No Effect on Body Dissatisfaction of an Interaction between 5-HTTLPR Genotype and Neuroticism in a Young Adult Korean Population

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Objective: Many studies suggest an association between the serotonin transporter gene-linked polymorphic region (5-HTTLPR) and anxiety-related personality traits (e.g., neuroticism) in healthy subjects. This study investigated the interaction of 5-HTTLPR genotype on body dissatisfaction by neuroticism and to evaluate the interaction of 5-HTTLPR genotype on self-esteem by body dissatisfaction in a young adult Korean population.

Methods: Two hundred and eighty three subjects were included in this study. The Eysenck Personality Questionnaire-Korean version was used to evaluate neuroticism, the Body Dysmorphic Disorder Examination-Self Report (BDDE-SR)-Korean version was used to evaluate body dissatisfaction, and the Self-Esteem Scale (SES)-Korean version was used to evaluate self-esteem. The 5-HTTLPR genotype by neuroticism (high : low) interaction was assessed according to the total BDDE-SR score, and 5-HTTLPR genotype by BDDE-SR (high : low) interaction was assessed according to the total SES score.

Results: The analysis of 5-HTTLPR genotype and neuroticism (high : low) with respect to body dissatisfaction showed no main effects of genotype whereas neuroticism did influence the BDDE-SR score and no interaction of the genotype with neuroticism. The analysis of 5-HTTLPR genotype and BDDE-SR (high : low) with respect to self-esteem score showed no main effects of genotype whereas BDDE-SR did influence the self-esteem score and no interaction of the genotype with body dissatisfaction.

Conclusion: These results suggest that an interaction between 5-HTTLPR genotype and neuroticism does not affect body dissatisfaction and an interaction between 5-HTTLPR genotype and body dissatisfaction does not affect self-esteem in a young adult Korean population.

KEY WORDS: 5-HTTLPR; Body dissatisfaction; Neuroticism; Self-esteem.

INTRODUCTION

Most people are concerned about their appearance and want to look good for others. In recent years, the mass media, advertisements, and other factors have showed a strong tendency to heighten and compare ideal body images¹⁾ and have led many people to exert excessive efforts to improve their body shape and appearance. In addition to this recent trend, people have become increasingly over-concerned about their body image.²⁾

Despite imaginary or mild defects with their body, some people are excessively negative about or dissatisfied with their body and have severe pain or impairments in

their social, professional and other activities, eventually leading to body dysmorphic disorder.³⁾ While body dissatisfaction can be influenced by physical factors like weight and aspects of appearance, it can also be significantly affected by personality traits and psychological, social and cultural factors.²⁾ Moreover, genetic factors are thought to have an influence. As body dissatisfaction has been recently suggested to be associated with abnormalities in the serotonin system, the use of selective serotonin reuptake inhibitors has been supported in the treatment of body dysmorphic disorder.⁴⁾

The personality traits of people who are unsatisfied with their appearance are characterized by sensitivity,⁵⁻⁸⁾ anxiety,⁷⁾ neuroticism,⁸⁾ shyness and reservation,^{9,10)} social avoidance,^{10,11)} introverted tendencies,⁸⁾ perfection with an obsessive tendency^{9,12,13)} and even hostility.¹⁴⁾ The personality trait variations of humans are influenced by genetic factors.¹⁵⁾ However, finding the specific genetic variants responsible for these personality trait variations is

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very difficult. The verification of specific genes and their associations using personality inventories is commonly investigated by behavioral geneticists¹⁶⁾ and many genetic studies associated with the serotonin system are being performed.

The principal function of the serotonin transporter (5-HTT) is to remove serotonin (5-HT) and return it to the presynaptic neuron, where the neurotransmitter can be degraded or retained for re-release at a later time. A functional polymorphism has been identified in the promoter region of the 5-HTT gene (5-HTT gene-linked polymorphic region; 5-HTTLPR), which consists of two common alleles differing by 44 base pairs: the short (S) and long (L) allele variants.¹⁷⁾ The L-allele is known to be 2-3 times more active in transcription than is the S-allele.^{17,18)} Lesch *et al.*¹⁹⁾ investigated the association of 5-HTTLPR genotype with anxiety-related traits using the NEO personality inventory and reported that the neuroticism item scores were higher in the group with the S-allele (S/S, S/L, or S/S + S/L) than they were in the group without the S-allele (L/L). Since then, several studies have been conducted to identify the relationship between 5-HTTLPR genotype and various mental illnesses. A possible association of the 5-HTTLPR S-allele with the drive for thinness and with body dissatisfaction has been suggested in eating disorders in females.²⁰⁾ However, there are no studies to support this report.

The purpose of this study was to examine the effects of 5-HTTLPR genotype on body dissatisfaction according to an interaction with neuroticism and on self-esteem according to an interaction with body dissatisfaction in a young adult Korean population.

METHODS

Participants

This study was conducted on normal individuals who resided in Daejeon, Korea. Participants were recruited by internet of Chungnam National University Hospital (CNUH) and directly visit. Participants were provided with adequate information about their participation in the study and gave informed consent voluntarily prior to completing the questionnaires. Participants included 283 young adult Koreans. No one had any medical or psychological problems. All subjects were of Korean descent and as far as they knew all subjects had ancestors of exclusively Korean descent. This study was approved by the Institutional Review Board of the CNUH and the procedures were followed in accordance with the Helsinki Declaration.

Measures

Neuroticism

The evaluation of neuroticism was performed using the neuroticism items of the Korean version of the Eysenck Personality Questionnaire (EPQ). The original EPQ was developed by Eysenck and Eysenck.²¹⁾ This questionnaire assesses the personality traits of a person according to four major dimensions: psychoticism, extraversion-introversion, neuroticism, and lie or social desire. The Korean version of the EPQ was standardized by Eysenck and Lee.²²⁾ This study classified subjects into high-neuroticism group and low-neuroticism groups based on the mean (9.2191) of the total score of neuroticism.

Body dissatisfaction

Body dissatisfaction was evaluated using the Korean version of the Body Dysmorphic Disorder Examination-Self Report (BDDE-SR). The BDDE-SR was devised by Rosen and Reiter²³⁾ and standardized by Kim *et al.*²⁴⁾ and Kim *et al.*²⁵⁾ in Korea. Of the three parts of the survey, only Part 3 was used in this study. There were 30 questions about the body part that was most unsatisfactory during the previous month. Each question used a scale from 0 to 6 depending on the severity. The score ranged from 0-168 points. A higher score indicated severe dissatisfaction with the body appearance. This study divided the subjects into high-body dissatisfaction group and low-body dissatisfaction groups based on the mean (32.6219) of the total score of BDDE-SR.

Depression

Depression was evaluated using the Korean version of the Beck Depression Inventory (BDI). The BDI was first introduced by Beck *et al.*,²⁶⁾ and standardized into the Korean version by Lee and Ih.²⁷⁾

Self-Esteem Scale

Rosenberg²⁸⁾ devised the Self-Esteem Scale (SES) to test the self-esteem of a person and evaluate the degree of self-respect and the aspect of self-acceptance. The SES comprised a total of 10 questions, including 5 questions each on positive self-esteem and negative self-esteem. The score ranged from 10 to 40 points, and a higher score indicated a higher self-esteem. This study used the scale adapted by Lee.²⁹⁾ The subjects were divided into high-SES group and low-SES group according to the mean (31.4735) of the total score of SES.

Body Mass Index

Body Mass Index (BMI) was calculated by dividing the body weight (in kilograms) by the height (in meters) squared.

Genetic Analysis

The genetic analysis was performed based on the procedures of Lesch *et al.*¹⁹ with modification. Venous blood was collected, and then DNA was isolated from the blood sample using the Wizard® genomic DNA purification kit (Promega, Madison, WI, USA). The polymorphic site of 5-HTTLPR was amplified by the polymerase chain reaction (PCR) using F: 5-GTG CAA GGA GAA TGC TGG AG-3 and R: 5-CAA CTC CCT GTA CCC CTC CT-3 as primers. After an initial denaturation for 5 min at 95°C, the PCR was performed for 34 cycles of 30 sec at 95°C, 30 sec at 60°C, and 30 sec at 72°C, followed by incubation for 5 min at 72°C. The amplified DNA sample was electrophoresed in a 2.5% agarose gel and then stained with ethidium bromide (1 µg/mL). The genotypes were determined as S/S (254 bp), S/L (297 bp and 254 bp), or L/L (297 bp).

Statistical Analysis

All data were checked for normal distribution with Kolmogorov-Smirnov test. If not the normal distribution was performed with nonparametric statistics. The mean values of age, BMI, neuroticism, BDDE-SR, and SES according to the 5-HTTLPR genotype were compared with one-way ANOVA. Value of BDI was done with Kruskal-Wallis test. For the comparison of genotype according to sex, the χ^2 -test was performed. The effect of the interaction of 5-HTTLPR genotype and neuroticism (high :

low) on the total BDDE-SR score was analyzed by univariate ANOVA with the general linear model (GLM). The difference in the total BDDE-SR score between the high-neuroticism group and low-neuroticism group was compared using the *t*-test. The effect of the interaction of the 5-HTTLPR genotype and BDDE-SR (high : low) on the total self-esteem score was analyzed by univariate ANOVA with the GLM. The difference in the total SES score between the high-BDDE-SR group and low-BDDE-SR group was compared using the *t*-test. The statistical analyses were performed using IBM SPSS Statistics software for Window version 20 (IBM Co., Armonk, NY, USA), and *p*-values of less than 0.05 were considered statistically significant.

RESULTS

Demographics

Table 1 showed that 5-HTTLPR genotypes (S/S, S/L, L/L) did not differ across a range of demographics and assessments including BMI, BDDE-SR, neuroticism, BDI, SES. The 5-HTTLPR genotypes were in Hardy-Weinberg equilibrium ($\chi^2=0.48$, $p>0.05$).

5-HTTLPR (S/S, S/L, L/L) X Neuroticism (High : Low) on the BDDE-SR Total Score

When this study examined the effect of the interaction of 5-HTTLPR genotype and neuroticism on the total BDDE-SR score, 5-HTTLPR genotype did not influence the score ($F=0.800$, $p=0.450$), whereas neuroticism did influence the score ($F=16.805$, $p=0.001$). The interaction of 5-HTTLPR genotype and neuroticism did not affect the total BDDE-SR score ($F=1.896$, $p=0.152$). The BDDE-SR scores were 40.07 ± 19.03 in the high-neuroticism

Table 1. Demographic and clinical characteristics by 5-HTTLPR genotype

Variable	5-HTTLPR genotype			Statistics
	S/S	S/L	L/L	
Total	161 (56.9)	102 (35.9)	20 (7.1)	$\chi^2=351$, $df=2$, $p=0.861$
Male	120 (56.1)	78 (36.4)	16 (7.5)	
Female	41 (59.4)	24 (34.8)	4 (5.8)	
Age (yr)	23.46 $\pm$ 1.66	23.99 $\pm$ 2.23	23.55 $\pm$ 1.64	$F=2.511$, $p=0.830$
BMI	22.23 $\pm$ 2.88	22.12 $\pm$ 2.56	21.01 $\pm$ 2.11	$F=1.811$, $p=0.165$
BDDE-SR	31.79 $\pm$ 16.65	33.47 $\pm$ 18.97	34.95 $\pm$ 15.22	$F=0.480$, $p=0.619$
Neuroticism	8.96 $\pm$ 5.69	9.83 $\pm$ 6.29	8.15 $\pm$ 5.55	$F=1.024$, $p=0.361$
BDI*	5.60 $\pm$ 5.03	6.48 $\pm$ 5.62	6.15 $\pm$ 7.53	$\chi^2=1.460$, $p=0.482$
SES	31.45 $\pm$ 4.62	31.38 $\pm$ 4.19	32.15 $\pm$ 5.36	$F=0.247$, $p=0.781$

Values are presented as number (%) or mean $\pm$ standard deviation.

S, short; L, long; BMI, Body Mass Index; BDDE-SR, Body Dysmorphic Disorder-Self Report; BDI, Beck Depression Inventory; SES, Self-Esteem Scale; *df*, degree of freedom.

*Kruskal-Wallis test.

Table 2. Neuroticism (high : low) on the BDDE-SR total score and BDDE-SR (high : low) on the SES total score by 5-HTTLPR genotype

Variable	5-HTTLPR genotype			Statistics
	S/S	S/L	L/L	
BDDE-SR				
H-Neuroticism (n=126)	71 (37.90±18.57)	51 (42.82±19.71)	4 (43.50±16.50)	$F=1.060, p=0.349$
L-Neuroticism (n=157)	90 (26.98±13.19)	51 (24.18±12.53)	16 (32.81±14.64)	$F=2.737, p=0.068$
SES				
H-BDDE-SR (n=128)	74 (30.70±4.32)	44 (29.73±3.89)	10 (30.20±6.32)	$F=0.695, p=0.501$
L-BDDE-SR (n=155)	87 (32.08±4.78)	58 (32.64±3.99)	10 (34.10±3.51)	$F=1.044, p=0.354$

Values are presented as number (mean±standard deviation).

S, short; L, long; H, high; L, low; BDDE-SR, Body Dysmorphic Disorder-Self Report; SES, Self-Esteem Scale.

group and 26.64 ± 13.28 in the low-neuroticism group ($t=6.715$, degree of freedom [df]=281, $p=0.001$). However, no differences in the BDDE-SR scores were found between the high-neuroticism ($F=1.060, p=0.349$) and the low neuroticism ($F=2.737, p=0.068$) groups by genotype (Table 2).

5-HTTLPR (S/S, S/L, L/L)×BDDE-SR (High : Low) on the SES Total Score

When this study examined the effect of the interaction of 5-HTTLPR genotype and BDDE-SR on the total SES score, 5-HTTLPR genotype did not influence the score ($F=0.497, p=0.666$), whereas BDDE-SR did influence the score ($F=13.076, p=0.001$). However, the interaction of 5-HTTLPR and BDDE-SR did not affect self-esteem ($F=1.382, p=0.253$). The SES scores were 30.31 ± 4.26 in the high-BDDE-SR group and 32.55 ± 4.48 in the low-BDDE-SR group ($t=4.307, df=281, p=0.001$). However, no differences in the SES scores were found between the high-BDDE-SR ($F=0.695, p=0.501$) and low-BDDE-SR ($F=1.044, p=0.354$) groups by genotype (Table 2).

DISCUSSION

The aim of this study was to examine whether the interaction of 5-HTTLPR genotype with neuroticism influenced body dissatisfaction and whether the interaction of 5-HTTLPR genotype with body dissatisfaction influenced self-esteem in a young adult Korean population. The results revealed that the interaction of 5-HTTLPR genotype and neuroticism had no influence on body dissatisfaction and the interaction of 5-HTTLPR and body dissatisfaction had no influence on self-esteem.

Many studies have investigated the association of 5-HTTLPR genotype with the personality traits of normal individuals¹⁶⁾ and with various mental illnesses.³⁰⁾ However, very few studies of this genetic variant have been performed with respect to body dissatisfaction. Frieling *et*

*al.*²⁰⁾ reported that those with the 5-HTTLPR S-allele tended to have higher scores on the body dissatisfaction scale of the Eating Disorder Inventory-2 in females with eating disorders. Eating disorders and obesity are predicted to have a relationship with body dissatisfaction, and 5-HTTLPR has been associated with eating disorders. The S-allele genotype, in particular, seems to work as a risk factor for obesity by increasing body weight and accelerating energy intake.^{31,32)}

However, Hinney *et al.*³³⁾ reported that 5-HTTLPR genotype was not associated with being either overweight or underweight. Although 5-HTTLPR genotype alone is considered to be related to the regulation of eating disorders, it is not a deterministic factor.³⁴⁾ Furthermore, stress has effects on eating disorders and obesity. Energy intake tends to increase by consuming more food when a person experiences emotional stress,³⁵⁾ and neuroticism increases the sensitivity to stress.³⁶⁾ Markus and Capello³⁴⁾ reported that the BMI increases in people with high neuroticism and the 5-HTTLPR S-allele.

Lowered serotonin transmission and functioning generate methods for coping with non-adaptive stress³⁷⁾ and excessive energy intake.³⁸⁾ Moreover, it is associated with body dysmorphic disorder, manifesting body dissatisfaction as the major symptom.⁴⁾ In this study, 5-HTTLPR had no influence on body satisfaction. However, neuroticism was found to influence body satisfaction. We were able to identify that self-esteem is affected more by body satisfaction than 5-HTTLPR. Therefore, we conclude that 5-HTTLPR has no effect on body dissatisfaction through neuroticism and no effect on self-esteem through the degree of body dissatisfaction. There were some limitations in this study. First, the use of self-report measurement of to assess the psychological problems might be have led to bias. Second, we did not get the information family history of psychiatric illness and such information might be relevant to the association between the genetic polymorphism and psychological problems. Third, the sample size may

be too small to examine the genetic polymorphism $\times$ psychological problems interactions.

Several pieces of evidence have suggested that 5-HTTLPR has a considerable influence on psychopathology. However, the exact mechanism by which the 5-HTTLPR genetic polymorphism plays a role has not been fully clarified. Additional studies with larger sample sizes, including clinical populations, on the combinational interactions of 5-HTTLPR, other genetic polymorphisms (e.g., Stin 2) in serotonin transporter genes³⁹⁾ and the tri-allelic 5-HTTLPR polymorphism⁴⁰⁾ in particular, are thought to be crucial to further examine the association between 5-HTTLPR and body dissatisfaction.

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