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The moderating effect of olfactory function on the relationship between interpersonal problems and the emotional intelligence of adults

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Abstract: This study examined the relationships among emotional intelligence, olfactory function, and interpersonal problems, as well as the moderating role of olfactory function. A total of 119 adults aged 18 and older were recruited from a university in Region C, South Korea, between December 1 and 22, 2023. Participants completed standardized surveys and tests. Data were analyzed using SPSS 29.0 and Hayes' PROCESS macro 4.2, employing descriptive statistics, t-tests, ANOVA, Pearson correlation, hierarchical regression, and simple slope analysis. Results showed that interpersonal problems were negatively correlated with both emotional intelligence ($r = -0.46$, $p < .001$) and olfactory function ($r = -0.21$, $p < .05$). Olfactory function significantly moderated the relationship between emotional intelligence and interpersonal problems ($F = 5.512$, $p < .001$), with an adjusted R^2 of 34.9%. Simple slope tests indicated that higher emotional intelligence was linked to fewer interpersonal problems across all levels of olfactory function, with stronger effects in those with average or high olfactory ability. These findings suggest that interventions aimed at improving emotional intelligence and olfactory function may be effective in reducing interpersonal difficulties.

Keywords: *Adult, Emotional intelligence, Interpersonal relationship problems, Olfactory function.*

1. Introduction

Interpersonal problems refer to situations in which an individual is unable to form positive relationships with others, has difficulty maintaining relationships, and does not cope well with relationships that negatively affect them [1]. A mental health survey of adults aged 19 and older found that 61.1% reported difficulty adjusting to relationships [2]. Interpersonal problems and conflicts prevent the fulfillment of needs in relationships and lead to negative emotions such as unhappiness [3]. Furthermore, these negative emotions can lead to more than just emotional distress; they can also lead to real-world problems, such as low perceived social support and loneliness [4]. Numerous studies have reported that interpersonal problems lead to psychological maladjustment, including social anxiety, personality disorders, alienation, and depression, leading to significant mental health impairments [5, 6]. Interpersonal problems have a lasting impact on mental health as well as social life, making research and interventions in this area crucial.

Among the many factors that contribute to interpersonal problems, emotional intelligence is the ability to perceive, understand, express, regulate, and utilize emotions in oneself and others, which continues to develop throughout life. Emotional characteristics such as paying attention to emotions, valuing emotions, being clear about the meaning of emotions, and expressing emotions are known to affect mental health, daily coping, and social problem solving [7, 8]. Numerous studies have demonstrated that improved emotional intelligence has a positive impact on interpersonal relationships, enhances the quality of interactions, and makes qualitative contributions in other domains of life [5-9].

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On the other hand, various studies have shown that the ability to navigate social interactions effectively in a complex society is rooted in olfactory function. Therefore, the role of olfactory function cannot be overlooked in how emotional intelligence impacts interpersonal problems. Sociable people, or those with a wide network of social connections, were more sensitive to smells and had better olfactory abilities than those who preferred to be alone or were introverted [10, 11]. The brains of sociable people with superior olfactory abilities had better connections between the amygdala, the emotional center, and the middle frontal lobe, the social brain, compared to unsociable people [10]. This suggests that olfactory function may be a factor that explains the relationship between emotional intelligence and interpersonal problems.

Therefore, this study aims to establish and test the following hypotheses, which will serve as a basis for developing an intervention program to address interpersonal problems in adults.

Hypothesis 1. Interpersonal problems are related to emotional intelligence and olfactory function.

Hypothesis 2. The effect of emotional intelligence on interpersonal problems may differ depending on olfactory function.

2. Research Method

2.1. Research Model

This study is a descriptive survey of adults aged 18 and older, aimed at determining the association between emotional intelligence, olfactory function, and interpersonal problems, as well as testing the moderating effect of olfactory function on the relationship between emotional intelligence and interpersonal problems. The research model is illustrated in Figure 1.

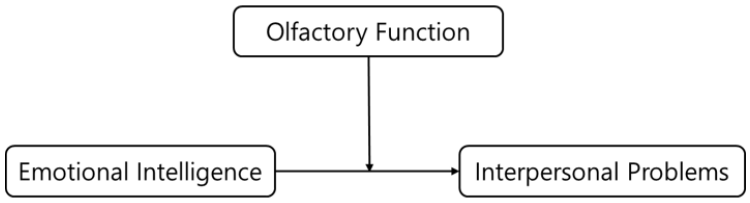

Figure 1.
The research model.

2.2. Participants

The study participants were recruited through bulletin board announcements at a university in Region C, South Korea. The G*Power 3.1.9.4 program was used to calculate the number of participants, and the minimum sample size was 107 with a medium effect of f^2=0.15, significance of α=.05, power of 1-β=.95, and number of predictors of 8 in a linear multiple regression. Considering the dropout rate, 123 participants were recruited for the study, and data from 119 were analyzed, excluding four participants who had insufficient survey responses or testing.

2.3. Measures and Scales

2.3.1. Dependent Variables: Interpersonal Problems

Participants' interpersonal problems were assessed using the Inventory of Interpersonal Problem scale (IIP). The IIP was developed by Horowitz, et al. [12] reformulated into a 64-item instrument by Alden, et al. [13] and shortened to 40 items in Korea by Hong, et al. [14] by supplementing and reformulating it to fit the Korean context (Short form of the Korean Inventory 9o0-l= Problems Circumplex Scale; KIIP-SC). The scale consists of 40 items in eight domains, including non-assertive (e.g., I find it difficult to assert myself), overly accommodating (e.g., I follow what others say too easily), self-sacrificing (e.g., I try too hard not to disappoint others), intrusive (e.g., I gossip about others too

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much), domineering (e.g., I am often too assertive), vindictive (e.g., I find it difficult to put others' needs first), cold (e.g., I find it difficult to express liking or affection for others), and socially inhibited (e.g., I am too easily influenced by others). It is scored on a 5-point Likert scale (1=not at all to 5=very much), with a higher score indicating a higher level of difficulty with interpersonal relationships. The internal consistency (Cronbach's α) was .89 at the time of the scale development and .93 in this study.

2.3.2. Independent variable: Emotional intelligence

Participants' emotional intelligence was assessed using the Wong and Law Emotional Intelligence Scale (WLEIS) developed by Wong and Law [15] and adapted and validated by Lim [16]. The WLEIS is based on the ability model of emotional intelligence proposed by Mayer and Salovey [17] and consists of 16 items in four domains: self-emotion appraisal (SEA), others' emotion appraisal (OEA), use of emotion (UOE), and regulation of emotion (ROE). It is scored on a 5-point Likert scale (1=not at all to 5=very much), with a higher score indicating a higher level of emotional intelligence. The internal consistency (Cronbach's α) was .86 at the time of the scale development and .83 in this study.

2.3.3. Moderating variable: Olfactory Function

Participants' olfactory function was assessed using the YSK olfactory function (YOF) test (RHICO Medical Co., Seoul, Korea). The YOF test is composed of three domains: olfactory threshold function, olfactory discrimination function, and olfactory identification function. The olfactory threshold test consists of 12 steps, beginning with a 10% solution of the highest concentration, which is diluted with dipropylene glycol in a 1:2 ratio at each step. Rose-scented PEA, which is not unpleasant and does not stimulate the trigeminal nerve, is used to determine the lowest odor concentration detected by the participant's olfactory sense. The YSK olfactory discrimination test is a triangle test (three objects presented, with two identical and one different) and consists of 12 steps—each with three pens containing one target odorant and two identical nontarget odorants. The participant smells all three test pens and then selects a target odorant that smells different from the other two. The total number of correct answers from the 12 steps is summed and evaluated. The olfactory identification test requires participants to smell a test pen containing a total of 12 olfactory substances, each of which has been developed considering cultural affinities and major chemical functional groups, and to select the correct answer from four given choices [18]. Each of the three domains has a minimum score of 0 and a maximum score of 12, and the scores of these three domains are combined to give a minimum score of 0 and a maximum score of 36, with a higher score indicating a higher level of olfactory function [19]. The internal consistency (Cronbach's α) was .77 at the time of the scale development and .83 in this study.

2.3.4. Control Variable

Participants' general characteristics included age, gender, and household type. Age was categorized into 25 years or younger and 26 years or older based on the date of birth. Household type was categorized into single-person households (living alone) and multi-person households (with two or more people, such as friends or family, living together). Drinking and smoking status was determined as of the point of the survey, and perceived stress was measured on a 5-point scale using the question, "To what extent do you feel stressed in your daily life?" Responses were categorized as follows: "low" for never or sometimes, "moderate" for sometimes, and "high" for often or always.

2.4. Ethical Considerations and Data Collection

This study was approved by the Institutional Review Board of the principal investigator's institution (IRB No. NSU-202310-001) to ensure the ethical treatment of participants. From December 1 to December 22, 2023, a recruitment notice was posted on the school bulletin board in City C, South

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Korea. Adults aged 18 and older who read the recruitment notice, voluntarily agreed to participate in the study, and either contacted or arrived at the designated time and place were tested and surveyed. Prior to participation in the study, the background, purpose, methods, and procedures of the study, as well as privacy and confidentiality issues, were fully explained to the participants. Written consent forms were signed; a structured questionnaire was filled out by the participants themselves, and olfactory tests were conducted by the principal investigator.

2.5. Data Analysis Method

The collected data were analyzed using SPSS 29.0 and Hayes' SPSS PROCESS macro 4.2. The analysis procedure was as follows.

The data collected were analyzed using the IBM SPSS/WIN 29.0 program.

1) Cronbach's α was calculated for the scales to determine the reliability of the instrument.

2) Participants' demographic characteristics, emotional intelligence, olfactory function, and interpersonal problems were calculated as real numbers and percentages, mean and standard deviation.

3) Differences in interpersonal problems according to participants' general characteristics were analyzed by t-test and ANOVA, and post hoc tests were performed using the Scheffé test.

4) Pearson's correlation coefficient was used to test the correlation between emotional intelligence, olfactory function, and interpersonal problems.

4) To examine the moderating effect of olfactory function on the relationship between emotional intelligence and interpersonal problems, a hierarchical regression analysis was conducted, and the Durbin-Watson test was used to test for autocorrelation of errors before the regression analysis. The tolerance and variation inflation factor (VIF) values confirmed that there was no multicollinearity problem. The residual analysis confirmed the assumptions of linearity, normality of the error term, and homoscedasticity of the model.

5) After the modulatory effect of olfactory function was verified, a simple slope test was conducted to analyze the significance of the modulatory effect, as illustrated in the figure. For illustration purposes, scores one standard deviation below the mean value of emotional cognition and olfactory functioning were set as low (-1 SD) and high (+1 SD) [20]. To determine the magnitude of the interaction effect of olfactory function, the Johnson-Neyman technique was used to identify the significance region of the conditional effect [21].

3. Results

3.1. Differences In Participants' General Characteristics and Interpersonal Issues

Participants' average age was 26.6 years. Of the participants, 93 (78.2%) were 25 years old or younger, while 26 (21.8%) were 26 or older. In terms of gender, there were 27 (22.7%) males and 92 (77.3%) females. Most of the participants (102; 85.7%) resided in multi-person households. Among the participants, there were 21 smokers (17.6%) and 94 drinkers (79.0%). Their levels of perceived stress were categorized as low (39 participants, 32.8%), moderate (46 participants, 38.7%), and high (34 participants, 28.6%). Those with high perceived stress had significantly more interpersonal problems than those with moderate or low perceived stress (F=3.620, p=.030) (Table 1).

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Table 1.
General Characteristics of the Participants and Differences in interpersonal problems (N=119).

Characteristics	Categories	n(%)	Interpersonal Problem M±SD	t / F	*p* (Scheffé test)
Age(year)	M±SD	26.60±12.76		-0.070	0.944
	≤ 25	93(78.2)	93.05±22.23		
	≥ 26	26(21.8)	92.73±13.96		
Gender	Male	27(22.7)	94.15±22.15	0.332	0.740
	Female	92(77.3)	92.64±20.31		
Households	One persons	17(14.3)	92.29±19.45	-0.148	0.883
	Multi-person	102(85.7)	93.10±20.93		
Smoking	No	98(82.4)	92.66±21.08	-0.364	0.717
	Yes	21(17.6)	94.48±18.94		
Drinking	No	25(21.0)	94.92±17.76	0.526	0.600
	Yes	94(79.0)	92.47±21.41		
Perceived stress	Low [a]	39(32.8)	87.67±20.26	3.620	0.030* (c>a,b)
	Usual [b]	46(38.7)	92.09±18.43		
	High [c]	34(28.6)	100.29±22.35		

3.2. Participants' Level of Olfactory Function, Emotional Intelligence, and Interpersonal Problems

The olfactory function score was 22.96±4.66 (range: 0-36), with 5.27±2.49 (range: 0-12) for olfactory threshold, 6.81±2.19 (range: 0-12) for olfactory discrimination function, and 10.88±1.77 (range: 0-12) for olfactory identification function. The emotional intelligence score was 3.77±0.45 (rating range: 1-5), with 3.98±0.62 (rating range: 1-5) for SEA, 3.95±0.67 (rating range: 1-5) for OEA, 3.51±0.65 (rating range: 1-5) for UOE, and 3.63±0.77 (rating range: 1-5) for ROE. The interpersonal problem score was 2.32±0.52 (rating range: 1-5), with 2.52±0.69 (rating range: 1-5) for being non-assertive, 2.37±0.79 (rating range: 1-5) for being overly accommodating, 2.90±0.85 (rating range: 1-5) for being self-sacrificing, 2.47±0.70 (rating range: 1-5) for being intrusive, 1.92±0.62 (rating range: 1-5) for being domineering, 2.03±0.59 (rating range: 1-5) for being vindictive, 2.12±0.75 (rating range: 1-5) for being cold, and 2.26±0.85 (rating range: 1-5) for being socially inhibited (Table 2).

Table 2.
Olfactory function, Emotional intelligence, and Interpersonal problems of the Participants (N=119).

Variables	Categories	Range	Min.	Max.	M±SD
Olfactory Function	Thereshold	0-12	0	11	5.27±2.49
	Discrimination	0-12	0	12	6.81±2.19
	Identification	0-12	0	12	10.88±1.77
	Total	0-36	0	31	22.96±4.66
Emotional Intelligence (rating average)	SEA	1-5	2.00	5.00	3.98±0.62
	OEA	1-5	1.75	5.00	3.95±0.67
	UOE	1-5	2.00	5.00	3.51±0.65
	ROE	1-5	2.00	5.00	3.63±0.77
	Total	1-5	1.00	2.50	3.77±0.45
Interpersonal Problems (rating average)	being non-assertive	1-5	1.00	4.40	2.52±0.69
	being overly accommodating	1-5	1.00	4.40	2.37±0.79
	being self-sacrificing	1-5	1.00	4.80	2.90±0.85
	being intrusive	1-5	1.00	4.80	2.47±0.70
	being domineering	1-5	1.00	4.00	1.92±0.62
	being vindictive	1-5	1.00	3.80	2.03±0.59
	being cold	1-5	1.00	4.00	2.12±0.75
	being socially inhibited	1-5	1.00	4.40	2.26±0.85
	Total	1-5	1.10	3.75	2.32±0.52

***Note:** SEA= self-emotion appraisal; OEA= others' emotion appraisal; UOE= use of emotion; ROE= regulation of emotion.

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3.3. Correlation Between Olfactory Function, Emotional Intelligence, and Interpersonal Problems

The correlation between interpersonal problems, emotional intelligence, and olfactory function is shown in Table 3. Overall, interpersonal problems showed a negative correlation with emotional intelligence (r=-.46, p<.001) and olfactory function (r=-.21, p<.05). Specifically, when examining the correlations across the subscales of interpersonal problems, being non-assertive was significantly negatively correlated with SEA (r=-.24, p<.01), UOE (r=-.50, p<.001), and ROE (r=-.25, p<.01) in emotional intelligence and with olfactory identification (r=-.24, p<.01). Regarding emotional intelligence, being overly accommodating was significantly negatively correlated with UOE (r=-.36, p<.001) and ROE (r=-.33, p<.001), showing no significant correlation with olfactory function. Being self-sacrificing was negatively correlated with SEA (r=-.20, p<.05), UOE (r=-.18, p<.05), and ROE (r=-.33, p<.001). Being intrusive was negatively correlated with SEA (r=-.20, p<.05) and ROE (r=-.22, p<.05), and being domineering was significantly negatively correlated with SEA (r=-.27, p<.01) and ROE (r=-.30, p<.01), showing no significant correlation with olfactory function. Being vindictive was significantly negatively correlated with all four domains of emotional intelligence—SEA (r=-.40, p<.001), OEA (r=-.28, p<.01), UOE (r=-.23, p<.05), and ROE (r=-.28, p<.01)—and with olfactory discrimination function (r=-.20, p<.05). Being cold was negatively correlated with SEA (r=-.33, p<.001), UOE (r=-.36, p<.001), and ROE (r=-.27, p<.01) in emotional intelligence, and with olfactory discrimination function (r=-.34, p<.001) and olfactory identification (r=-.19, p<.05). Being socially inhibited was significantly negatively correlated with all four domains of emotional intelligence—SEA (r=-.39, p<.001), OEA (r=-.20, p<0.05), UOE (r=-.43, p<.001), and ROE (r=-.34, p<.001)—and with olfactory discrimination function (r=-.23, p<.05).

Table 3.
Correlation between olfactory function, emotional intelligence, and interpersonal problems (N=119).

Variables		Interpersonal Problems								
	Categories	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Total**
Emotional Intelligence	SEA	-0.24**	-0.179	-0.20*	-0.20*	-0.27**	-0.40***	-0.33***	-0.39***	-0.39***
	OEA	-0.05	0.057	0.15	0.15	0.06	-0.28**	-0.17	-0.20*	-0.05
	UOE	-0.50***	-0.36***	-0.18*	0.07	-0.02	-0.23*	-0.36***	-0.43***	-0.37***
	ROE	-0.25**	-0.27**	-0.33***	-0.22*	-0.30**	-0.28**	-0.27**	-0.34***	-0.40***
	Total	-0.39***	-0.30**	-0.22*	0.08	-0.21*	-0.45***	-0.42***	-0.51***	-0.46***
Olfactory Function	Threshold	-0.06	-0.01	-0.04	-0.06	-0.03	-0.17	0.01	-0.08	-0.07
	Discrimination	-0.24**	-0.13	-0.17	0.01	-0.12	-0.20*	-0.34***	-0.23*	-0.25**
	identification	-0.11	-0.06	-0.06	-0.06	-0.11	-0.14	-0.19*	-0.13	-0.15
	Total	-0.19*	-0.09	-0.12	-0.05	-0.11	-0.27*	-0.23*	-0.20*	-0.21*

*** Note:** SEA= self-emotion appraisal; OEA= others' emotion appraisal; UOE= use of emotion; ROE= regulation of emotion; A= being non-assertive; B= being overly accommodatingl C= being self-sacrificing; D= being intrusive; E= being domineering; F= being vindictive; G= being cold; H= being socially inhibited.

3.4. The Moderating Effect of Olfactory Function on the Relationship Between Emotional Intelligence and Interpersonal Problems

To examine the moderating effect of olfactory function on the relationship between emotional intelligence and interpersonal problems in adults, the autocorrelation of the dependent variable and the multicollinearity between the independent variables were first examined. The Durbin-Watson index was 2.035, indicating that the dependent variables were independent without autocorrelation. The VIF values for the independent variables ranged from 1.073 to 1.491, all below 10, indicating that there was no multicollinearity among the independent variables, making them suitable for regression analysis.

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The results of the hierarchical regression analysis are shown in Table 4. Model 1 showed a significant explanatory power of 6.1% for perceived stress (β=.35). In other words, a higher level of perceived stress was associated with an increase in interpersonal problems.

In Model 2, controlling for age, gender, household type, smoking, alcohol consumption, and perceived stress, the four domains of emotional intelligence (SEA, OEA, UOE, and ROE) and the three domains of olfactory function (olfactory threshold, olfactory discrimination function, and olfactory identification function) increased by 29.3% compared to Model 1 (F=5.437, p<.001). In Model 2, the independent variables SEA (β=-2.78), UOE (β=-3.24), and ROE (β=-2.77), as well as the control variable gender (β=-.19) and the moderator variable olfactory identification (β=-2.20), were statistically significant. In other words, it can be interpreted that men, compared to women, as well as individuals with lower self-emotional awareness, emotional utilization, emotional regulation, and olfactory discrimination function, experience more interpersonal problems.

Finally, Model 3, which included an interaction term between the independent variable emotional intelligence and the moderator variable olfactory function, explained 34.9% of the variance, representing an increase of 2.4% over Model 2 (F=.426, p<.001). The interaction effect between emotional intelligence and olfactory function in adults was statistically significant (β=-2.07), and olfactory function as a moderating variable showed a significant moderating effect on the relationship between emotional intelligence and interpersonal problems in adults.

Table 4.
The moderating effect of olfactory function on the relationship between emotional intelligence and interpersonal problems.

Variables		**Model 1**			**Model 2**			**Model 3**		
		B	***β***	**t**	**B**	***β***	**t**	**B**	***β***	**t**
Constant		72.43		6.10***	176.48		8.34***	175.29		8.41***
The contorl variable	Age	0.143	0.09	0.86	0.04	0.03	0.28	0.02	0.01	0.13
	Gender (1= female)	-5.25	-0.11	-1.05	-9.31	-0.19	-2.11*	-6.94	-0.14	-1.54
	Household type (1= multi-person)	0.78	0.01	0.14	1.16	0.02	0.24	1.31	0.02	0.28
	Smoking (1= smoker)	0.43	0.01	0.08	-4.75	-0.09	-0.94	-4.23	-0.08	-0.85
	Drinking (1= drinker)	-5.15	-0.10	-1.04	-4.31	-0.09	-1.01	-4.74	-0.09	-1.13
	Perceived stress	8.04	2.22	0.35***	3.81	0.17	1.89	3.04	0.13	1.51
The independent variable (A)	SEA				-8.73	-0.26	-2.78**	-8.92	-0.27	-2.89**
	OEA				4.83	0.16	1.72	5.13	0.17	1.86
	UOE				-8.66	-0.27	-3.24**	-8.56	-0.27	-3.25**
	ROE				-6.69	-0.25	-2.77**	-6.08	-0.23	-2.53**
The moderator variable (B)	Threshold				-.12	-0.01	-0.18	-0.14	-0.02	-0.21
	Discrimination				-1.76	-0.19	-2.20**	-1.63	-0.17	-2.06**
	identification				-.24	-0.02	-0.23	-.34	-0.03	-0.32
The interaciton effect	(A*B)							-.22	-0.16	-2.07**
F		2.289**			5.437***			5.512***		
R^2 (adj R^2)		0.109(0.061)			0.402(0.328)			0.426(0.349)		
Δ R^2		0.109			0.293			0.024		
d(du)		2.035								

Note: *** <.001, **<.01, *<.05; A= Emotional Intelligence; B= Olfactory function; SEA= self-emotion appraisal; OEA= others' emotion appraisal; UOE= use of emotion; ROE= regulation of emotion

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3.5. Test For Significance of the Moderating Effect of Olfactory Function

Since the moderating effect of olfactory function was significant, a simple slope test was performed to examine this in more depth; the results are shown in Table 5. The effect of olfactory function on interpersonal relationships was significant at the mean and +1SD, but not at -1SD. In other words, in the group with low olfactory function (-1 SD), higher emotional intelligence tended to be associated with a modest decrease in interpersonal problems, whereas in the group with average (0.00) or high olfactory function (+1 SD), interpersonal problems decreased sharply with higher emotional intelligence.

Table 5.
Test for significance of the moderating effect of olfactory function.

	B	SE	t	*p*
-1*SD* (-4.66)	-0.53	0.35	-1.48	0.140
Average (0.00)	-1.21	0.23	-5.24	<0.001
+1*SD* (4.66)	-1.89	0.32	-5.84	<0.001

Upon examining the coefficients, the hypothesis was confirmed, revealing that olfactory function had a synergistic effect, as shown in Figure 2.

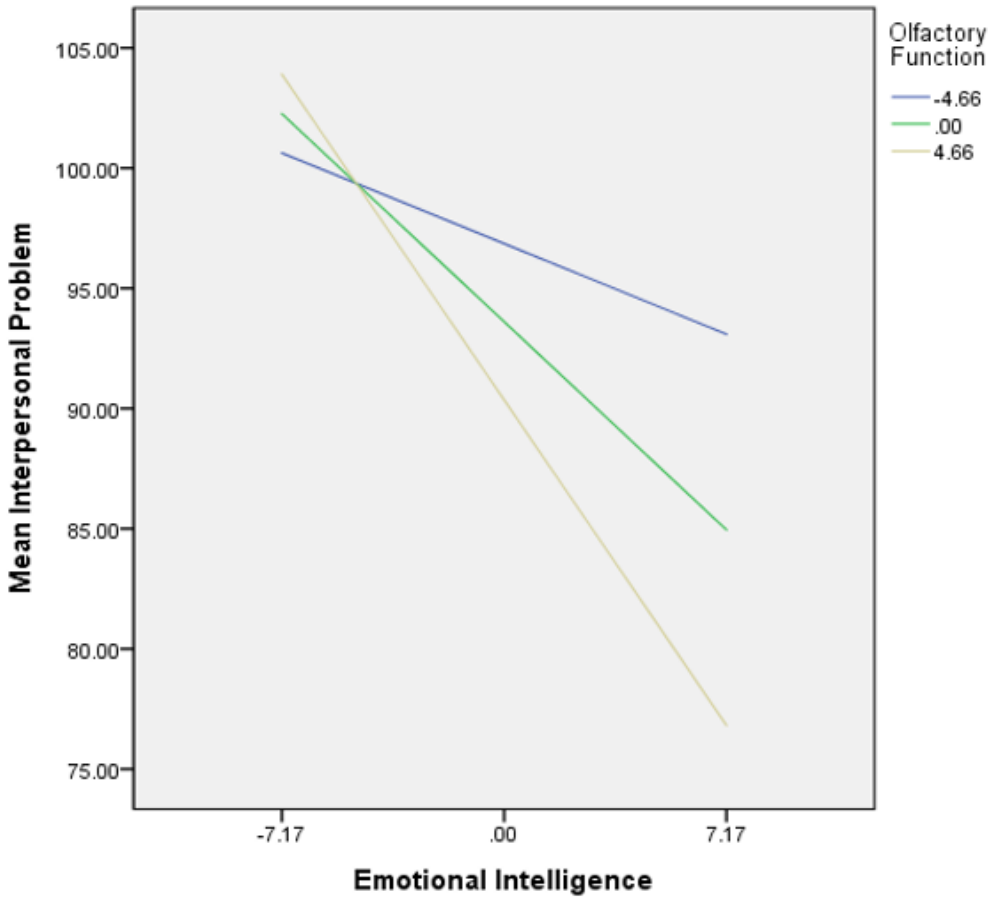

Figure 2.
The moderating effect of olfactory function on the relationship between emotional intelligence and interpersonal problems.

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4. Discussion

This study sought to determine whether emotional intelligence differs in its impact on interpersonal problems depending on olfactory function, using a sample of adults aged 18 and older to test the following two hypotheses: 1) "Interpersonal problems are related to emotional intelligence and olfactory function" and 2) "The effect of emotional intelligence on interpersonal problems may differ depending on olfactory function." The discussion of the results is as follows.

First, interpersonal problems showed a negative correlation with emotional intelligence and olfactory function. In other words, a higher level of emotional intelligence and better olfactory function were associated with fewer interpersonal problems. In particular, interpersonal problems showed a significant negative correlation with self-emotion recognition, emotion utilization, and emotion regulation among the four domains of emotional intelligence, and a significant negative correlation with olfactory discrimination function among the three domains of olfactory function. This is consistent with several previous studies that have shown that people with high emotional intelligence can be viewed as having good social skills and that people with higher emotional intelligence report fewer interpersonal problems [4, 5, 22-24]. Specifically, among the domains of emotional intelligence, SEA, ROE, and UOE were found to have a significant impact on interpersonal problems. SEA is the ability to focus attention on internal emotions to understand and identify what they are, and to recognize and evaluate the thought processes that lead to them [17]. Higher SEA is associated with less suppression of emotional expression in interpersonal relationships and better UOE [25]. In addition, ROE is an ability that directly affects interpersonal relationships by suppressing emotions and enabling flexible responses in emotionally stimulating situations [26]. This means that when emotion regulation is functioning effectively, it can help maintain good interpersonal relationships, but when it is not functioning properly, it can lead to interpersonal problems [27]. This suggests that the ability to recognize one's own emotions, rather than the ability to recognize the emotions of others, enhances one's capacity to effectively utilize and regulate personal emotions, creating a favorable condition for identifying and addressing interpersonal problems.

Olfactory function was also negatively correlated with interpersonal problems. The human olfactory nerve runs from olfactory receptors in the nose to the amygdala, hippocampus, and cerebral cortex, which share the areas of the brain responsible for human mood, emotion, and memory [28]. The act of smelling is a fundamental first step in feeling emotion, which in turn triggers many emotions. What the act of smelling a scent and the act of feeling an emotion have in common is that both experiential acts shape people's behavior in a single moment [29]. Research has shown that the ability to smoothly navigate complex social interactions is rooted in the sense of smell [10, 11]. In line with this, several studies have reported that olfactory function is related to emotions and interpersonal relationships [28-31]. Which is consistent with the results of this study. However, among the domains of olfactory function, there was a significant negative correlation with the olfactory discrimination function and no correlation with the olfactory threshold function or olfactory identification function. There is little direct comparable research on olfactory discrimination function and its relation to interpersonal problems, making it a topic that should be actively explored in the future. However, studies have shown that psychopathic traits are related to olfactory discrimination and identification but not to olfactory threshold [32]. In addition, emotional empathy has been positively correlated with the ability to discriminate odors using the right nostril [33]. These findings suggest that olfactory identification and discrimination play a more significant role in interpersonal problems than olfactory threshold. However, the olfactory threshold test in this study used a single scent, phenolphthalein (PEA), to detect its concentration, rather than measuring thresholds for a variety of smells. Additionally, although the olfactory identification test involved 12 different scents, the participants' mean score was 10.88 ± 1.77 on a scale of 0 to 12. This suggests that most participants had normal or above-normal olfactory identification function, with few showing reduced function, making it difficult to draw relevant

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conclusions. Therefore, future studies should consider these characteristics of olfactory testing instruments and replicate the study using different olfactory testing instruments.

Second, the effect of emotional intelligence on interpersonal problems was found to differ by olfactory function, supporting the hypothesis. Specifically, in the low olfactory function group, higher emotional intelligence was associated with a modest decrease in interpersonal problems, whereas in the average or high olfactory function group, there was a sharp decrease in interpersonal problems with higher emotional intelligence.

Sensory processing is the ability to effectively receive, regulate, integrate, and organize sensations within the central nervous system to respond with action [34]. Problems with sensory processing can affect physiological responses, behavior, emotions, cognition, and sensorimotor development, as well as functional abilities in daily life [35, 36]. Adults may have difficulty in interpersonal relationships and social life due to their inability to understand the words, actions, and social mood of others, causing them to react slowly or act differently than intended [35]. Reduced sensory registration is associated with anxiety and avoidance Jerome and Liss [37] and individuals with high sensory thresholds and passive behaviors have difficulty forming positive interpersonal relationships with others and are unable to adequately express their desires or intentions in front of others [38]. In addition, people with low sensory thresholds may exhibit introverted tendencies or be associated with social phobia, anxiety, and maladjustment, resulting in a lack of empathy for others and an inability to read the emotions of others [39]. Furthermore, research on chemosignals has shown that social situations are heavily influenced by human body odor, and that the sense of smell is inherently a major contributor to social communication [40]. While there is a conscious pathway for sensory information, especially from smell, to reach the cerebral cortex and be recognized, most of it follows an unconscious pathway in the amygdala, where it is quickly analyzed and triggers the necessary response [41]. For most of the affected participants, subjective ratings of visual and hearing functions were consistent with objective ratings, but subjective ratings of olfactory function were not consistent with objective ratings [42-44]. In other words, even when surveyed directly, people are not likely to recognize that they have a problem with their olfactory function. The inability to subjectively assess olfactory function prevents early diagnosis, which in turn can lead to subtle adverse events such as decreased quality of life and depression [45]. Affecting social and interpersonal relationships. Therefore, olfactory problems that affect interpersonal relationships in adulthood, a time when socialization and interpersonal skills are crucial, require more attention. In other words, participants with interpersonal problems may be able to find clues to solve their problems by assessing not only their emotional intelligence but also their objective olfactory function.

However, the olfactory threshold test in this study used a single scent, phenolphthalein (PEA), to detect its concentration, rather than measuring thresholds for a variety of smells. Although the olfactory identification test involved 12 scents, the participants' mean score was 10.88±1.77 on a scale of 0 to 12. This suggests that most participants had normal or above-normal olfactory identification function, with few showing reduced function, making it difficult to draw relevant conclusions. The TDI test has the advantage of being able to examine multiple aspects of olfactory function, but simply summing the scores of the three sections of the test measure may not be able to identify the exact problem in each participant. For example, one person might be good at discrimination but not at identification, while another might have a high threshold score but a low discrimination score. A limitation of the YOF test is that it summarizes TDI scores, leading to results being reported as the same summed score of different compositions. Therefore, future studies should consider these characteristics of olfactory testing instruments and replicate the study using different olfactory testing instruments.

This study was conducted with adults from a single geographic region, which limits the generalizability of its findings. Nevertheless, this study is significant in that it has identified the relationship between emotional intelligence and olfactory function, which may affect interpersonal problems. It has also revealed the moderating effect of olfactory function on the relationship between

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emotional intelligence and interpersonal problems, thereby raising the need for olfactory function testing and olfactory training to develop programs to address interpersonal problems in adults.

5. Conclusion

This study sought to determine whether emotional intelligence differs in its impact on interpersonal problems depending on olfactory function, using a sample of adults aged 18 and older to test the following two hypotheses: 1) Interpersonal problems are related to emotional intelligence and olfactory function and 2) The effect of emotional intelligence on interpersonal problems may differ depending on olfactory function. The results showed that participants' interpersonal problems negatively correlated with emotional intelligence and olfactory function, and olfactory function had a moderating effect on the relationship between emotional intelligence and interpersonal problems. This study suggests that accurate assessment and training of olfactory function, as well as emotional intelligence, are essential for developing programs for individuals with interpersonal difficulties. However, this study was conducted among adults in a single geographic region, limiting the generalizability of its findings. It is recommended that the scope of the study be expanded to include a variety of conditions and settings in the future. Furthermore, there is a need for expanded research on the specific olfactory functions that influence interpersonal problems using various olfactory testing instruments. Finally, it is recommended to develop and test the effectiveness of intervention programs for people with interpersonal problems, focusing on improving both emotional intelligence and olfactory function.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References

[1] I. Choi and H. Sim, "The influences of internalized shame and anger expression on interpersonal problems of college students," *Korean J Couns Psychother*, vol. 22, no. 2, p. 479e92, 2010.

[2] Korean Council for University Education, "Design study on university students' psychological crisis overcoming and character development support project: Design of support base for psychological toughness and character development to cultivate future talents (Homo Futurus) in higher education," *Seoul: Kyungsung*, 2018.

[3] K. Yu and D. Ahn, "Mediating effects of anger and interpersonal problems in the relationship between overprotection and happiness perceived by adolescents," *Journal of Learner-Centered Curriculum and Instruction*, vol. 19, no. 23, pp. 821–844, 2019. https://doi.org/10.22251/jlcci.2019.19.13.821

[4] S.-M. Lee, K.-J. Cho, and H.-R. Kim, "The effect of emotional intelligence on interpersonal relationships and the life satisfaction of university students," *The Korean Journal of Human Development*, vol. 16, no. 3, pp. 131-147, 2009.

[5] A. J. Bae and H. W. Shim, "The mediating effect of fear of compassion and affect regulation between adult attachment and interpersonal problems," *The Korean Journal of Counseling and Psychotherapy*, vol. 30, no. 4, pp. 1193–1217, 2018. https://doi.org/10.23844/kjcp.2018.11.30.4.1193

[6] J. Li, J. Li, R. Jia, Y. Wang, S. Qian, and Y. Xu, "Mental health problems and associated school interpersonal relationships among adolescents in China: A cross-sectional study," *Child and Adolescent Psychiatry and Mental Health*, vol. 14, pp. 1-10, 2020. https://doi.org/10.1186/s13034-020-00318-6

[7] A. S. Yun and H. Y. Park, "Emotional intelligence research trend analysis: Using keyword network analysis," *The Korean Journal of Human Development*, vol. 31, no. 1, pp. 67–84, 2024. https://doi.org/10.15284/Kjhd.2024.31.1.67

[8] C. L. Gohm and G. L. Clore, "Four latent traits of emotional experience and their involvement in well-being, coping, and attributional style," *Cognition & Emotion*, vol. 16, no. 4, pp. 495-518, 2002. https://doi.org/10.1080/02699930143000374

[9] J. D. Mayer, R. D. Roberts, and S. G. Barsade, "Human abilities: Emotional intelligence," *Annu. Rev. Psychol.*, vol. 59, no. 1, pp. 507-536, 2008. https://doi.org/10.1146/annurev.psych.59.103006.093646
[10] L.-q. Zou *et al.*, "What does the nose know? Olfactory function predicts social network size in human," *Scientific Reports*, vol. 6, no. 1, p. 25026, 2016. https://doi.org/10.1038/srep25026
[11] S. Boesveldt, J. R. Yee, M. K. McClintock, and J. N. Lundström, "Olfactory function and the social lives of older adults: A matter of sex," *Scientific Reports*, vol. 7, no. 1, p. 45118, 2017. https://doi.org/10.1038/srep45118
[12] L. M. Horowitz, S. E. Rosenberg, B. A. Baer, G. Ureño, and V. S. Villaseñor, "Inventory of interpersonal problems: psychometric properties and clinical applications," *Journal of consulting and clinical psychology*, vol. 56, no. 6, p. 885, 1988.
[13] L. E. Alden, J. S. Wiggins, and A. L. Pincus, "Construction of circumplex scales for the Inventory of Interpersonal Problems," *Journal of personality assessment*, vol. 55, no. 3-4, pp. 521-536, 1990. https://doi.org/10.1080/00223891.1990.9674088
[14] S.-H. Hong, E.-Y. Park, Y.-H. Kim, J.-H. Kwon, Y.-R. Cho, and Y. K. Kim, "Short form of the Korean inventory of interpersonal problems circumplex scales (KIIP-SC)," *Korean Journal of Clinical Psychology*, vol. 21, no. 4, pp. 923-940, 2002.
[15] C.-S. Wong and K. S. Law, "The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study," Routledge, 2017, pp. 97-128.
[16] J. O. Lim, "A relationship of the emotional intelligence of counselors, counseling relationships, and counseling outcomes," Catholic University, Doctoral Dissertation, 2014.
[17] J. D. Mayer and P. Salovey, "What is emotional intelligence?" in emotional development and emotional intelligence: implications for educators, P. Salovey and D. Sluyter, Eds." New York: Basic Books, 1997, pp. 3–31.
[18] H.-J. Cho, J. G. Ha, and C.-H. Kim, "The YSK olfactory function test: Development of a new Korean olfactory test," *Journal of Rhinology*, vol. 29, no. 2, pp. 61-68, 2022. https://doi.org/10.18787/jr.2021.00379
[19] T. Hummel *et al.*, "Position paper on olfactory dysfunction," *Rhinology*, vol. 54, pp. 1-30, 2017. https://doi.org/10.4193/Rhino16.248
[20] B. J. Cohen, *Theory and practice of psychiatry*. Oxford University Press, 2003.
[21] S. W. Carden, N. S. Holtzman, and M. J. Strube, "CAHOST: An excel workbook for facilitating the Johnson-Neyman technique for two-way interactions in multiple regression," *Frontiers in Psychology*, vol. 8, p. 1293, 2017.
[22] H. K. Lee, "Emotional intelligence, interpersonal relationship and psychological well-being in nursing students," *The Journal of Kyungpook Nursing Science*, vol. 16, no. 1, pp. 11-20, 2012.
[23] M. A. Brackett, J. D. Mayer, and R. M. Warner, "Emotional intelligence and its relation to everyday behaviour," *Personality and Individual differences*, vol. 36, no. 6, pp. 1387-1402, 2004. https://doi.org/10.1016/S0191-8869(03)00236-8
[24] P. N. Lopes, P. Salovey, and R. Straus, "Emotional intelligence, personality, and the perceived quality of social relationships," *Personality and individual Differences*, vol. 35, no. 3, pp. 641-658, 2003.
[25] J. J. Chang and J. M. Kim, "The effect of emotional awareness based expression training on emotional awareness, emotional expression, suppression of emotional expression and interpersonal relationship," *Korean Journal Of Counseling And Psychotherapy*, vol. 23, no. 4, pp. 861-884, 2011.
[26] P. Salovey and J. D. Mayer, "Emotional intelligence," *Imagination, Cognition and Personality*, vol. 9, no. 3, pp. 185-211, 1990. https://doi.org/10.2190/DUGG-P24E-52WK-6CDG
[27] I. Baek and K. M. Shin, "The Effect of Early Parental Attachment on Adulthood Interpersonal Problems: The Serial Mediating Effect of Self-Emotion Recognition and Emotion Regulation," *The Korean Journal of Developmental Psychology*, vol. 36, no. 4, pp. 25-44, 2023. https://doi.org/10.35574/KJDP.2023.12.36.4.25
[28] Y. Soudry, C. Lemogne, D. Malinvaud, S.-M. Consoli, and P. Bonfils, "Olfactory system and emotion: Common substrates," *European Annals of Otorhinolaryngology, Head and Neck Diseases*, vol. 128, no. 1, pp. 18-23, 2011. https://doi.org/10.1016/j.anorl.2010.09.007
[29] B. M. Preston and S. M. Smith, "Psychology of smell, seoul: The business books," 2021.
[30] S. Kivity, O. D. Ortega-Hernandez, and Y. Shoenfeld, "Olfaction—a window to the mind," *The Israel Medical Association Journal*, vol. 11, no. 4, pp. 238-243, 2009.
[31] J. Seubert, A. F. Rea, J. Loughead, and U. Habel, "Mood induction with olfactory stimuli reveals differential affective responses in males and females," *Chemical senses*, vol. 34, no. 1, pp. 77-84, 2009. https://doi.org/10.1093/chemse/bjn054
[32] M. K. Mahmut and R. J. Stevenson, "Olfactory abilities and psychopathy: Higher psychopathy scores are associated with poorer odor discrimination and identification," *Chemosensory Perception*, vol. 5, pp. 300-307, 2012. https://doi.org/10.1007/s12078-012-9135-7
[33] D. Wilkinson, S. Moreno, C. S. Ang, F. Deravi, D. Sharma, and M. Sakel, "Emotional correlates of unirhinal odour identification," *Laterality: Asymmetries of Body, Brain and Cognition*, vol. 21, no. 1, pp. 85-99, 2016. https://doi.org/10.1080/1357650X.2015.1075546

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 2209-2221, 2025
DOI: 10.55214/25768484.v9i4.6515

[34] M.-H. Park and K.-M. Kim, "The necessity for adult's sensory processing evaluating tool and the introduction of adolescent/adult sensory profile," *The Journal of Korean Academy of Sensory Integration*, vol. 4, no. 1, pp. 17-28, 2006.
[35] C. E. Brown and W. Dunn, "Adolescent/adult sensory profile," *San Antonio: Harcourt Assessment Co*, 2002.
[36] W. Dunn, "The sensations of everyday life: Empirical, theoretical, and pragmatic considerations," *The American Journal of Occupational Therapy*, vol. 55, no. 6, pp. 608-620, 2001. https://doi.org/10.5014/ajot.55.6.608
[37] E. M. Jerome and M. Liss, "Relationships between sensory processing style, adult attachment, and coping," *Personality and Individual Differences*, vol. 38, no. 6, pp. 1341-1352, 2005. https://doi.org/10.1016/j.paid.2004.08.016
[38] J. D. Choi, J. K. Kim, and T. Y. Lee, "Relationship between sensory processing styles and personality," *The Journal of Korean Society of Occupational Therapy*, vol. 18, no. 1, pp. 23–30, 2010.
[39] J. H. Lee and T. G. Nam, "The relation between sensory processing ability and interpersonal problem of some university students," *Journal of the Korea Academia-Industrial Cooperation Society*, vol. 14, no. 6, pp. 2780–2787, 2013. https://doi.org/10.5762/KAIS.2013.14.6.2780
[40] L. Schäfer, V. A. Schriever, and I. Croy, "Human olfactory dysfunction: causes and consequences," *Cell and Tissue Research*, vol. 383, pp. 569-579, 2021. https://doi.org/10.1007/s00441-020-03381-9
[41] C. Rita, "The brain, seoul: Book21," 2010.
[42] A. Cavazzana, A. Röhrborn, S. Garthus-Niegel, M. Larsson, T. Hummel, and I. Croy, "Sensory-specific impairment among older people. An investigation using both sensory thresholds and subjective measures across the five senses," *PloS one*, vol. 13, no. 8, p. e0202969, 2018. https://doi.org/10.1371/journal.pone.0202969
[43] D. R. Adams *et al.*, "Factors associated with inaccurate self-reporting of olfactory dysfunction in older US adults," *Chemical Senses*, vol. 42, no. 3, pp. 223-231, 2017. https://doi.org/10.1093/chemse/bjw108
[44] A. Oleszkiewicz, F. Kunkel, M. Larsson, and T. Hummel, "Consequences of undetected olfactory loss for human chemosensory communication and well-being," *Philosophical Transactions of the Royal Society B*, vol. 375, no. 1800, p. 20190265, 2020. https://doi.org/10.1098/rstb.2019.0265
[45] I. Croy, S. Nordin, and T. Hummel, "Olfactory disorders and quality of life—an updated review," *Chemical senses*, vol. 39, no. 3, pp. 185-194, 2014. https://doi.org/10.1093/chemse/bjt072

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