



Emotion Recognition Through the Eyes And its Association With Depression in Adults: The Role of Age, Gender, and Education

Yetişkin Bireylerde Gözlerden Duygu Tanıma ve Depresyon İlişkisi: Yaş, Cinsiyet ve Eğitimin Rolü

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Abstract:

Emotion recognition, especially interpreting mental states through the eyes, is key to social cognition and may be impaired in depression. This study examined the relationship between mind-reading ability and depression levels in adults, evaluating how this relationship varies by age, gender, and education level. The descriptive, cross-sectional study was carried out online between January and March 2024 using a snowball sampling method. This involved 696 individuals aged 18 and older. Data were collected using a personal information form, the Reading the Mind in the Eyes Test (RMET), and the Beck Depression Inventory (BDI). Depression levels were significantly higher in women than in men ($p < 0.05$). Participants aged 19–29 had higher RMET and BDI scores than those in older age groups. No significant association was found between educational attainment and depression ($p > 0.05$), but mind-reading ability was better in individuals with 12 or more years of education ($p < 0.05$). The statistically significant negative correlation was found between depression levels and RMET scores ($r = -0.14, p < 0.001$). The findings suggest that increased depression is associated with reduced mind-reading ability from the eyes. In this context, emotion recognition may be related to depression, and awareness of these changes may contribute to better mental health outcomes.

Keywords: Depression, Emotion recognition, Theory of mind, Mind reading, Social cognition, Reading the Mind in the Eyes Test.

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Date of Received/Geliş Tarihi: 21.10.2025, **Date of Revision/Düzeltilme Tarihi:** 11.03.2026, **Date of Acceptance/Kabul Tarihi:** 19.03.2026, **Date of Online Publication/Çevrimiçi Yayın Tarihi:** 03.08.2026

Citing/Referans Gösterimi: Dilek, F., Yıldırım, E. & Ünal, A. (2026). Emotion recognition through the eyes and its association with depression in adults: The role of age, gender, and education. *Cyprus Turkish Journal of Psychiatry & Psychology*, 1-7. <https://doi.org/10.35365/ctjpp.26.3.18>

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Öz:

Duyguları tanıma, özellikle de zihinsel durumları gözler aracılığıyla yorumlama, sosyal biliş için kilit öneme sahiptir ve depresyonda bozulabilir. Bu çalışmanın amacı yetişkinlerde zihin okuma becerisi ile depresyon düzeyleri arasındaki ilişkiyi incelemek ve bu ilişkinin yaş, cinsiyet ve eğitim düzeyine göre nasıl değiştiğini değerlendirmektir. Bu tanımlayıcı, kesitsel çalışma, kartopu örnekleme kullanılarak Ocak ve Mart 2024 tarihleri arasında çevrimiçi olarak yürütülmüştür. Çalışmaya 18 yaş ve üzeri toplam 696 kişi katılmıştır. Veriler kişisel bilgi formu, Gözlerden Zihin Okuma Testi (GZOT) ve Beck Depresyon Envanteri (BDE) kullanılarak toplanmıştır. Kadınların depresyon düzeyi, erkeklere göre daha yüksek bulunmuştur ($p < 0.05$). 19-29 yaş arası katılımcıların GZOT ve BDE skorları, daha büyük yaş gruplarına kıyasla daha yüksek bulunmuştur. Eğitim düzeyi ile depresyon arasında istatistiksel olarak anlamlı bir ilişki bulunmamıştır ($p > 0.05$); ancak zihin okuma becerisi, 12 yıl veya daha fazla eğitim almış bireylerde daha iyi saptanmıştır ($p < 0.05$). GZOT puanları ile depresyon düzeyleri arasında negatif yönde anlamlı bir ilişki bulunmuştur ($r = -0.14$, $p < 0.001$). Çalışmadan elde edilen bulgular; artan depresyonun gözlerden zihin okuma becerisinin azalmasıyla ilişkili olduğunu göstermektedir. Bu bağlamda, duygu tanıma depresyonla ilişkili olabilir ve bu değişikliklerin farkında olmak daha iyi ruh sağlığı sonuçlarına katkıda bulunabilir.

Anahtar Kelimeler: Depresyon, Duygu tanıma, Zihin kuramı, Zihin okuma, Sosyal biliş, Gözlerden Zihni Okuma Testi.

Introduction

Theory of Mind (ToM) refers to the ability to understand and interpret the intentions, thoughts, and feelings of others. The use of these interpretations in ways consistent with an individual's goals significantly supports social success (François & Rossetti, 2020; Küçük, 2021; Özbaran, Köse, & Ermiş, 2009). ToM is commonly divided into two components: Cognitive ToM involves understanding other people's beliefs and thoughts, while affective ToM involves recognizing emotions from observable cues (Zegarra-Valdivia et al., 2023; Poletti, Enrici, & Adenzato, 2012; Tager-Flusberg & Sullivan, 2000; Kemp, Després, Sellal, & Dufour, 2012). Deficits in ToM skills may limit an individual's social problem-solving abilities, a difficulty that is frequently reported in various psychiatric and neurological disorders (Orso et al., 2020; Ataoglu, Toptan, Vurali, Bozdag, & Bolay, 2014; Fett, Viechtbauer, Penn, van Os, & Krabbendam, 2011).

Mind-reading from the eyes is an essential component of ToM, particularly in making inferences from emotional and social cues. Facial expressions, and particularly eye movements, provide critical information about others' mental states and form the basis of social interaction (Zegarra-Valdivia et al., 2023; Henry, Cowan, Lee, & Sachdev, 2015). The RMET is among the most widely used assessments of affective ToM, which evaluates emotion recognition using eye-region photographs (Poletti, Enrici, & Adenzato, 2012; Tager-Flusberg & Sullivan, 2000; Kemp, Després, Sellal, & Dufour, 2012). Depression is a common mood disorder that can negatively affect cognitive and emotional functions, thereby reducing ToM performance (Kilian, Schiller, Meyer-Doll, Heinrichs, & Schläpfer, 2024). The ability to recognize emotions from facial expressions, particularly from the eye region, is fundamental for effective social interaction (Prado, Watt & Crowe, 2018). Reductions in performance on social cognition tasks, such as the RMET, observed in depression can be explained within the framework of Aaron Beck's cognitive theory of depression. According to this theory, susceptibility to depression is associated with cognitive distortions and can therefore affect attention, interpretation, and memory processes, leading to information processing disorders (Jiang, 2024). For this reason, the negative social interpretation tendency in depressed individuals can negatively affect emotion recognition performance from facial expressions.

Furthermore, Ruihua et al. (2021) study shows that depressed individuals have a marked decline in emotional facial expression recognition performance as well as overall cognitive function (processing speed, memory, problem solving, etc.). Similarly, previous research has revealed that depressed individuals make more mistakes in recognizing emotions from the eyes and have difficulty interpreting social cues (Prado, Watt & Crowe, 2018; Liedtke, Kohl, Kret & Koelkeck, 2018). Thus, these findings suggest that impairments in emotional recognition performance from social cognition and facial expressions of depressed individuals result not only from mood changes but also from limitations in cognitive processes.

Depression-related impairments in reading emotions through the eyes may lead to miscommunication and disruptions in both professional and interpersonal relationships. Although the relationship between depression and emotion recognition through the eyes has been examined in numerous studies, most of these studies are limited to clinical populations. Therefore, the extent of this relationship in the general population, especially in the context of RMET performance, has not been adequately investigated. This study aims to contribute to the literature by examining the relationship between RMET performance and depression in a general population sample in Turkey, while accounting for interactions with age and education. In addition, it explores whether a decline in RMET performance could serve as an early indicator of depression, given that the early identification of depressive symptoms may support social mental well-being by enabling timely psychological intervention. For this reason, the objective of this study is to examine the relationship between mind-reading ability and depression levels in individuals aged 18 years and older.

Method**Design and Participants**

This descriptive cross-sectional study collected data online via snowball sampling between January 1 and March 30, 2024. After the study was completed, a post hoc G*Power analysis using the RMET-BDI correlation ($r = -0.14$, $\alpha = 0.05$) indicated that a sample of 652 participants was required to achieve 95% power. This analysis

demonstrated that the current sample size of 696 participants was sufficient for the correlational analyses.

Instruments

Data were gathered using three tools: a personal information form, the RMET, and the BDI.

Personal Information Form

This form, developed by the researchers, included three questions regarding participants' descriptive characteristics (age, gender, and educational status).

Reading the Mind in the Eyes Test (RMET)

Initially developed by Baron-Cohen et al. and revised in 2001, the RMET consists of 36 items, each offering four possible emotional state options (Harkness, 2010). The test assesses facial emotion recognition and social cognition by asking participants to identify a person's emotional state from a photograph of the eye region. The test's Turkish adaptation was conducted by Yıldırım et al. in 2011, who removed four items due to low internal consistency. Therefore, the Turkish version comprises 32 items. Written consent was received from the authors for the use of the test. The current study found Cronbach's alpha to be 0.70, indicating acceptable internal consistency.

Beck Depression Inventory (BDI)

The Turkish adaptation of the test, developed by Beck and colleagues in 1961, was conducted by Hisli. The BDI includes 21 questions that assess depressive symptoms experienced over the previous week. Each item is evaluated using a 4-point Likert scale (0-3), yielding a total score of 0-63 (Hisli, 1989). A score of 17 or below indicates the absence of depression, whereas a score of 18 or above suggests the presence of depression. The scale is

recommended for depression screening due to its ease of use, time brevity, and minimal overlaps with neurological symptoms. The current study found the Cronbach's alpha coefficient to be 0.80

Statistical Analysis

The statistical analysis was conducted in Jamovi 2.3.28. Descriptive statistics (mean, standard deviation, median, etc.) were used to summarize the data. Data normality was assessed using the Shapiro-Wilk test. The data were normally distributed, so Student's t-test was used for two-group comparisons and Pearson's correlation for relationships among variables. Post-hoc comparisons were performed using Tukey's HSD test.

Ethical Approval

Ethical approval was obtained from Tekirdağ Namık Kemal University's Non-Interventional Clinical Research Ethics Committee (Decision No: 2023.205.11.19, Date: 28.11.2023). At the beginning of the Google survey, participants were presented with an informed consent form. Those who agreed to participate were asked to select the option "I agree to participate in the study. Individuals who did not provide consent or complete the survey were excluded from the study.

Results

Participants were roughly equally split, with 51% male. The mean age of the participants was 37.6 ± 12.2 years, and the mean educational attainment was 9.94 ± 3.84 years. Descriptive characteristics of the participants, including age, gender, and education, are presented in Table 1.

Table 1. Demographic characteristics of the study sample, including sex, age, and years of education

	Female		Male		Total	
n (%)	344 (49)		352 (51)		696	
Age	36.6 ± 12.1	(19–60)	38.7 ± 12.2	(19–60)	37.6 ± 12.2	(19–60)
m ± SD (min–max)						
Education (years) m ± SD (min–max)	9.80 ± 3.99	(1–22)	10.01 ± 3.69	(3–20)	9.94 ± 3.84	(1–22)

Note. *m* = Mean; *SD* = Standard Deviation.

Depression levels were significantly higher in female participants compared to male participants ($p = 0.037$),

indicating a significant difference of small magnitude (Table 2).

Table 2. Comparison of RMET and BDI scores by gender using independent samples *t*-test

Scale	Female (n = 344)	Male (n = 352)	p-value
RMET	20.70 ± 5.15	20.22 ± 5.40	0.229
m ± SD (min–max)	(5–32)	(5–32)	
BDI	9.24 ± 8.85	7.89 ± 8.21	0.037
m ± SD (min–max)	(0–44)	(0–43)	

Note. *RMET*: Reading the Mind in the Eyes Test; *BDI*: Beck Depression Inventory; $p < 0.05$; Student's *t*-test.

A statistically significant difference in scores on both the RMET and the BDI was found between age groups ($p < 0.05$) (Table 3). Post hoc analysis revealed that participants in the 19–29 age group had significantly

higher RMET scores than those in the 30–39 and 50–60 age groups ($p < 0.001$). Additionally, the BDI scores were significantly higher in the 19–29 age group than in the 30–39 age group ($p < 0.05$).

Table 3. Mean RMET and BDI scores across different age groups with one-way ANOVA

Scale	Age groups				p-value
	19–29 (n = 229)	30–39 (n = 148)	40–49 (n = 165)	50–60 (n = 154)	
BDI	9.62 ± 8.99	7.14 ± 7.96	8.21 ± 8.17	8.69 ± 8.69	0.045
m ± SD (min–max)	(0–44)	(0–36)	(0–39)	(0–39)	
RMET	21.60 ± 4.59	19.93 ± 5.32	20.48 ± 5.32	19.24 ± 5.83	<0.001
m ± SD (min–max)	(5–29)	(6–29)	(5–32)	(6–32)	

Note. $p < 0.05$; One-way ANOVA.

While no statistically significant difference was found between years of education and BDI scores, a significant difference was seen between education level and RMET scores ($p < 0.05$) (Table 4). Post-hoc comparisons indicated that individuals with 1–5 years of education had

significantly lower RMET scores than those with 12 or more years of education. Also, a negative correlation was found between depression levels and mind-reading ability from the eyes ($r = -0.14$, $p < 0.001$).

Table 4. Differences in RMET and BDI scores by educational attainment level

Scale	Educational level				p-value
	1–5 years (n = 126)	6–8 years (n = 230)	9–11 years (n = 60)	≥12 years (n = 280)	
BDI	9.53 ± 9.36	8.60 ± 8.52	8.25 ± 7.98	8.14 ± 8.32	0.546
m ± SD (min–max)	(0–39)	(0–38)	(0–36)	(0–44)	
RMET	18.70 ± 5.39	20.17 ± 5.49	21.58 ± 4.77	21.24 ± 4.96	<0.001
m ± SD (min–max)	(6–28)	(5–31)	(7–32)	(8–32)	

Note. $p < 0.05$; One-way ANOVA.

In the study, multiple regression analysis results showed that BDI scores, age, and education level significantly predict RMET performance. According to the analysis, RMET scores decrease as BDI scores increase ($r = -0.0904$, $p < 0.001$). Similarly, age has a significant negative effect on RMET scores (-0.0537 , $p = 0.001$). In

contrast, the level of education correlates positively and significantly with RMET scores ($r = 0.2251$, $p < 0.001$). The gender variant did not make a significant contribution to the model (0.5458, $p = 0.161$). The model generally accounts for about 7.6% of the variance in RMET scores ($R^2 = 0.076$) (Table 5).

Table 5. Multiple Regression Predicting RMET Scores from BDI, Age, Gender, and Education

Independent Variables	Estimate	SE	t	p
Intercept^a	20.7421	0.9827	21.11	< .001
BDI	−0.0904	0.0227	−3.98	< .001
Age	−0.0537	0.0164	−3.27	.001
Education	0.2251	0.0520	4.33	< .001
Gender	0.5458	0.3889	1.40	.161

p < 0.01; Model Fit Measures; R = 0.276; R² = 0.0761

Discussion

This descriptive, cross-sectional study aimed to examine the relationship between mind reading through the eyes and depression, as well as the links between emotion recognition and variables such as age, education level, and gender. The findings of the study reveal that depression negatively affects emotion recognition abilities and shows a small but significant negative correlation with RMET scores. Also, depression level, age, and education were found to significantly predict RMET performance, while gender did not contribute independently. Younger individuals exhibited both higher depression scores and better emotion recognition from the eyes; women, despite

higher depression levels, did not differ from men in emotion recognition. Education, while not significantly affecting depression, positively supported mind-reading ability.

In our study, female participants reported higher levels of depression. This finding is consistent with the literature (Salk, Hyde, & Abramson, 2017; Eskin et al., 2016; Hopcroft & Bradley, 2007; Martin, Neighbors, & Griffith, 2013; Seidler, Dawes, Rice, Oliffe, Dhillon, 2016; Altemus, Sarvaiya, & Epperson, 2014). No significant difference was observed between genders in terms of RMET scores. Although the literature reports that women

generally perform better (Yıldırım et al., 2011; Vellante et al., 2013; McClure, 2000), cultural norms, familiarity with facial expression patterns, and individual differences may influence the emotion recognition process (Hall, Carter & Horgan, 2000; Brody & Hall, 2008; Schulte-Rüther, Markowitsch, Shah, Fink, & Piefke, 2008; Ciarrochi, Chan, & Bajgar, 2001; Salk, Hyde & Abramson, 2017; Martin, Neighbors & Griffith, 2013; Derntl et al., 2012). It is also possible that tests administered in a digital environment may have reduced the gender difference by limiting emotional involvement and differences in response style (Olderbak & Wilhelm, 2017). Within this framework, our findings suggest that social cognition is multidimensional and cannot be explained solely by biological sex.

In our study, when examining the relationships between age, depression, and RMET performance, it was observed that younger individuals had both higher levels of depression and better mind-reading abilities. This finding is consistent with previous studies showing that depressive symptoms are more prevalent in adolescents and young adults, likely due to developmental vulnerabilities, difficulties in identity formation processes, and increased exposure to psychosocial stressors (Polanczyk, Salum, Sugaya, Caye & Rohde, 2015; Kessler et al., 2005). Young individuals perform better than older adults on tasks requiring rapid processing of facial expressions and subtle social cues (Burnett, Sebastian, Cohen Kadosh & Blakemore, 2011; Meinhardt-Injac, Daum & Meinhardt, 2020; Ruffman, Henry, Livingstone & Phillips, 2008), which can be explained by higher cognitive flexibility and more frequent exposure to socially dynamic environments (Blakemore, 2008). Digital communication and social media use may increase sensitivity to non-verbal emotional content while also heightening emotional vulnerability (Twenge, Spitzberg & Campbell, 2019). These findings suggest a dual dynamic in younger individuals. While they may demonstrate enhanced performance in social cognition tasks such as the RMET, they may also be more susceptible to mood disturbances due to elevated internal and external stressors. This paradox underscores the need for age-sensitive mental health strategies that both support emotional well-being and foster healthy social-cognitive development.

Although the study found no significant relationship between educational level and depression, participants with longer education showed higher mind-reading performance. The increase in RMET scores with education is consistent with previous international findings (Lee et al., 2021) and suggests that education may support cognitive flexibility and social inference skills. Our findings indicate that educational level has no significant effect on depression, which contradicts the literature suggesting that higher educational levels reduce the risk of depression through improved problem-solving skills and resilience (Marx et al., 2023). World Health Organization data also indicate that lower educational levels may increase depression risk due to factors such as lower income, unemployment, and limited access to healthcare (Patel et al., 2018). The inconsistency regarding the relationship between education and depression indicates that depression is influenced not only by educational attainment but also by broader biological and socio-economic factors.

Our study demonstrates that mind-reading performance decreases as depression increases, a finding consistent with previous research showing that individuals with major depressive disorder exhibit lower performance on RMET (Harkness, Jacobson, Duong & Sabbagh, 2010; Manstead, Dösmukhambetova, Shearn & Clifton, 2013; Nejati, 2018; Nejati, Zabihzadeh, Maleki & Tehrani, 2012). The negative relationship between depression and RMET is small but significant; therefore, it should not be interpreted as a diagnostic or predictive indicator on its own. Multiple regression analyses showed that depression level, age, and education significantly predicted RMET performance, whereas gender did not contribute independently. However, the model's limited explanatory power ($R^2 = 0.076$) suggests that more complex social cognitive processes influence mind-reading ability.

Finally, the cultural context of the RMET can significantly affect the test's performance in different societies. For example, Black and African-American participants have been reported to score lower on the RMET (Van Staden & Callaghan, 2022). Similarly, a study conducted on a young sample from different countries suggests that culture may influence mind-reading performance (Hünefeldt, Hussein, & Olivetti Belardinelli, 2021). Therefore, when interpreting RMET results, it is important to consider the cultural appropriateness of the stimuli, ethnic representation, and language, and to ensure that future studies include multi-center designs that account for cultural differences.

Limitations

This study has certain limitations. Firstly, a descriptive, cross-sectional research design does not permit causal inferences about the relationship between depression and emotion recognition ability. This limits the interpretation of the relationships discussed in the discussion section.

Secondly, the data were collected online and via self-report scales; this method may introduce reporting biases stemming from participants' response tendencies and measurement inaccuracies. Thirdly, although the RMET is a well-validated instrument, it measures only a specific dimension of social cognition; therefore, the emotion recognition processes discussed in the study may not fully reflect real-life situations. Fourthly, the use of a non-clinical general population sample limits the generalisability of the findings to individuals diagnosed with depression. Finally, the use of probability sampling may be considered another methodological limitation, limiting the generalisability of the findings to a broader population.

Conclusion

This study revealed that higher levels of depression are associated with lower mind-reading abilities from the eyes. Depression was more common among women and younger individuals, while education level was positively associated with emotion recognition ability but not with depression. These findings suggest that difficulties in recognizing others' emotions, especially from eye cues, may be an important social cognitive indicator of depression. Given the central role of emotion recognition in interpersonal communication, impairments in these abilities may contribute to the development or persistence of depressive symptoms. Therefore, early identification of individuals with declining social cognitive skills may

facilitate timely psychological support. Public health initiatives should emphasize raising awareness of depression-related symptoms, including disruptions in social cognition, as part of a strategic approach to enhancing mental well-being in the community.

Declarations

Ethics Committee Approval

Ethical approval was obtained from Tekirdağ Namık Kemal University's Non-Interventional Clinical Research Ethics Committee (Decision No: 2023.205.11.19, Date: 28.11.2023).

Publication Permission

Not applicable

Availability of Data and Materials

Not applicable

Conflict of Interest

The authors have no relevant conflicts of interest.

Funding

Not applicable.

Authors' Contributions

FD, EY, and AÜ developed the research's main idea. FD, AÜ, and EY contributed to the data collection. FD, EY, and AÜ performed the analyses and contributed to the interpretation of the findings. AÜ, EY, and FD made significant contributions to the article's introduction and discussion sections. All authors have read and approved the final version of the article.

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