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Attachment styles predict personality traits according to a pilot study of patients with anxiety and mood disorders

Victor Israel Cervera-Solís,[1] Manuel Alejandro Muñoz Suárez,[2] José Francisco Cortés Sotres,[3] José Octavio Hernández Lagunas,[4] Adriana Díaz-Anzaldúa[4]

[1] Dirección de Servicios Clínicos, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

[2] Hospitlización y APC, Dirección de Servicios Clínicos, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

[3] Departamento de Apoyo Académico, Dirección de Enseñanza, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

[4] Departamento de Genética, Subdirección de Investigaciones Clínicas, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México. México.

Correspondence:
Adriana Díaz Anzaldúa
Departamento de Genética, Subdirección de Investigaciones Clínicas, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz.
Calzada México Xochimilco 101, Col. San Lorenzo Huipulco, C.P. 14370, Ciudad de México, México.
Phone: 52(55) 4160-5114
Email: adiaza2@imp.edu.mx

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ABSTRACT

Introduction. The mother and child attachment could have an important and long-lasting impact. An insecure attachment could lead to emotional development difficulties. It has been suggested that maternal care in infants is associated with personality. However, more studies in adults are needed. **Objective.** To determine if attachment styles in subjects with affective or anxiety disorders are associated with the expression of personality traits, and if this effect can be modulated by the presence of the short allele of the 5-HTTLPR polymorphism. **Method.** Our sample included 87 patients with mood or anxiety disorders. The NEO-PI-R questionnaire and the Adult Attachment questionnaire by Melero were used. **Results.** Insecure attachment styles were associated with a higher expression of neuroticism, and a lower expression of extraversion, conscientiousness, and agreeableness, especially in individuals with the most insecure attachment. An interaction was identified between the attachment style and the 5-HTTLPR genotype on the expression of agreeableness. Higher neuroticism, and lower extraversion and conscientiousness tended to be present in carriers of the S allele. **Discussion and conclusion.** There was a significant association between the attachment styles and the expression of neuroticism, extraversion, agreeableness, and conscientiousness-responsibility according to the Big Five Model. The short allele may be associated with the modulation of certain aspects of personality. Prevention strategies should be established to promote adequate attachments between infants and caregivers to avoid a possible risk factor for future maladaptive personality traits.

Keywords: Personality and attachment, NEO-PI-R, gene-environment interactions, 5-HTTLPR, SLC6A4.

RESUMEN

Introducción. El apego entre la madre y el hijo puede tener un impacto importante. Un apego inseguro podría afectar el desarrollo emocional. Se ha sugerido que los cuidados de la madre en la infancia temprana se asocian a la personalidad. Sin embargo, se requieren más estudios en adultos. **Objetivo.** Determinar si los estilos de apego en personas con trastornos del afecto o ansiedad se asocian a la expresión de rasgos de personalidad y si esta expresión es modulada por la presencia del alelo corto del polimorfismo 5-HTTLPR. **Método.** Se incluyeron 87 pacientes. Se emplearon los cuestionarios NEO-PI-R y el de Apego en el Adulto de Melero. **Resultados.** Los estilos de apego inseguro se asociaron con una expresión mayor de neuroticismo y menor de extroversión, conciencia y amabilidad, especialmente en los individuos con el estilo de apego más inseguro. Se identificó una interacción entre el estilo de apego y el genotipo del 5-HTTLPR en la expresión de amabilidad. En los portadores del alelo corto hubo una tendencia hacia mayores valores de neuroticismo y menores niveles de extroversión y conciencia. **Discusión y conclusión.** Los estilos de apego se asocian con la expresión de neuroticismo, extroversión, amabilidad y conciencia/responsabilidad. El alelo corto del 5-HTTLPR podría asociarse con la modulación de algunos aspectos de la personalidad. Los resultados sugieren la importancia de promover un apego adecuado entre los niños y sus cuidadores primarios para evitar posibles riesgos que se asocien con rasgos desadaptativos de la personalidad.

Palabras clave: Personalidad y apego, NEO-PI-R, interacciones genético-ambientales, 5-HTTLPR, SLC6A4.

INTRODUCTION

John Bowlby proposed that the mother-child attachment could have an important and long-lasting impact on several aspects of life (Bowlby, 1958). Attachment involves a group of behaviors that encourage the proximity between an infant and his or her main bond, who usually is the mother. This system starts working during the first 12 months of life and it depends on the innate necessities of the child; it may differ according to the infant needs and the environment. The tendency to build attachment relationships could be biologically modulated (Ainsworth, Bell, & Stayton, 1971; Main, 1995; Malik & Marwaha, 2022).

Empirical data have demonstrated that insecure attachment patterns may be risk factors for difficulties during the emotional development (Adam, Sheldon, & West, 1995; Fonagy et al., 1996; Patrick, Hobson, Castle, Howard, & Maughan, 1994). It has been proposed that attachment patterns gradually become a property of the individual. Also, that there are mental representations of interactions related with attachment that guide the person in his or her future attachment interactions (Bowlby, 1998). It is mainly accepted that attachment patterns in adulthood are generalized thoughts, feelings, and expectations that regulate the way an individual gets involved in close relationships (Rholes & Simpson, 2004). Attachment patterns are thought to be relatively stable over time. In this way, a person who has experienced sensitive and warm care will tend to have a positive and open attitude towards future close relationships, which may evoke positive responses in others.

A link between maternal care in early life and the development of personality has been suggested (Bowlby, 2005). Personality, as a psychological construct, has been studied from different perspectives. Nevertheless, how it develops, what factors influence its characteristics, and how these factors can be modified need to be further investigated. The Big Five Model has been consistently used and it is accepted as one of the closest models of the personality construct. In this model, factors that underlie personality are extraversion, neuroticism, agreeableness, openness to experience, and responsibility or conscientiousness (Schmidt et al., 2010). According to the evidence, these factors show genetic and environmental influences.

Although twin studies have allowed estimating a heritability of .49 to .57 for extraversion, .33 to .51 for agreeableness, .44 to .52 for conscientiousness, .41 to .58 for neuroticism, and .53 to .61 for openness, the precise genetic factors implicated in the expression of each trait have not been unequivocally identified (Jang, Livesley, & Vernon, 1996).

The genetic variant that has been more frequently associated with personality traits is the short allele of the 5-HTTLPR polymorphism, located at the promoter region of the serotonin transporter gene (SLC6A4). This allele has been directly associated with higher levels of neuroticism using the NEO personality questionnaire in its revised version (NEO-PI-R), but results are still inconclusive as they have not always been replicated (Arbelle et al., 2003; Ball et al., 1997; Beevers Wells, Ellis, & McGeary, 2009; Flory et al., 1999; Fox, Ridgewell, & Ashwin, 2009; Jorm et al., 1998; Munafo, Clark, & Flint, 2005). Further evidence supporting an association between the 5-HTTLPR marker and the Big Five Model was reported in a sample from Sweden, where childhood adversity and the polymorphism were found to be associated with openness in a recessive manner (Rahman et al., 2017). A functional dominance of the low activity S allele has been described. In a Caucasian sample, male carriers of the S allele had higher openness than non-carriers (Stoltenberg et al., 2002). In another study, carriers of the 5-HTTLPR S allele and the BDNF 66 methionine allele were associated with the mental health of college students; mental health correlated with conscientiousness, extraversion, and neuroticism (Nestor et al., 2021).

In addition, parental care and attachment have been associated with mental disorders such as depression or anxiety (Lacasa, Mitjavila, Ochoa, & Balluerka, 2015; Rosas Santiago, Marván Garduño, Hernández-Aguilera, & Campos Uscanga, 2021; Zheng, Luo, & Chen, 2020).

The aim of this study was to evaluate if attachment styles influence the expression of personality traits, and if this effect is modulated by the presence of the short allele of the 5-HTTLPR polymorphism in individuals with mood or anxiety disorders.

METHOD

Design of the study, subjects, and places

A cross-sectional study was carried out in a group of 101 Mexican Mestizo patients from the outpatient clinic at the National Institute of Psychiatry Ramón de la Fuente Muñiz (INPRFM, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz). They all had a diagnosis of a mood or anxiety disorder according to the *Diagnostic and Statistical Manual of Mental Disorders* IV, text revision (DSM IV-TR). Patients with intellectual disability, schizophrenia, bipolar disorder in mania, hypomania or with psychotic symptoms, dementia, active abuse or dependence to drugs, and/or with mood or anxiety disorders secondary to a medical cause were excluded. Patients who left more than 40 items blank, those who decided to withdraw from the study after inclusion, or whose DNA and/or genotype was not available were not considered. Hence, our sample included 87 patients who were 18 to 60 years old and had a mean age of 35.56 years, standard deviation (S.D.) 12.42 years. There were 69 women and 18 men. Main diagnoses were major depression (N = 62), dysthymia (N = 1), bipolar disorder II in euthymia (N = 2), anxiety disorder with agoraphobia (N = 4), social phobia (N = 1), and generalized anxiety disorder (N = 17). Some patients had

more than one of these disorders. Apart from these conditions and the ones that were excluded, other comorbidities and the specific treatment of each patient were not taken into consideration.

Measurements and procedure

Personality. The NEO-PI-R questionnaire was used to evaluate personality. By means of 240 items, it represents the measurement of the Five Factor Model with the description of the expression of extraversion, agreeableness, conscientiousness/responsibility, neuroticism, and openness to experience. Results of T scores for NEO-PI-R are categorized as very low (20 to 35), low (35 to 45), average (45 to 55), high (55 to 65), or very high (65 to 80; McCrae, 2002; McCrae, Terracciano, & Personality Profiles of Cultures, 2005). In a study on twins, alpha coefficients for the NEO-PI-R subscales fluctuated from .69 to .90 (Eggert, Levendosky, & Klump, 2007). In a test-retest study in university students, the reliability of the Spanish version was described (Gellman, 1994). In addition, in two samples from university students in Mexico, alpha for the five dimensions ranged from .79 for openness to experience to .88 for neuroticism and conscientiousness/responsibility (Ortiz, 2006).

To evaluate attachment styles, we used the Adult Attachment Questionnaire developed by Melero and coworkers, with 40 items grouped into four scales. Its analysis allows the classification of subjects according to a secure, insecure worried, insecure dismissing, and insecure hostile fearful attachment (Melero & Cantero, 2008).

Genetics

DNA was extracted from cheek brushing cells with the Gentra Puregene Buccal cell kit. PCR reactions for the 5-HTTLPR polymorphism were performed as follows: Primer sequences (Invitrogen) previously described (Collier et al., 1996; Lesch et al., 1996): Forward: 5'-GGCGTTGCCGCTCTGAATGC-3' and Reverse. 5'-GAGGGACTGAGCTGGACAACCAC-3'. The PCR mix included .2 mM dNTPs, 1.8 mM MgCl2, 1x Hot Start PCR buffer (Fermentas Life Science), .5 µM each primer, 5% DMSO, .25 U Hot Start Taq DNA polymerase (Fermentas Life Science), and water (Sigma–Aldrich) in a total volume of 12 µL. Amplification conditions were: 95°C for 12 min followed by 40 cycles of 95°C for 30 sec, 61°C for 30 sec, and 72°C for 1 min, with a final extension at 72°C for 5 min. PCR products were electrophoresed on a 1.4% agarose gel (.7% Ultrapure Agarose Invitrogen, and .7% high resolution agarose Gene Choice). Individuals with the three possible genotypes were identified: homozygotes for the large allele (LL), heterozygotes (LS), and homozygotes for the S allele (SS).

Each personality trait was compared with the attachment style, the 5-HTTLPR polymorphism or a combination of these factors.

Statistical analyses

Clinical and demographic characteristics among diagnostic groups were described by frequencies and percentage for categorical variables, as well as mean and standard deviation for continuous variables. To determine the effect over the variance in the expression of personality traits according to the Big Five Model, a univariate ANOVA was used for each factor of personality, attachment style, 5-HTTLPR genotype and the combination of both. The t-test for independent means was used to determine whether there were differences in personality among groups of patients with different attachment styles.

Ethical considerations

The study was approved by the Research Ethics Committee of the INPRFM on November 26, 2012. Patients gave a written informed consent.

RESULTS

Mean values in the sample were very high for neuroticism, average for openness, and low for extraversion, agreeableness, and responsibility (Figure 1).

The most common attachment style was hostile fearful (in 36% of the sample), followed by secure (in 27%), insecure dismissing (in 22%), and insecure hostile (in 15%).

The variance of values for neuroticism, extraversion, agreeableness, and conscientiousness was explained by differences in the attachment style ($p < .05$).

Regarding genetics, the sample included 11 homozygotes for allele L, 42 heterozygotes, and 34 homozygotes for allele S. The genotype frequencies of the 5-HTTLPR marker did not deviate from Hardy Weinberg Equilibrium

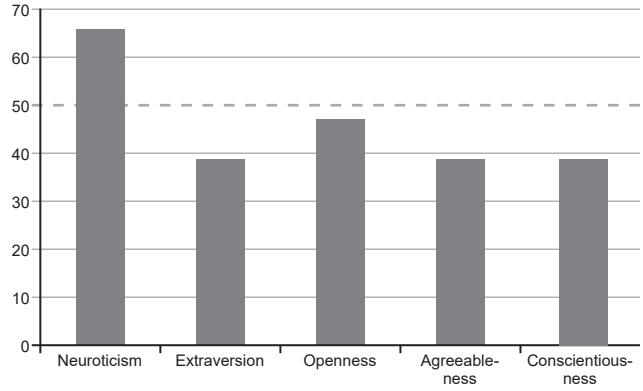

Figure 1. Mean T scores for NEO PI-R scales. A value of 50 represents the expected average for the general population.

Table 1
Univariate ANOVA results for personality factors with respect to attachment styles, 5-HTTLPR genotype, and a combination of both

NEO PI-Rfactor	*Significance for attachment style*	*Significance for genotype*	*Significance for attachment style and genotype interaction*
Neuroticism R^2 = .490 (Corrected R^2 = .445)	.000* (F = 22.904, 3 df)	.100 (F =2.775, 1 df)	.227 (F = 1.478, 3 df)
Extraversion R^2 = .222 (Corrected R^2 = .153)	.002* (F = 5.580, 3 df)	.109 (F= 2.627, 1 df)	.369 (F = 1.065, 3 df)
Openness R^2 = .086 (Corrected R^2 = .005)	.254* (F = 1.382, 3 df)	.363 (F = 0.836, 1 df)	.485 (F = .823, 3 df)
Agreeableness R^2 = .328 (Corrected R^2 = .268)	.000* (F = 6.881, 3 df)	.410 (F = 0.686, 1 df)	.001 (F = 5.727, 3 df)
Conscientiousness R^2 = .295 (Corrected R^2 = .232)	.000* (F = 9.589, 3 df)	.122 (F = 2.449, 1 df)	.615 (F = .603, 3 df)

Note: * $p < .05$ values.

(χ^2 = .13, p = .722). There was a significant effect of the interaction of the attachment style and the 5-HTTLPR polymorphism (carriers of the S allele versus non-carriers) on the expression of agreeableness (Tables 1 and 2).

Neuroticism. There was a significant influence of the attachment style on the expression of neuroticism, which was higher in the most insecure attachment styles, i.e., in insecure hostile fearful attachment, followed by insecure worried, and insecure dismissing; the lowest neuroticism mean score was found in patients with a secure attachment style. Furthermore, higher levels of neuroticism were identified in carriers of the S allele (mean ± SD = 66.36 ± 12.33) when compared to non-carriers (61.49 ± 10.42), but this difference was not significant.

Extraversion. There was a statistically significant effect between the attachment style and the expression of extraversion. Subjects with a secure attachment had similar extraversion levels than those reported for the general population. In contrast, there were very low levels of extraversion in individuals with insecure dismissing and hostile fearful attachment styles. Regarding the genotype, carriers of the S allele tended to have a lower expression of extraversion (38.15 ± 13.46) than non-carriers (44.48 ± 9.68).

Openness. In general, individuals with secure or insecure worried attachments had similar openness values to those reported in the general population. There were lower levels of openness in individuals with insecure dismissing attachment, but still considered average, and

Table 2
Genotype and allele frequencies with T score means for agreeableness grouped by attachment style and genotype

Genotype	*Males n (%)*	*Females n (%)*	*Total sample n (%)*	*Alleles*	*Total sample n (%)*
LL	0 (0)	11 (12.64)	11 (12.64)	L	64 (36.78)
LS	15 (17.24)	27 (31.04)	42 (48.28)	S	110 (63.22)
SS	3 (3.45)	31 (35.63)	34 (39.08)		

Genotype	*Attachment style*	*Mean*	*Standard Deviation*	*n (%)*
LL	Secure	46.63	10.93	4 (4.60)
	Insecure dismissing	8.95		1 (1.15)
	Insecure worried	38.22	12.33	2 (2.3)
	Insecure hostile fearful	45.07	10.13	4 (4.60)
	Total	*41.11*	*14.33*	*11 (12.64)*
LS/SS	Secure	42.53	7.19	21 (24.14)
	Insecure dismissing	38.76	10.84	17 (19.54)
	Insecure worried	46.80	9.11	11 (12.64)
	Insecure hostile fearful	31.91	10.31	27 (31.03)
	Total	*38.53*	*10.82*	*76 (87.36)*
Total	Secure	43.18	7.77	25 (28.74)
	Insecure dismissing	37.11	12.65	18 (20.69)
	Insecure worried	45.48	9.61	13 (14.94)
	Insecure hostile fearful	33.61	11.07	31 (35.63)
	Total	*38.86*	*11.26*	*87 (100)*

the lowest levels were found in those with an insecure hostile fearful attachment. S-allele carriers had higher levels of openness (47.71 ± 11.46 *vs*. 43.59 ± 11.46 in non-carriers), but we did not identify a statistically significant association between the attachment style and the genotype, or between a combination of these variables with the expression of this personality trait.

Agreeableness. There was a significant effect of the attachment style on the variance of the expression of agreeableness. The lowest levels of agreeableness were identified in the most insecure attachment style (insecure hostile fearful). The S allele by itself does not explain the differences in variance for agreeableness, but the allele in combination with attachment styles does explain this variance in a significant manner. The lowest mean score of agreeableness was identified in patients who were carriers of the S allele and had an insecure hostile fearful attachment (Tables 1 and 2)

Conscientiousness. A very significant influence of the attachment style on the expression of conscientiousness was identified ($p < .001$). Subjects with a secure attachment had a higher expression of conscientiousness. Individuals with insecure dismissing and insecure worried attachments had lower levels, while those with an insecure hostile fearful attachment had the lowest levels. There was a tendency of lower levels of conscientiousness in carriers of the S allele (mean 38.31 ± 11.94 vs. a mean of 43.40 ± 6.59 in non-carriers). T scores according to NEO PI-R for each attachment style are shown in Figure 2.

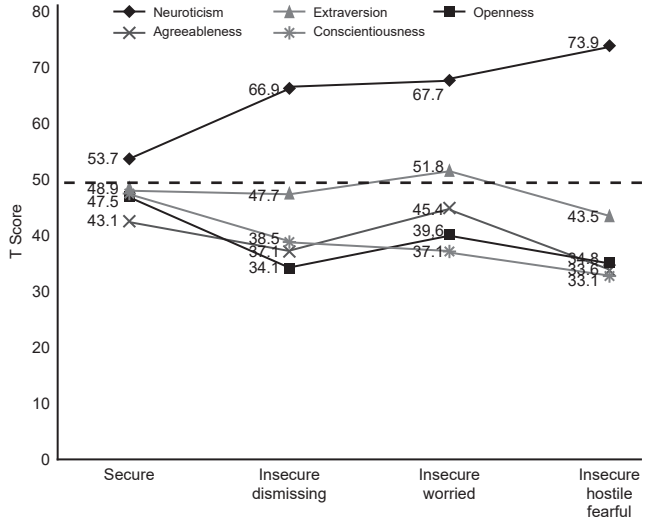

Figure 2. Mean T scores for personality traits in each attachment style. In T scores, a value of 50 represents the mean for the general population. Any value that moves away from 50 is considered a deviation from the expected score.

DISCUSSION AND CONCLUSION

There was a significant effect of the attachment styles on the expression of neuroticism, extraversion, agreeableness, and conscientiousness/responsibility according to the Big Five Model. Individuals with a secure attachment style had average scores of neuroticism, extraversion, openness, and conscientiousness, indicating that this attachment style may protect against maladaptive personality traits.

The insecure attachment styles were more common in our sample. Almost three out of four patients (73%) had this kind of attachment (dismissing, worried, or hostile fearful). Given that insecure attachments are a risk factor for difficulties during emotional development (Adam et al., 1995; Fonagy et al., 1996; Patrick et al., 1994), it is possible that they are more prevalent in psychiatric samples composed of patients with anxiety and depression than in non-clinical samples, in which 65% of the individuals are expected to have a secure attachment (Main, Kaplan, & Cassidy, 1985).

The insecure hostile fearful attachment was identified in 36% of the sample, which has been considered in adults as the equivalent to the insecure disorganized attachment in infants, i.e., the most insecure of attachments. This style is considered as secondary to early stressful or traumatic situations in which the bond with the primary caregiver, loaded with the need of love and care, was affected by fear and aggression, leading to internal working models that make it difficult to establish a secure basis to explore the world (Lyons-Ruth K, 1996). The second most common style was the secure attachment, followed by insecure dismissing, and insecure worried styles.

Differences in the expression of neuroticism were significantly correlated with the attachment style and showed a directly proportional increase as the degree of insecure attachment increased, finding the highest levels of neuroticism in subjects with a hostile fearful attachment, followed by insecure worried, insecure dismissing, and finally secure attachment. According to the Big Five Model, neuroticism is understood as a tendency to experience negative emotions such as anger, anxiety, and depression, and even emotional instability. This is consistent with the belief that a secure attachment could be a protective factor against high levels of neuroticism; a secure basis could allow the individual to regulate more easily his or her negative feelings, turning to a positive self-model, possibly encouraging positive thoughts and feelings that can help to cope with everyday stressful situations or interpersonal difficulties.

The attachment style, rather than the genotype, helped explain differences in extraversion. Patients with secure or insecure worried attachments had similar extraversion scores when compared with the expected values for the general population, which was not the case for patients with insecure dismissing or insecure hostile fearful attachments. Extraversion can be considered as a predominance

of positive emotions, insurgency, a tendency to stimulation seeking, for being close to others, for an involvement with the outer world, the capacity to enjoy while being close to others, being enthusiastic, action-oriented, and being positive in front of opportunities of excitement. It is interesting that high extraversion was associated with a secure attachment style. This result supports the notion that an adequate emotional regulation based on the attachment style and a positive model of others and oneself could facilitate the development of adaptative personality traits, such as extraversion, by connecting with others and allowing a more optimistic perception of life. The insecure worried attachment is regarded as resulting from internal working models that arise from an ambivalent-resistant attachment in infancy, when there is an excessive dependency on the caregiver, and the infant is not easily calmed after a separation or a stressful situation. There is a tendency to have a positive model of others and a negative self-model when they reach adulthood. This is consistent with the fact that patients with an insecure worried attachment style were more extroverted than people with other insecure attachment styles. According to Melero and coworkers, an insecure dismissing attachment implies internal working models in which a positive self-model and a negative model of others dominates. In contrast, in an insecure hostile fearful attachment, there are negative models of oneself and of others (Ainsworth et al., 1971; Ainsworth, Blehar, Waters, & Wall, 1978). In our sample, these two styles of attachment were associated with lower levels of extraversion, with only a tendency to lower levels of extraversion in carriers of the S allele.

Regarding openness, patients with an insecure hostile fearful attachment had the lowest scores and they may tend to have more conventional and traditional interests, a preference for simple or obvious matters.

Agreeableness was lower in individuals with an insecure dismissing or hostile fearful attachment. The variance of the expression of agreeableness was affected by an interaction between the attachment style and the genotype. Carriers of the S allele expressed lower levels of agreeableness than non-carriers, which was significant when the attachment style was taken into consideration. Nevertheless, the significance of this result should be further explored, given that comparison subgroups were very small.

There was also an important association between attachment and conscientiousness, with high levels of conscientiousness in subjects with secure attachment, and the lowest levels in individuals with the most insecure attachment styles. Conscientiousness in this case is understood as a tendency to show self discipline, to act responsibly, and actively try to reach goals and external expectations. This trait shows a preference for planned rather than spontaneous behavior and it influences the way we control, regulate, and direct our impulses. Our finding evokes the concepts of self direction and coherence, both of which are altered in serious personality disorders. It may be that the presence of an insecure attachment influences the development of a personality with certain deficiencies in self-discipline, responsibility, and goal attainment. Although there was a tendency to express lower levels of conscientiousness in S allele carriers, this was not statistically significant.

Even when the variance analysis did not show a statistically significant effect of the S allele on the overall differences in the expression of personality traits, it is important to consider the high frequency of carriers of this allele (87.36%) in a sample with high levels of neuroticism. It would be relevant to analyze attachment styles, personality, and the 5HTTLPR marker in non-clinical samples from the Mexican population to determine if the prevalence of the S allele is similar or if this result may be due to a selection bias, in case this allele is one of the many indirect risk factors associated with the need for clinical attention in a mental health institution. In Mexico, a high frequency of carriers of the S allele (85%) was also found in a sample of adolescents with depression and a history of suicide attempt. Allelic frequencies (63% S and 37% L) were similar to the ones reported here (Table 2); significant genotypic and allelic differences were found in Mexican individuals without psychopathology, with allele frequencies of 51% S and 49% L (Sarmiento-Hernández et al., 2019).

A high frequency of carriers of the S allele was also reported in a Mexican sample of patients with obsessive-compulsive disorder (83.48%) while the frequency in their control group was 75.74%, having allele frequencies of 58% S and 42% L in the proband group and 52% S and 48% L in the control group (Camarena et al., 2001). In addition, allelic frequencies in Mexican subjects with diabetes were 61% for the S allele and 39% for the L, while they were 55% for the S allele and 45% for the L in the group without diabetes (Peralta-Leal et al., 2012).

There was a tendency to express higher levels of neuroticism and lower levels of extraversion and conscientiousness in carriers of the S allele. In addition, an interaction between the attachment style and the 5-HTTLPR polymorphism was identified for the expression of agreeableness, but the sample was too small and, as mentioned earlier, this result needs to be further investigated.

A significant gender effect on the expression of neuroticism and agreeableness has been reported, with no significant association with the 5-HTTLPR polymorphism (Du et al., 2000). In another study, a significant association between the polymorphism and agreeableness was identified; there was an interaction between the S allele and gender in the expression of agreeableness ($p < .01$; Brummett et al., 2003). In a third investigation, lower levels of the expression of agreeableness were found in carriers of the S allele in a sample of 397 subjects, in which 84% of them were women (Greenberg et al., 2000). In the present study, women constituted 79% of the sample, so the interaction

between gender and the 5-HTTLPR polymorphism for the expression of agreeableness is possible, but new studies will be required to determine if this interaction does exist. Women may be more likely to exhibit differences in the expression of agreeableness depending on the 5-HTTLPR genotype, as suggested by previous analyses (Brummett et al., 2003; Greenberg et al., 2000) which, according to our results, also have a significant interacting effect of the attachment style. Attachment was associated with the expression of agreeableness in our sample, and we did not identify in the literature other studies about a possible interaction between attachment styles and the serotonergic polymorphism we evaluated with respect to agreeableness.

Our results suggest that levels of extraversion and agreeableness can be affected to some degree by different attachment styles. In this way, those that share having a positive model of other people (secure and insecure worried attachments) would have a different effect from those in which there is a negative model of others (insecure dismissing and hostile fearful). In addition, it is possible that neuroticism and conscientiousness are affected by having a positive self-model (secure and insecure dismissing attachments) or a negative self-model (insecure worried and hostile fearful attachments). In this sense, it is possible to propose a model where neuroticism and conscientiousness are related with a self-model, while extraversion and agreeableness are related with a model of others (Figure 3). In our study, the role of openness is not completely clear, and further studies are needed to evaluate this variable.

Our findings show that an insecure attachment style, especially if it is hostile fearful, is significantly associated

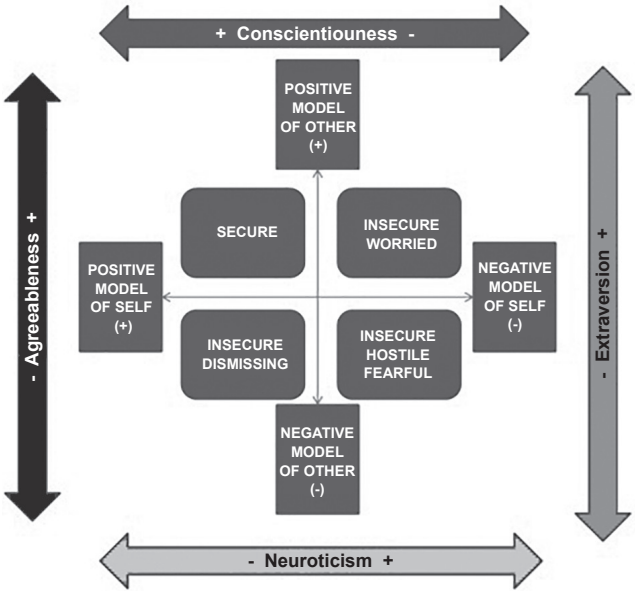

Figure 3. Explanatory model of the expression of personality traits with respect to attachment styles.

to the development of maladaptive personality traits. In theory, attachment styles are established early in life, mainly during the first year of life, and they depend on the interaction between the infant and the primary caregiver, who usually is the mother. It has been estimated that 75% to 80% of the attachment style in infant can be predicted by the attachment style in the caregiver (Benoit & Parker, 1994; Fonagy et al., 1996; Fonagy, Steele, & Steele, 1991; Ward & Carlson, 1995). Nevertheless, the score of the reflexive function is a better predictor of the attachment style in the infant (Fonagy & Target, 1997).

Among the limitations of our study is the fact that we only analyzed outpatients with anxiety or mood disorders. It would be necessary to evaluate patients according to the DSM-5 and to determine if anxiety or mood symptoms influence NEO-PI-R scores. While some comorbid conditions were excluded, other comorbidities and the specific treatment of patients were not considered. These aspects could partially affect the results related with personality. Recently, treatment was associated with a reduction in neuroticism and an increase in extraversion and openness in individuals with generalized anxiety disorder (Kennair et al., 2021). Test-retest reliability studies that evaluate each item of the NEO-PI-R are needed.

A larger sample may also be needed for the genetic analysis, to detect possible interactions with attachment styles and personality, to determine if results are replicated, and to evaluate other models with genome-wide association studies (GWAS). In Korea, a GWAS on young adult females found associations between personality traits and genes that code for dopaminergic (DRD1 and DRD3) and serotonergic receptors (5-HTR5A), a receptor with a 7-transmembrane domain structure (OR1A2), and a transmemrane protein (NKAIN2; Kim et al., 2013). In extended pedigrees from Mexico and Central America, suggestive linkage was found for neuroticism (markers rs936347 and rs 1052238), openness (rs336610, rs791346, rs7520974, rs160195, and rs4239577), agreeableness (rs206934 and rs2028030), and conscientiousness (rs1425566; Lee et al., 2017).

In a meta-analysis for neuroticism, a functional follow-up suggested the involvement of cells such as dopaminergic neuroblasts, medium spiny neurons, and serotonergic neurons (Nagel et al., 2018).

Other aspect to take into consideration is that cross-sectional studies, such as this one, while affordable, suitable for studying different variables at the same time, and useful for the development of new research, have some limitations as large samples are usually needed, and they do not give information about causal relationships about the variables in study.

Currently, there are interventional strategies based on Fonagy's postulates about the Mind Theory, focused on strenghtening the reflexive structure in adults for therapeutic purposes, e.g., the mentalization therapy. If this kind of

interventions could be generally used for at-risk populations, an inadequate reflexive function that facilitates deficient infant-caregiver interactions, and thus an insecure attachment style could be prevented. This could help to avoid the development of maladaptive patterns of personality that could increase the risk in the best case to a saturation of mental health units. Therefore, prevention strategies are crucial, especially if they are focused on the development of the reflexive function in at-risk populations, people who expect to become parents, or even in the general population. This can be a promising strategy to improve our population's mental health and quality of life.

In conclusion, according to the Big Five Model, attachment styles may have a significant effect on personality traits in individuals with anxiety or mood disorders. Subjects with a secure attachment tended to have average personality scores, so a secure attachment may protect them against maladaptive personality traits. In contrast, having an insecure attachment, especially if it is hostile fearful, may be a risk factor for the development of this kind of maladaptive traits. If these results are confirmed, it may be very important to establish prevention strategies to promote adequate bonds between the primary caregiver and an infant, which may help in turn to prevent maladaptive traits, certain dysfunction, and psychopathology. More studies are needed to confirm the effect of the 5-HTTLPR on personality traits.

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Conflict of interest

The authors declare they have no conflicts of interest.

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