control ($r = -0.183, p = 0.023$).

Table 3 shows the relationships between DEBQ scores and Big Five personality traits. In males, restrained eating was significantly positively correlated with conscientiousness ($r = 0.139, p = 0.004$). Emotional eating was significantly negatively correlated with agreeableness ($r = -0.105, p = 0.031$), conscientiousness ($r = -0.124, p = 0.011$), and neuroticism ($r = -0.100, p = 0.040$). External eating was significantly positively correlated with extraversion ($r = 0.187, p < 0.001$), and significantly negatively correlated with conscientiousness ($r = -0.103, p = 0.035$) and neuroticism ($r = -0.161, p = 0.001$). In females, emotional eating was significantly negatively correlated with neuroticism ($r = -0.316, p < 0.001$). External eating was significantly negatively correlated with neuroticism ($r = -0.238, p = 0.003$).

Table 4 shows the associations of eating behaviors with effortful control and Big Five

personality traits. DEBQ restrained eating scores were significantly positively associated with activation control ($\beta = 0.214, p = 0.001$) in males, and significantly negatively associated with openness to experience in females ($\beta = -0.251, p = 0.010$). Emotional eating was significantly negatively associated with inhibitory control in males ($\beta = -0.215, p < 0.001$). In females, emotional eating was significantly negatively associated with inhibitory control ($\beta = -0.297, p = 0.001$), neuroticism ($\beta = -0.273, p = 0.001$), and openness to experience ($\beta = -0.241, p = 0.006$), and significantly positively associated with extraversion ($\beta = 0.186, p = 0.033$). External eating was significantly positively associated with extraversion ($\beta = 0.231, p < 0.001$), and significantly negatively associated with inhibitory control ($-0.159, p = 0.005$) and neuroticism ($\beta = -0.144, p = 0.005$) in males. In females, external eating was significantly negatively associated with inhibitory control ($-0.208, p = 0.028$), neuroticism ($\beta = -0.203, p = 0.020$), and openness to experience ($\beta = -0.213, p = 0.022$).

Table 1. Gender difference on big five personality traits, effortful control, and eating behaviors

	Males (n = 428)	Females (n = 154)	P value
Big five personality traits			
Extraversion	45.3 ± 10.2	46.4 ± 9.2	0.194
Agreeableness	48.2 ± 9.4	48.4 ± 9.2	0.808
Conscientiousness	52.3 ± 9.6	51.0 ± 9.9	0.157
Neuroticism	46.4 ± 9.7	46.7 ± 10.5	0.720
Openness to experience	50.8 ± 10.1	45.8 ± 9.3	<0.001
Effortful control			
Inhibitory control	30.8 ± 4.6	30.6 ± 4.7	0.685
Activation control	30.7 ± 5.7	30.7 ± 5.7	0.955
Attentional control	28.6 ± 5.8	28.4 ± 6.6	0.769
DEBQ			
Restrained eating	22.7 ± 8.7	29.2 ± 7.5	<0.001
Emotional eating	26.0 ± 12.0	29.7 ± 12.1	0.001
External eating	31.3 ± 7.9	33.2 ± 6.8	0.009

Data are mean ± standard deviation
DEBQ: Dutch Eating Behavior Questionnaire

Table 2. Gender difference on effortful control

	Effortful control (male)			Effortful control (female)		
	Inh	Act.	Att.	Inh	Act.	Att.
DEBQ						
Restrained eating	0.039	0.207*	0.077	0.044	0.164*	-0.018
Emotional eating	-0.286*	-0.157*	-0.188*	-0.378*	-0.189*	-0.180*
External eating	-0.257*	-0.147*	-0.178*	-0.243*	-0.032	-0.183*

Data are mean ± standard deviation
Int: Inhibitory control, Act: Activation control, Att: Attentional control,
DEBQ: Dutch Eating Behaviour Questionnaire

Table 3. Correlation coefficients between Big Five personality traits and eating behaviors

	Big Five personality traits				
	Ext	Agr	Con.	Neu	Ope
DEBQ (male)					
Restrained eating	0.072	0.084	0.139*	-0.036	0.065
Emotional eating	0.082	-0.105*	-0.124*	-0.100*	0.002
External eating	0.187*	0.021	-0.103*	-0.161*	-0.020
DEBQ (female)					
Restrained eating	0.129	0.060	0.134	-0.063	-0.118
Emotional eating	0.095	-0.018	-0.043	-0.316*	-0.144
External eating	0.121	0.055	0.042	-0.238*	-0.125

* $p < 0.05$ (Pearson's correlation coefficient), Ext: Extraversion, Agr: Agreeableness, Con: Conscientiousness, Neu: Neuroticism, Ope: Openness to experience, DEBQ: Dutch Eating Behavior Questionnaire

Table 4. Associations of eating behaviors with effortful controls and personality

	Male		Female	
	β	p value	β	p value
Restrained eating				
Inhibitory control	-0.065	0.271	0.017	0.862
Activation control	0.214	0.001	0.131	0.229
Attentional control	0.009	0.883	-0.026	0.789
Extraversion	0.022	0.698	0.196	0.042
Agreeableness	0.048	0.368	-0.020	0.809
Conscientiousness	0.016	0.807	0.119	0.283
Neuroticism	-0.070	0.187	-0.107	0.234
Openness	0.008	0.888	-0.251	0.010
Emotional eating				
Inhibitory control	-0.215	<0.001	-0.297	0.001
Activation control	-0.029	0.647	-0.131	0.184
Attentional control	-0.112	0.052	0.039	0.659
Extraversion	0.103	0.063	0.186	0.033
Agreeableness	-0.071	0.169	-0.032	0.669
Conscientiousness	0.022	0.733	0.184	0.067
Neuroticism	-0.030	0.556	-0.273	0.001
Openness	0.040	0.452	-0.241	0.006
External eating				
Inhibitory control	-0.159	0.005	-0.208	0.028
Activation control	-0.066	0.299	0.021	0.839
Attentional control	-0.080	0.160	-0.082	0.380
Extraversion	0.231	<0.001	0.176	0.056
Agreeableness	0.039	0.442	0.008	0.924
Conscientiousness	0.007	0.917	0.176	0.099
Neuroticism	-0.144	0.005	-0.203	0.020
Openness	-0.028	0.599	-0.213	0.022

4. DISCUSSION

We attempted to clarify the relationships among eating behavior, effortful control, and Big Five personality traits in Japanese university students. Our main findings show that restrained eating was positively associated with effortful control in both males and females, whereas emotional eating and external eating were negatively associated with effortful control in both genders.

Extraversion was positively associated with emotional eating and external eating, whereas the other Big Five personality traits were negatively associated with emotional eating and external eating.

We found no significant difference in effortful control between males and females. This is consistent with previous research [32,33]. Regarding the relationship between DEBQ and

effortful control, both males and females showed similar correlations. That is, emotional and external eating were negatively associated with each effortful control subscale. In contrast, restrained eating was positively associated with activation control. The multiple regression analysis indicated that activation control was positively associated with restrained eating, whereas inhibitory control was negatively associated with emotional and external eating. Effortful control is the ability to inhibit a dominant response and to perform instead a subdominant response. Activation control is the capacity to perform an action when there is a strong tendency to avoid it [14]. Emotional eating and external eating are associated with disinhibition [34]. Disinhibition in eating behavior, which is characterized in part as the propensity to eat opportunistically in response to environmental cues, has long been associated with obesity in both youth and adults [35]. Previous work has shown that disinhibition is also negatively related to restrained eating [30]. These researches support the present findings and indicate that effortful control relates differently to restrained eating, emotional eating, and external eating.

We found a significant difference in Big Five personality traits between males and females only for openness. A previous study found no gender difference on Big Five personality trait items in medical students [36]. However, another study in Italy found gender differences on energy, agreeableness, and emotional stability [37]. Some research also indicates that women score higher than men on conscientiousness [38]. Therefore, studies vary regarding gender differences in Big Five personality traits; this may reflect subjects' characteristics.

The present study found that agreeableness, conscientiousness, and neuroticism were negatively correlated with emotional and external eating and that extraversion was positively correlated with external eating. The multiple regression analysis showed that neuroticism and openness were negatively associated with emotional and external eating and that extraversion was positively associated with emotional eating and external eating. Emotional and external eating can be considered problematic eating styles, as they are associated with higher body weights [39]. In a previous study, conscientiousness-related traits were negatively related to all risky health-related behaviors and positively related to all beneficial health-related behaviors [40]. Another study found a significant relationship between eating

behaviors and the personality facets associated with neuroticism and conscientiousness [24]. Research also shows that agreeableness is positively associated with beneficial health behaviors, such as vegetable consumption [41], and negatively associated with smoking and a healthy diet [42]; in contrast, extraversion is positively associated with drinking [42]. These reports support the results in the present study. However, we found that conscientiousness was positively correlated with restrained eating. The multiple regression analysis showed that activation control was positively associated with restrained eating. Restrained eating implies conscious determination and efforts to restrict food intake and calories to control body weight [30]. Restrained eating is positively correlated with greater education [43] and related to higher conscientiousness [25]. The present findings are consistent with this previous research.

This study had several limitations. First, our samples were convenience samples drawn from a limited area of Japan. Second, this was a cross-sectional design, which limits the possibility of drawing inferences about the direction of effects. Third, our sample contained fewer females than males.

5. CONCLUSION

In the present study, restrained eating was positively associated with effortful control, whereas emotional eating and external eating were negatively associated with effortful control. Extraversion was positively associated with emotional eating and external eating, whereas other Big Five personality traits were negatively associated with emotional eating and external eating. Taken altogether, our results indicate that eating behaviors are associated with effortful control and with Big Five personality traits. However, the direction of the associations of effortful control and Big Five personality traits with restrained eating differed from the associations of effortful control and personality with emotional and external eating.

CONSENT

It is not applicable. No treatment or intervention was performed on the participants.

ETHICAL APPROVAL

The study was approved by the Human Ethics Committee of the Graduate School of Human

Development and Environment, Kobe University (no. 140).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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