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

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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.

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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). Restained 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 (β = 0.214, p = 0.001) in males, and significantly negatively associated with openness to experience in females (β = −0.251, p = 0.010). Emotional eating was significantly negatively associated with inhibitory control in males (β = −0.215, p < 0.001). In females, emotional eating was significantly negatively associated with inhibitory control (β = −0.273, p = 0.001), and openness to experience (β = −0.241, p = 0.006), and significantly positively associated with extraversion (β = 0.186, p = 0.033). External eating was significantly positively associated with extraversion (β = 0.231, p < 0.001), and significantly negatively associated with inhibitory control (−0.159, p = 0.005) and neuroticism (β = −0.144, p = 0.005) in males. In females, external eating was significantly negatively associated with inhibitory control (−0.208, p = 0.028), neuroticism (β = −0.203, p = 0.020), and openness to experience (β = −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)**             |       |       |       |       |       |
| Restrainted 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)**           |       |       |       |       |       |
| Restrainted 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 |
| **Restrainted 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     | 0.101    |
| **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. Restraint 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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